River Bend Station

Unit 3

Combined

License

Application

Part 3: Environmental Report

Revision 0

September 2008

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CHAPTER 9

ACRONYMS AND ABBREVIATIONS

Terms	Definitions
ABWR	Advanced Boiling Water Reactor
ACR-700	Advanced CANDU Reactor
ADS	Automatic Depressurization System
AEA	Atomic Energy Act
AECL	Atomic Energy of Canada, Limited
AEO	Annual Energy Outlook
AGFC	Arkansas Game and Fish Commission
AHP	Ahead of Pass
AHS	Auxiliary Heat Sink
AIRFA	American Indian Religious Freedom Act
ALARA	As Low As Reasonably Achievable
amsl	Above Mean Sea Level
ANS	Aquatic Nuisance Species
ANS	American Nuclear Society
ANSI	American National Standards Institute
AP1000	Advanced Passive Pressurized Water Reactor
APE	Area of Potential Effect
Applicant	Entergy Operations, Inc. (EOI)
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BGS	Below Ground Surface
BMP	Best Management Practice

BOC	Break Outside of Containment
BOD	Biochemical Oxygen Demand
B.P.	Before the Present
BTA	Best Technology Available
CBG	Census Block Groups
CDF	Core Damage Frequency
CEQ	Council on Environmental Quality
CFC	Chlorinated Fluorocarbons
CIRC	Circulating Water System
CITES	Convention on International Trade in Endangered Species
COD	Chemical Oxygen Demand
COL	Combined License
COLA	Combined License Application
COOP	Cooperative Observation
CORMIX	Cornell Mixing Zone Expert System
CWA	Clean Water Act
CWIS	Cooling Water Intake Structures
CWS	Circulating Water System
DB	Dry-Bulb Temperature
DBT	Design-Basis Tornado
DCD	Design Control Document
DO	Dissolved Oxygen
DOE	U.S. Department of Energy
DSM	Demand-Side Management

EAB	Exclusion Area Boundary
EAI	Entergy Arkansas, Inc.
EEI	Edison Electric Institute
EES	Entergy Electric System
EF	Enhanced Fujita
EFH	Essential Fish Habitat
EGSL	Entergy Gulf States Louisiana, L.L.C.
EIA	Energy Information Administration
EIS	Environmental Impact Statement
ELL	Entergy Louisiana, LLC
EMF	Electromagnetic Fields
EMI	Entergy Mississippi, Inc.
ENO	Entergy New Orleans, Inc.
EOI	Entergy Operations, Inc.
EPA	U.S. Environmental Protection Agency
EPP	Environmental Protection Plan
EPRI	Electric Power Research Institute
EPT	Ephemeroptera, Plecoptera, Tricoptera
EPZ	Emergency Planning Zone
ER	Environmental Report
ESA	Endangered Species Act
ESBWR	Economic Simplified Boiling Water Reactor
ESP	Early Site Permit
ESRI	Environmental Systems Research Institute

ESRP	Environmental Standard Review Plan
ETI	Entergy Texas, Inc.
FAA	Federal Aviation Administration
FAPCS	Fuel and Auxiliary Pools Cooling System
FEIS	Final Environmental Impact Statement
FER	Final Environmental Report
FERC	Federal Energy Regulatory Commission
FGEIS	Final Generic Environmental Impact Statement
FPS	Fire Protection System
FWPCA	Federal Water Pollution Control Act
GDC	General Design Criteria
GEH	General Electric-Hitachi Nuclear Energy
GEIS	General Environmental Impact Statement
GGNS	Grand Gulf Nuclear Station
GIS	Geographic Information System
GSU	Gulf States Utilities
HEPA	High-Efficiency Particulate Air
HUSWO	Hourly U.S. Weather Observations
HWSA	Hazardous and Solid Waste Amendment
IAEA	International Atomic Energy Agency
IM&E	Impingement and Entrainment
ISB	Intra-System Billing
ISFSI	Independent Spent Fuel Storage Installation
ISL	In Situ Leaching

JFD	Joint Frequency Distribution
LCD	Local Climatological Data Summaries
LDEQ	Louisiana Department of Environmental Quality
LDNR	Louisiana Department of Natural Resources
LDOT	Louisiana Department of Transportation
LDOTD	Louisiana Department of Transportation and Development
LDWF	Louisiana Department of Wildlife & Fisheries
LEPC	Local Emergency Planning Committee
LLRWPAA	Low-Level Radioactive Waste Policy Amendments Act
LLW	Low-Level Radioactive Waste
LNHP	Louisiana National Heritage Program
LMR	Lower Mississippi River
LWA	Limited Work Authorization
LWMS	Liquid Waste Management System
LOCA	Loss-of-Coolant Accident
LOS	Level of Service
LPDES	Louisiana Pollutant Discharge Elimination System
LPSC	Louisiana Public Service Commission
LST	Local Standard Time
LSU	Louisiana State University
LWR	Light-Water-Cooled Reactor
MAAP	Modular Accident Analysis Program
MCWB	Mean Coincident Wet-Bulb Temperature
MDCT	Mechanical Draft Cooling Tower

MICRA	Mississippi Interstate Cooperative Resource Association
MIT	Massachusetts Institute of Technology
MRAA	Mississippi River Alluvial Aquifer
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act of 1976
msl	Mean Sea Level
MSLB	Main Steam Line Break
MWS	Makeup Water System
NANPCA	Nonindigenous Aquatic Nuisance Prevention and Control Act
NAPEE	National Action Plan for Energy Efficiency
NCDC	National Climatic Data Center
NCI	National Cancer Institute
NDCT	Natural Draft Cooling Tower
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act
NESC	National Electrical Safety Code
NGVD	National Geodetic Vertical Datum
NHC	National Hurricane Center
NHPA	National Historic Preservation Act
NIEHS	National Institute of Environmental Health Sciences
NISA	National Invasive Species Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System

NPHS	Normal Power Heat Sink
NPS	National Park Service
NRC	Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NWS	National Weather Service
O&M	Operations and Maintenance
ODCM	Off-Site Dose Calculation Manual
OECD	Organization for Economic Co-operation and Development
OPCO	Operating Company
PDI	Palmer Drought Index
PPA	Purchase Power Agreement
PPM	Parts per Million
PRA	Probabilistic Risk Assessment
PSDAR	Post-Shutdown Decommissioning Activities Report
PSWS	Plant Service Water System
PWS	Potable Water System
radwaste	Radioactive Waste
RBS	River Bend Station
RCRA	Resource Conservation and Recovery Act
REMP	Radiological Effluents Monitoring Program
RM	River Mile
RO	Reverse Osmosis
ROI	Region of Interest
ROW	Right-of-Way

RRY	Reactor Reference Year
RWCU	Reactor Water Cleanup
SACTI	Seasonal/Annual Cooling Tower Impact Prediction Code
SAMA	Severe Accident Mitigation Alternative
SAMDA	Severe Accidents Mitigation Design Alternative
SAMSON	Solar and Meteorological Surface Observation Network
SDC	Shutdown Cooling
SEI	Structural Engineering Institute
SERC	Southeastern Electric Reliability Corporation
SHPO	State Historic Preservation Office
SIS	System Impact Study
SL	Standard Length
SPCC	Spill Prevention, Control, and Countermeasure
SPO	System Planning and Operations
SPP-ICT	Southwest Power Pool - Independent Coordinator of Transmission
SSCs	Structures, Systems, and Components
SSRP	Strategic Supply Resource Plan
SWMS	Solid Waste Management System
SWPPP	Stormwater Pollution Prevention Plan
SWS	Station Water System
T&D	Transmission and Distribution
T&E	Threatened and Endangered
TDS	Total Dissolved Solids
TOC	Total Organic Carbon

TSS	Total Suspended Solids
TVA	Tennessee Valley Authority
UO_2	Uranium Dioxide
U_3O_8	Uranium Oxide
UC	University of Chicago
UF_6	Uranium Hexaflouride
UFC	Uranium Fuel Cycle
UHS	Ultimate Heat Sink
UMR	Upper Mississippi River
UPC	Usage per Customer
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish & Wildlife Service
USGS	U.S. Geological Survey
UTA	Upland Terrace Aquifer
UV	Ultraviolet
VACAR	Virginia-Carolinas Reliability Agreement
W3	Waterford Unit 3
WQC	Water Quality Certification
ZMMCP	Zebra Mussel Monitoring and Control Program

CHAPTER 1 INTRODUCTION

This environmental report (ER) is being submitted by Entergy Operations, Inc. (EOI) (the Applicant) on behalf of itself; Entergy Mississippi, Inc. (EMI); Entergy Louisiana, LLC (ELL); and Entergy Gulf States Louisiana, L.L.C. (EGSL).

The Applicant has been authorized to act as agent for EMI, ELL, and EGSL and has exclusive responsibility for control, maintenance, and licensing for the River Bend Station (RBS) Unit 3 site. EOI, EMI, ELL, and ESGL are wholly owned subsidiaries of Entergy Corporation (Entergy), which is incorporated in the state of Delaware.

This ER is being submitted as Part 3 of a Combined License Application (COLA) for a new nuclear power generating facility at the Applicant's RBS site in West Feliciana Parish, Louisiana, in compliance with the requirements contained within 10 CFR 52, Subpart C, for Combined Licenses and 10 CFR 50.30(f), "Applications for License, Form, Content, Ineligibility of Certain Applicants." The U.S. Nuclear Regulatory Commission (NRC) may then utilize this ER to aid in the preparation of an environmental impact statement (EIS) in accordance with the provisions of 10 CFR 51 Subpart A, National Environmental Policy Act - Regulations Implementing Section 102(2), for the purpose of issuing a combined license to the Applicant.

This ER is organized into the following chapters:

- Chapter 1, Introduction.
- Chapter 2, Environmental Description.
- Chapter 3, Plant Description.
- Chapter 4, Environmental Impacts of Construction.
- Chapter 5, Environmental Impacts of Station Operation.
- Chapter 6, Environmental Measurement and Monitoring Programs.
- Chapter 7, Environmental Impacts of Postulated Accidents Involving Radioactive Materials.
- Chapter 8, Need for Power.
- Chapter 9, Alternatives to Proposed Action.
- Chapter 10, Unavoidable Adverse Environmental Impacts.

Chapter 1, Introduction, is organized into the following sections:

- The Proposed Project (Section 1.1).

- Status of Reviews, Approvals, and Consultations (Section 1.2).
- Environmental Report Contents (Section 1.3).

1.1 THE PROPOSED PROJECT

The Applicant proposes to construct and operate a new nuclear power plant at the RBS site in West Feliciana Parish, Louisiana. The proposed unit is to be designated as RBS Unit 3 and is to consist of one reactor. Federal action resulting in the issuance of a combined license (COL) by the NRC under "Combined Licenses for Nuclear Power Plants" is anticipated (Reference 1.1-1). The purpose of the proposed new nuclear power plant is to generate electricity for sale.

1.1.1 OWNERSHIP AND APPLICANT

The Applicant applying for a COL for the proposed nuclear power plant at the RBS site is an independent wholly owned subsidiary of Entergy. EGSL, ELL, and EMI are the owners of the proposed project. The Applicant is the licensed operator of the existing RBS Unit 1 nuclear power plant facility and would be the operator of the proposed project, RBS Unit 3. The Applicant supports this application and is the NRC contact during the licensing process for RBS Unit 3.

1.1.2 SITE LOCATION

The proposed location of the new nuclear power plant is the existing RBS site. The RBS site, the area within the RBS property boundary, consists of approximately 3330 acres (ac.) (1348 hectares [ha]) in the southeastern corner of West Feliciana Parish in eastern Louisiana, along the east bank of the Mississippi River. The RBS site is approximately 24 miles (mi.) north-northwest of Baton Rouge, Louisiana, and 3 mi. southeast of St. Francisville, Louisiana. Reference ER Figures 2.1-1 and 2.1-2 for an illustration of the RBS site location.

The RBS site was originally intended for the construction of two nuclear units when the Operating License applications were docketed on August 25, 1981. The original RBS Unit 2 was abandoned after initial construction activities were terminated and the unit was cancelled on January 5, 1984. This unit was to be constructed west-southwest of the existing RBS Unit 1. The proposed RBS Unit 3 is to be located in the same general location as the abandoned RBS Unit 2 site.

1.1.3 REACTOR INFORMATION

The Applicant proposes to construct and operate an Economic Simplified Boiling Water Reactor (ESBWR) designed by General Electric-Hitachi Nuclear Energy (GEH) at the RBS site in West Feliciana Parish, Louisiana. The reactor has a rated core thermal power of 4500 megawatts thermal (MWt) and a gross electrical output of approximately 1600 ± 50 megawatts electric (MWe). The NRC accepted the ESBWR Design Certification Application for review in a letter dated December 1, 2005, and expects review of the application to continue through 2010 (Reference 1.1-2).

1.1.4 COOLING SYSTEM INFORMATION

The GEH ESBWR reactor design proposes to dissipate waste heat from the main condensers and transfer this heat to the normal power heat sink (NPHS). The NPHS comprises a natural draft tower and a mechanical helper tower.

The RBS station water system (SWS) provides the necessary water for the cooling systems utilized by RBS Unit 3. The SWS integrates the raw water supply for RBS Unit 3 with the water supply for the existing unit. The SWS draws water from the Mississippi River through four river water intake screens utilizing three pumps, piping, valves, and four 33 percent clarifiers. The intake structure is designed to house components serving both units. Two pairs of intake screens are to be connected to the existing intake lines and sized for the maximum single unit flow of 25,524 gallons per minute (gpm) associated with RBS Unit 3. The SWS provides the makeup water for RBS Units 1 and 3 through separate discharge lines and clarifiers.

Cooling tower blowdown water would be discharged to the Mississippi River through a re-sized wastewater blowdown line and outfall utilized by RBS Unit 1. The total effluent through the wastewater blowdown line and outfall includes wastewater effluent from RBS Units 1 and 3. The RBS Unit 1 total effluent is 2612 gpm, and the RBS Unit 3 total effluent is 6422 gpm. The total maximum flow to be discharged through the wastewater blowdown line is expected to be 9034 gpm (refer to Figure 3.3-1). The discharge velocity of the combined effluent at the Mississippi River outfall is expected to be 3.0 feet per second (fps).

1.1.5 TRANSMISSION SYSTEM INFORMATION

The Applicant expects that the existing transmission system serving the RBS site will require expansion to reliably interconnect and transmit the power anticipated to be produced by RBS Unit 3. The Applicant conducted a Transmission Line Route Study to identify potential routes for a new transmission line. The Study provides representative information for a new transmission corridor. However, the new transmission corridor has not been finalized and is still subject to change.

Portions of the current transmission system expected to expand include an on-site transmission corridor, on-site Fancy Point Substation, and a new off-site transmission corridor. On-site activities would require the addition of one new single-circuit 500 kV transmission line to interconnect with the Entergy Operating Companies’ system, which would reside adjacent to and west of the existing 230 and 500 kV lines in an expanded corridor from the RBS Unit 3 to the RBS property boundary along the Mississippi River. Additionally, the existing Fancy Point Substation on the RBS site would need to be expanded to accommodate the transmission of the power anticipated to be produced by RBS Unit 3. The proposed on-site expansion of the transmission corridor would affect an area of approximately 15 ac. of forest.

Off-site activities would include the extension of a new off-site 500 kV transmission line from the expanded on-site 500 kV corridor. The 500 kV transmission line would interconnect with the existing Hartburg to Mount Olive 500 kV transmission line. The new off-site line would be constructed along a new, approximately 200-ft. wide right-of-way corridor not currently used for transmission purposes, involving approximately 3334 ac. of various land uses along its approximate 148 mi. length. The new transmission line will be built in accordance with Entergy Standards. The actual structure design to be utilized is not anticipated to be finalized until a time closer to the construction of the new transmission line.

1.1.6 PROPOSED ACTION AND CONSTRAINTS

The action proposed by the Applicant is the construction and operation of a new nuclear power unit on the RBS site. The NRC 10 CFR 52 licensing process will be followed to obtain a COL. The Applicant has not identified any constraints to the review process at the time of submittal of this application. If the Applicant commits to the construction of a plant, numerous other permits and approvals from federal, state, and local agencies will be required. The permits and approvals required for the construction and operation of a new unit are discussed in Section 1.2. The necessary agency reviews and approvals may place a constraint on the proposed action. However, the Applicant will become aware of these potential constraints as agencies undergo their review processes and will promptly inform the NRC staff, as appropriate.

The Applicant undertook an analysis at the parish and Census Block Group level and concluded that the areas near RBS do not qualify as low income or minority areas, according to the NRC guidance for determining low income and minority population areas. Additionally, the Applicant discussed the issue with West Feliciana Parish officials who confirmed these conclusions and indicated that they did not consider the project one that would raise environmental justice concerns.

1.1.7 SUMMARY OF PROCEDURES IN CONDUCTING THE ENVIRONMENTAL REVIEW

The following environmental review was conducted through the assessment of the proposed site's baseline conditions and subsequent assessment of effects that may occur during the construction and operation of the proposed RBS Unit 3. The potential environmental effects of the proposed and alternative actions were assessed using the NRC-established standard of Council on Environmental Quality (CEQ) Guidance 40 CFR 1508.27 (Reference 1.1-3). The definitions of the three significance levels are defined in Footnote 3 of Table B-1 of 10 CFR 51 as follows:

- SMALL: Environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small as the term is used in this table.
- 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.

1.1.8 MAJOR ACTIVITY START AND COMPLETION DATES

The Applicant is making no commitment to the start of construction of a plant; rather, it seeks only to obtain a COL enabling the construction and operation of a new facility at any time during the lifetime of the license. A typical construction and operation timeline may be projected by assuming that a COL would be granted in 2011. Current projections are for preliminary site work and regulatory permitting starting shortly upon authorization, with construction taking a conservative 5 to 6 years. It is estimated that site preparation would require 12 to 18 months and construction would require 36 to 42 months from first concrete to fuel loading (Reference 1.1-4). Based on this estimated timeline, commercial power operations could commence as early as 2017. An elapsed time of 6 years is a conservative estimate of the time required from licensing to operation.

1.1.9 REFERENCES

1.1-1 U.S. Nuclear Regulatory Commission, 10 CFR §52.71 et al., 2007.

1.1-2 U.S. Nuclear Regulatory Commission, "Background on New Nuclear Plant Designs," Website, http://nrc.gov/reading-rm/doc-collections/fact-sheets/new-nuc-plant-des-bg.html, accessed September 7, 2007.

1.1-3 40 CFR 1508.27, "Protection of Environment, Council on Environmental Quality," 2007.

1.1-4 U.S. Department of Energy, "DOE NP2010 Nuclear Power Plant Construction Infrastructure Assessment," pp. 1-4, October 21, 2005.

1.2 STATUS OF REVIEWS, APPROVALS, AND CONSULTATIONS

Construction and operation of a new facility at the RBS site would require complying with several environmental regulations, obtaining a number of associated permits and approvals, and conducting consultations with state, federal, and tribal agencies. A search for regulations and permits potentially required by federal, state, regional, local, and affected Native American tribal agencies that could be applicable to the construction and operation of a new facility was conducted, and the results are presented in Table 1.2-1.

Except for submittal of the COLA, the Applicant has not endeavored to secure other necessary federal, state, or local authorizations. Therefore, the columns titled "License/Permit Number" and "Expiration Date" were purposefully left blank except for those instances where the existing RBS maintains a permit, or the state of Louisiana has issued a General Permit authorizing the activity. Entergy will apply for and receive the required authorizations prior to initiating regulated activities.

The U.S. Department of Energy (DOE) Standard Contract for disposal of spent nuclear fuel in 10 CFR 961 is being modified by the DOE. The Nuclear Energy Institute (NEI) is actively engaged with the DOE in revising the language in the Standard Contract. It is anticipated that this revision would be completed and the Standard Contract entered into by the end of 2008.

The following subsections identify the environmental concerns and provide an evaluation of potential administrative problems that could delay or prevent agency authorization. Further, Subsection 1.2.2 provides a summary of efforts to obtain permits under the Federal Water Pollution Control Act (FWPCA, also known as the Clean Water Act [CWA]).

1.2.1 IDENTIFICATION OF ENVIRONMENTAL CONCERNS AND EVALUATION OF POTENTIAL ADMINISTRATIVE PROBLEMS THAT COULD DELAY OR PREVENT AGENCY AUTHORIZATION

The Applicant requested comments regarding the proposed project from the agencies identified in Table 1.2-1. Comments were received from various federal and state agencies (refer also to Appendix 2A), including the following:

- Federal Aviation Administration - Fort Worth District (Reference 1.2-1).
- National Oceanic and Atmospheric Administration - National Marine Fisheries Service (Reference 1.2-2).
- U.S. Army Corps of Engineers - New Orleans District.
- U.S. Fish & Wildlife Service - Ecological Services Offices (Reference 1.2-3).
- Louisiana Department of Transportation and Development (Reference 1.2-4).
- Louisiana Department of Environmental Quality.

- Louisiana Department of Wildlife & Fisheries (Reference 1.2-5).

- Louisiana Department of Culture, Recreation & Tourism - Office of Cultural Development, Division of Archaeology (Reference 1.2-6).

The agencies' responses did not identify any significant environmental concerns or potential administrative problems that could delay or prevent agency authorization.

1.2.2 SUMMARY OF EFFORTS TO OBTAIN PERMITS UNDER THE FEDERAL WATER POLLUTION CONTROL ACT, SECTIONS 401 AND 402

Water quality certification (WQC) under Section 401 of the FWPCA will likely be required to authorize activities that may impact state water quality resulting from actions authorized by a federal license or permit. Efforts to obtain a 401 WQC have not begun, but discussions with the Louisiana Department of Environmental Quality (LDEQ) regarding the issuance of a 401 WQC have occurred. Further, all necessary permits will be applied for in a timely manner. Both the issuance of a Section 404 permit by the U.S. Army Corps of Engineers and the issuance of a COL by the NRC trigger Section 401 review.

Construction and operational activities associated with a new nuclear unit at the RBS site will require multiple permits for compliance with Section 402 of the FWPCA. All FWPCA Section 402 permits will be received from the LDEQ, as authorized by the U.S. Environmental Protection Agency (EPA) as of August 27, 1996 (Reference 1.2-7). It is expected that the construction activities at the RBS site triggering Section 402 of the FWPCA would be authorized under general permits previously issued by the state of Louisiana. Operational activities associated with a new nuclear unit would require modification(s) to Louisiana Pollutant Discharge Elimination System (LPDES) Permit LA0042731, under which the existing facility operates. With the exception of an initial consultation meeting held on April 5, 2007, between Entergy and the LDEQ, efforts to obtain authorizations for compliance with FWPCA Section 402 have not begun. All necessary permits, however, will be applied for in a timely manner.

1.2.3 STATE, LOCAL, AND REGIONAL PLANNING AUTHORITIES

The Planning Authorities contacted or consulted during the development of this application include the following:

- Regional Authority - Louisiana Speaks - Center for Planning Excellence.

- Local Authorities:

    - West Feliciana Parish Planning and Zoning.

    - West Feliciana Parish Local Emergency Planning Committee (LEPC).

1.2.4 REFERENCES

1.2-1 Federal Aviation Administration, telephone memo by applicant, October 29, 2007.

1.2-2 National Oceanic and Atmospheric Administration - National Marine Fisheries Service, letter to applicant, November 7, 2007.

1.2-3 U.S. Fish & Wildlife Service, letter to applicant, February 10, 2007.

1.2-4 Louisiana Department of Transportation and Development, letter to applicant, November 2, 2007.

1.2-5 Louisiana Department of Wildlife & Fisheries, letter to applicant, February 22, 2007.

1.2-6 Louisiana Department of Culture, Recreation & Tourism - Office of Cultural Development, Division of Archaeology, letter to applicant, March 14, 2007.

1.2-7 Approval of Application by Louisiana to Administer the National Pollutant Discharge Elimination System Program, 61 *Federal Register* 47 932, September 11, 1996.

Table 1.2-1 (Sheet 1 of 6)
Potential Federal, State, and Local Environmental Authorizations

Agency	Authority	Requirement	License/ Permit Number	Expiration Date	Activity Covered
U.S. Army Corps of Engineers (USACE)	Section 10 of the Rivers and Harbors Act of 1899	Section 10 Permit			Structures and/or work that may affect navigability of any navigable waters of the United States. Structural alterations may include barge slip modifications and the installation or modification to existing intake and outfall structures.
USACE	33 USCA 1344, Federal Water Pollution Control Act, Section 404	Section 404 Permit			Discharge of dredge or fill material within waters of the United States, including wetlands.
U.S. Department of Transportation	49 CFR Part 107, Subpart G	Hazardous Materials Certificate of Registration	061708550004Q	June 30, 2009	Shipment of radioactive and hazardous materials.
Federal Aviation Administration (FAA)	14 CFR 77.13, Federal Aviation Act	Notice of Proposed Construction or Alteration			Notice required before erecting structures with a height greater than 200 feet (ft.) or impacting navigable airspace (construction cranes, cooling towers, transmission lines).
National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service	Threatened and Endangered Species Act, 16 USCA 1536	Endangered Species Act Biological Consultation (marine species)			Consultation regarding the potential impact to threatened or endangered marine species; incidental take permit if necessary.
U.S. Nuclear Regulatory Commission (NRC)	10 CFR 52, Subpart C	Combined License			Construction activities associated with a nuclear power facility.

Table 1.2-1 (Sheet 2 of 6)
Potential Federal, State, and Local Environmental Authorizations

Agency	Authority	Requirement	License/ Permit Number	Expiration Date	Activity Covered
NRC	10 CFR 30	By-product License			Approval to possess special nuclear material.
NRC	10 CFR 70	Special Nuclear Materials License			Approval to possess fuel.
NRC	10 CFR 40	Domestic Licensing of Source Material			Approval to possess source material.
U.S. Coast Guard	14 USCA 81, 83, 85, 633	Authorization to Impact Navigation			The interference of existing navigation aids or the placement and use of private aids to navigation in navigable waters of the United States.
U.S. Environmental Protection Agency	40 CFR 82.162(a)	Certification[(a)]			Certification to the EPA that the site acquired certified Freon recovery or recycling equipment and is complying with the applicable requirements.
U.S. Fish & Wildlife Service (USFWS)	Threatened and Endangered Species Act, 16 USCA 1539	Endangered Species Act Biological Consultation (non-marine species)			Consultation regarding the potential impacts to federally threatened and endangered species; incidental take permit if necessary.
USFWS	Migratory Bird Treaty Act, 16 USCA 703	Migratory Bird Treat Act Consultation			Consultation regarding the potential impacts to protected migratory birds.
USFWS	Bald and Golden Eagle Protection Act, 16 USCA 668	Bald and Golden Eagle Protection Act Consultation			Consultation regarding the potential impacts to Bald and Golden Eagles.

Table 1.2-1 (Sheet 3 of 6)
Potential Federal, State, and Local Environmental Authorizations

Agency	Authority	Requirement	License/ Permit Number	Expiration Date	Activity Covered
Louisiana Department of Environmental Quality (LDEQ), Division of Air	LAC 33.III.507; 42 U.S.C. § 7661a	Title V Operating Permit or Minor Source Permit			Operation of a source with the potential to emit air pollutants in excess of the 100 tons per year (tpy) Title V threshold. Air pollutants less than 100 tpy are covered by the Minor Source Permit.
LDEQ, Division of Air	LAC 33.III.2201	Control of Emissions of Nitrogen Oxides			Emissions of nitrogen oxides (NO_x) within the Baton Rouge non-attainment area region of influence.
LDEQ, Division of Air	LAC 33.III.919	Emission Inventory			The emission of or potential to emit 50 tpy of VOC, 100 tpy of NO_x, CO, SO_2, PM_{10}, or $PM_{2.5}$, or 5 tpy of Pb.
LDEQ, Division of Air Quality and Radiation Protection	La. R.S. 30:2101	License			Transportation, procurement, ownership, or use of nuclear materials or devices utilizing such materials.
LDEQ, Division of Water	LAC 33.IX.1501 LAC 33.IX.1507	Section 401 Water Quality Certification			Impacts to state waters resulting from activities authorized by a federal license or permit, including Section 10 of the Rivers and Harbors Act of 1899, Section 404 of the Federal Water Pollution Control Act, Section 404, and the NRC COL.

Table 1.2-1 (Sheet 4 of 6)
Potential Federal, State, and Local Environmental Authorizations

Agency	Authority	Requirement	License/ Permit Number	Expiration Date	Activity Covered
LDEQ, Division of Water	LAC 33.IX.301; 33 U.S.C. § 402	Louisiana Pollution Discharge Elimination System (LPDES) Individual Wastewater/ Stormwater Discharge Permit	LA0042731[(a)]	June 1, 2011	Wastewater discharge and stormwater runoff during facility operation. Modification of the existing permit will likely occur.
LDEQ, Division of Water	La. R.S. 30:2001, et seq.; 33 U.S.C. § 402	LPDES General Permit - Dewatering of Petroleum Storage Tanks, Tank Beds, New Tanks and Excavations	General Permit Number LAG300000[(a)]	December 31, 2009	Dewatering of Petroleum Storage Tanks, Tank Beds, New Tanks and Excavations.
LDEQ, Division of Water	La. R.S. 30:2001, et seq.; 33 U.S.C. § 402	LPDES General Permit - Discharges of Hydrostatic Test Wastewaters	General Permit Number LAG670000[(b)]	January 31, 2013	Discharges of Hydrostatic Test Wastewaters.
LDEQ, Division of Water	La. R.S. 30:2001, et seq.; 33 U.S.C. § 402	LPDES Stormwater Notices of Intent - Stormwater discharges associated with construction activity 5 acres (ac.) or greater	General Permit Number LAR100000[(b)]	September 30, 2009	Stormwater discharges from construction areas of 5 ac. or greater.
Louisiana Department of Health and Hospitals	LAC 51:XIII.701	Certification			Expansion of sanitary sewage system.
LDEQ, Division of Hazardous Waste	La. R.S. 30:2183 LAC 33.V.105	Hazardous Waste Generator Notification	LAD070664818[(a)]	None	Generation of hazardous waste.

Table 1.2-1 (Sheet 5 of 6)
Potential Federal, State, and Local Environmental Authorizations

Agency	Authority	Requirement	License/ Permit Number	Expiration Date	Activity Covered
Louisiana Department of Natural Resources	LAC 43:I.701	Water Well Construction Notification			Installation of groundwater wells.
Louisiana Department of Transportation and Development (LDOTD)	LAC 73.I.301	Oversize/ Overweight Permit			Vehicles or loads exceeding the legal size or weight.
LDOTD	R.S. 38:3091-3098.8	Well Registration			Construction of groundwater wells.
Louisiana Department of Wildlife & Fisheries	Endangered Species Act 16 USCA 1536	Consultation			Consultation regarding the potential impacts to threatened and endangered species.
Louisiana Public Service Commission	R.S. 45:1163, General Order 1983	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 or facility.
Louisiana State Historic Preservation Office	National Historic Preservation Act Section 106	Consultation			Consultation concerning the potential impacts to cultural resources.
Tennessee Department of Environment and Conservation	TN ADC 1200-2-10-.32 10 CFR 71	Radioactive Waste License for Delivery	T-LA002-L08[a]	December 31, 2008	Shipment of radioactive waste to disposal/processing facility in Tennessee.
South Carolina Department of Health and Environmental Control	SC ADC 61-83 10 CFR 71	Radioactive Waste Transport Permit	0232-17-08-X[a]	December 31, 2008	Transportation of radioactive waste to disposal facility in South Carolina.
Tunica-Biloxi Tribe	National Historic Preservation Act Section 106	Consultation			Consultation concerning the potential impacts to cultural resources.

Table 1.2-1 (Sheet 6 of 6)
Potential Federal, State, and Local Environmental Authorizations

Agency	Authority	Requirement	License/ Permit Number	Expiration Date	Activity Covered
Mississippi Band of Choctaw	National Historic Preservation Act Section 106	Consultation			Consultation concerning the potential impacts to cultural resources.
West Feliciana Parish Planning and Zoning Commission	West Feliciana Parish Planning Ordinance Article IV(3)(2)	Building permit			The excavation or construction of any building or structure.
West Feliciana Parish Planning and Zoning Commission	West Feliciana Parish Planning Ordinance Article IV(3)(4)	Certificate of Occupancy			Occupation or use of a building or structure.
West Feliciana Parish Planning and Zoning Commission	West Feliciana Parish Planning Ordinance Article III(6)(d)	Road Relocation Approval			Alteration of parish roads or rights-of-way.
West Feliciana Parish Police Jury	West Feliciana Parish Planning Ordinance Article III(6)(d)	Road Relocation Approval			Alteration of parish roads or rights-of-way.

a) Permits authorizing activities associated with operation of the existing RBS. When possible, existing permits will be modified to authorize activities associated with the construction or operation of a new nuclear facility on-site.

b) General permits are authorized under LAC 33:IX 2515. Each general permit will require the submittal of a notice of intent (NOI) to the agency.

Note: All necessary permits will be applied for in a timely manner. New permits may not be obtained in certain instances because of potential authorization of construction and operational activities through the modification of existing RBS permits.

Abbreviations:

U.S.C. = United States Code.
USCA = United States Code Annotated.
CO = Carbon Monoxide.
$PM_{2.5}$ = Particulate Matter less than 2.5 Micrometers.
PM_{10} = Particulate Matter less than 10 Micrometers.
Pb = Lead.
SO_2 = Sulfur Dioxide.
VOC = Volatile Organic Compounds.

1.3 ENVIRONMENTAL REPORT CONTENTS

The requirement for an Applicant to submit an ER as part of its combined license application to the NRC resides within the regulations of 10 CFR 52.80(b), 10 CFR 51.50(c) and 51.53. The RBS Unit 3 ER format and structure follow the general outline guidance for an NRC EIS, as addressed in the Table of Contents and Appendix A of NUREG-1555 (the Environmental Standard Review Plan [ESRP], Revision 1, July 2007), for the purpose of aiding the NRC staff in preparing an EIS under the provisions of 10 CFR 51 Subpart A, National Environmental Policy Act - Regulations Implementing Section 102(2).

The RBS Unit 3 ER consists of 10 chapters, as identified in the Chapter 1 Introduction. Chapters 1 through 3 are descriptive in nature and assist the NRC staff's review of (1) the regional setting for the proposed action, (2) the detailed description of the site and its environment, and (3) the plant and the detailed description of those features of the plant that are most likely to affect the environment. Chapters 4 through 7 are related to the technical analyses of impacts and assist the NRC staff's review of potential environmental impacts associated with the construction and operation of the proposed plant. Finally, Chapters 8 through 10 are related to the overall evaluation of the proposed action. They assist the NRC staff's review of the need for power, compare the proposed action with alternatives, and summarize the conclusions related to the proposed action.

1.3.1 ENVIRONMENTAL CONDITIONS

10 CFR 50.36b states that for each license the NRC authorizes for construction and operation of a utilization facility, including a combined license under Part 52 of the regulations, the NRC may include conditions to protect the environment during construction, operation, and decommissioning. These conditions are to be set out in an attachment to the license, which is incorporated in and made a part of the license. These conditions are to be derived from information contained in the ER or the supplement to the ER submitted as part of the application, as analyzed and evaluated in the NRC record of decision, and will identify the obligations of the licensee in the environmental area, including, as appropriate, requirements for reporting and keeping records of environmental data, and any conditions and monitoring requirements for the protection of the non-aquatic environment.

The Applicant has developed an RBS Unit 3 Environmental Protection Plan (EPP) as a supplement to the ER for use by the NRC as part of its record of decision for the protection of nonradiological environmental resources during construction and operation of RBS Unit 3. The EPP has been included as COL Application, Part 11, Enclosure 11B. The principal objectives of the EPP are to:

- Verify that the facility is constructed and operated in an environmentally acceptable manner, as established by the COL Final Environmental Impact Statement (FEIS), and other NRC environmental impact assessments.

- Coordinate NRC requirements and maintain consistency with other federal, state, and local requirements for environmental protection.
- Keep the NRC informed of adverse environmental effects of construction and operation of the facility and of the actions taken to control those adverse effects.

1.3.2 REFERENCES

None.

CHAPTER 2 ENVIRONMENTAL DESCRIPTION

Chapter 2 describes the existing environmental conditions at the River Bend Station (RBS) site, the site vicinity, and the surrounding region. The environmental description provides sufficient detail to identify those environmental resources that may be affected by the construction, operation, or decommissioning of the proposed RBS Unit 3. This chapter is divided into eight sections:

- Station Location (Section 2.1).
- Land (Section 2.2).
- Water (Section 2.3).
- Ecology (Section 2.4).
- Socioeconomics (Section 2.5).
- Geology (Section 2.6).
- Meteorology and Air Quality (Section 2.7).
- Related Federal Project Activities (Section 2.8).

To define the scope of the areas discussed throughout this chapter, the following descriptions should be noted:

- RBS site - The 3330-acre (ac.) property that is the existing location of RBS Unit 1 and the proposed location of RBS Unit 3.
- Vicinity - The area within approximately the 8- to 10-mile (mi.) radius of the proposed RBS Unit 3 reactor (this distance may vary as specified in the sections that follow).
- Region - The area within approximately the 50-mi. radius around the RBS site.

2.1 STATION LOCATION

The RBS is located in the southeastern corner of West Feliciana Parish in eastern Louisiana, near the southwest corner of Mississippi and approximately 16 mi. south of the Louisiana-Mississippi border. The site is near the east bank of the Mississippi River, extending from river mile Marker 262 to 265, approximately 24 mi. north-northwest of Baton Rouge, Louisiana. Figure 2.1-1 shows the location of the RBS Unit 3 facility/site in relation to the parishes and counties and larger cities and towns in the region, which is the area within a 50-mi. (80-kilometers [km]) radius from the center of the proposed power block. The proposed Unit 3 site lies within Sections 58, 59, and 63 of Township 3 South, Range 2 West. The principal structures for Unit 1 are located in Section 58 of Township 3 South, Range 2 West. The community of St. Francisville is approximately 3 mi. northwest of the RBS site (Reference 2.1-1). The town of New Roads is approximately 7 mi. southwest of the RBS site. Figure 2.1-2 shows the RBS Unit 3 facility/site in relation to the features of the surrounding 8-mi. (13-km) vicinity. The vicinity of the RBS site is mostly rural.

The Universal Transverse Mercator NAD83 Zone 15 coordinates for the location of the proposed Unit 3 reactor on the site are approximately N 3,403,793 meters (m) (30°45'23" north latitude) and E 659,460 m (91°20'02" west longitude).

The property boundary shown in Figure 2.1-3 encompasses the approximately 3330 ac. that comprise the RBS site. Figure 2.1-4 shows the site plan for RBS Unit 3. There are no apparent erosion issues on the Mississippi River bank that would reduce the acreage of the RBS site. Along this area of the Mississippi River, banks on outside bends of the river have been stabilized by rock and concrete structures called revetments. The inside bends have been stabilized by wing dams or dikes. Together, these structures serve to keep Mississippi River flow within the main river channel and to prevent erosion of the banks (Reference 2.1-2).

Air and water effluent release points at RBS and distances from each release point to the nearest restricted area boundary are shown in the table below; these buildings and the Mississippi River outfall can be seen in Figures 2.1-3 and 2.1-4.

Effluent Release Point	Distance from Effluent Release Point to Nearest Restricted Area Boundary (feet)	
	Unit 1	Unit 3
Air		
Main Plant Exhaust Duct	2886 (Reactor Building)[a]	2197 (Turbine Building)
Radwaste Building	2725	2328
Fuel Building	2822	2234 (Reactor/Fuel Building)
Water		
Existing outfall to Mississippi River (distance to where discharge pipe crosses restricted area)	2419	2419

Effluent Release Point	Distance from Effluent Release Point to Nearest Restricted Area Boundary (feet)	
	Unit 1	Unit 3
Water (Continued)		
Existing outfall to Mississippi River (distance to where discharge pipe reaches the Mississippi River)	11,431	11,431

a. Unit 1 main plant exhaust is a primary release point and includes the Reactor Building vent, Auxiliary Building vent, Turbine Building vent, piping, standby gas treatment system exhaust, and Off-Gas Building vent exhausts.

The RBS site and its environs, consisting primarily of farmland and forests, lie within the Southern Hills section of the Gulf Coastal Plain physiographic province approximately 85 mi. from the Gulf of Mexico. The entire Gulf Coastal Plain is a generally flat to gently sloping sedimentary plain. The predominant feature in this region is the Mississippi River with its approximately 45-mi. wide floodplain. At this site, the river's natural levee has an elevation of about 46 feet (ft.) above mean sea level (msl); the ground surface slopes downward toward the valley wall to the east, where its elevation is approximately 35 ft. msl. The southern portion of the RBS site (in the undeveloped areas surrounding the existing plant and its facilities) is rough and irregular, with steep slopes and deep-cut stream valleys and drainage courses. Ground elevations in this portion of the plant site range from approximately 35 ft. msl to more than 95 ft. msl inland. Elevations up to 150 ft. msl occur on the hilltops; most hilltop areas are at elevations near 100 ft. Grade elevation for the existing RBS Unit 1 plant structures is 95 ft. msl, and the proposed RBS Unit 3 is expected to have approximately the same elevation (Reference 2.1-3).

An oblique aerial photograph of Unit 1 at the RBS site is included as Figure 2.1-5. Unit 3 is proposed to be constructed in the area that can be seen south and southwest of the water tanks shown on the right side of the aerial photograph.

2.1.1 REFERENCES

2.1-1 Gulf States Utilities Company, "River Bend Station Environmental Report, Operating License Stage," Volumes 1-4, Supplements 1-9, November 1984.

2.1-2 McClain, M., "Cruising America's Waterways - Mississippi River (lower)," Website, http://members.aol.com/americacruising/mississippi-lower.htm, accessed February 3, 2008.

2.1-3 Entergy Operations, Inc., "River Bend Station Updated Safety Analysis Report" through Revision 19, July 2006.

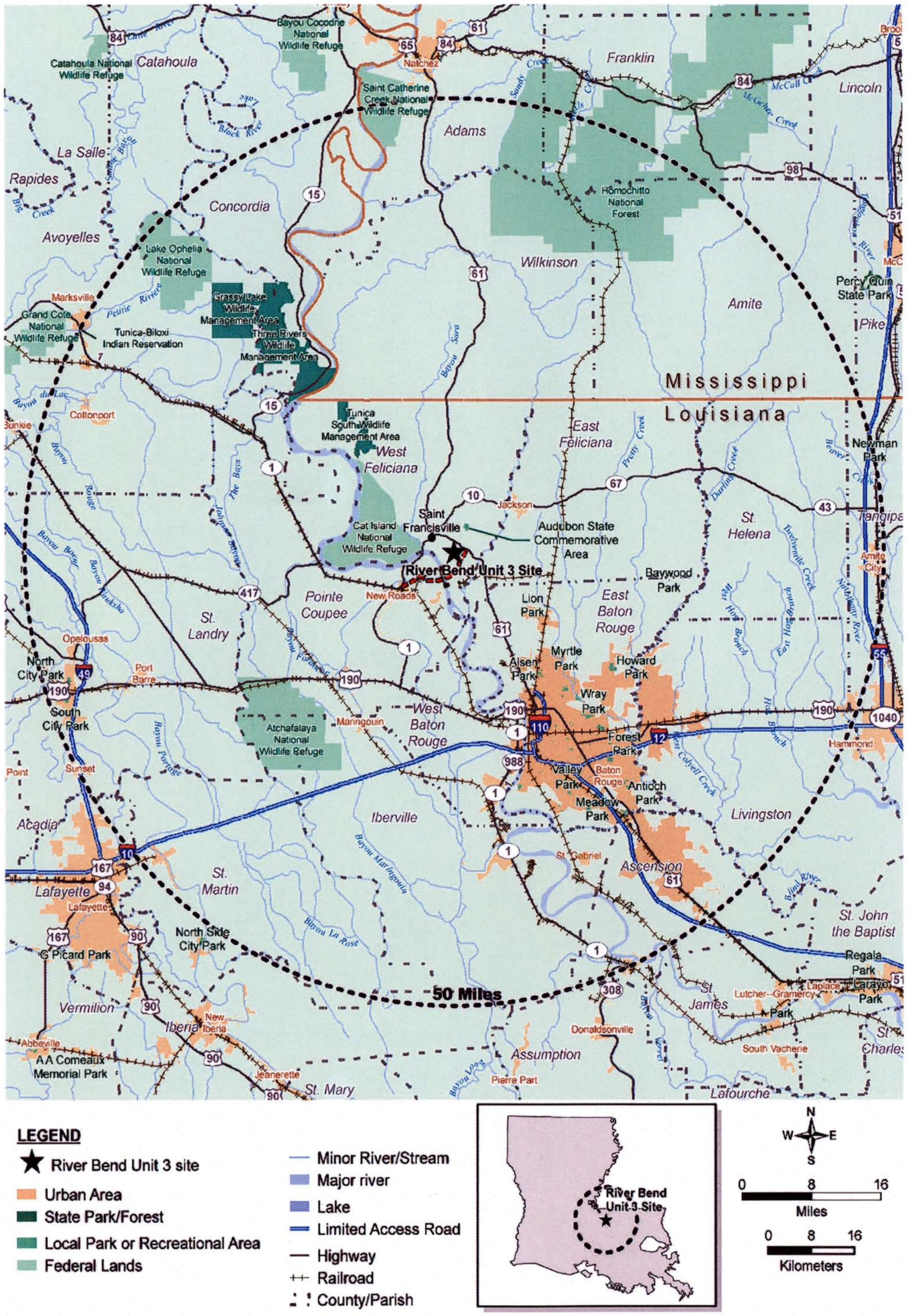

Figure 2.1-1. Unit 3 Site Location and Region Within 50 Mi. (80 Km)

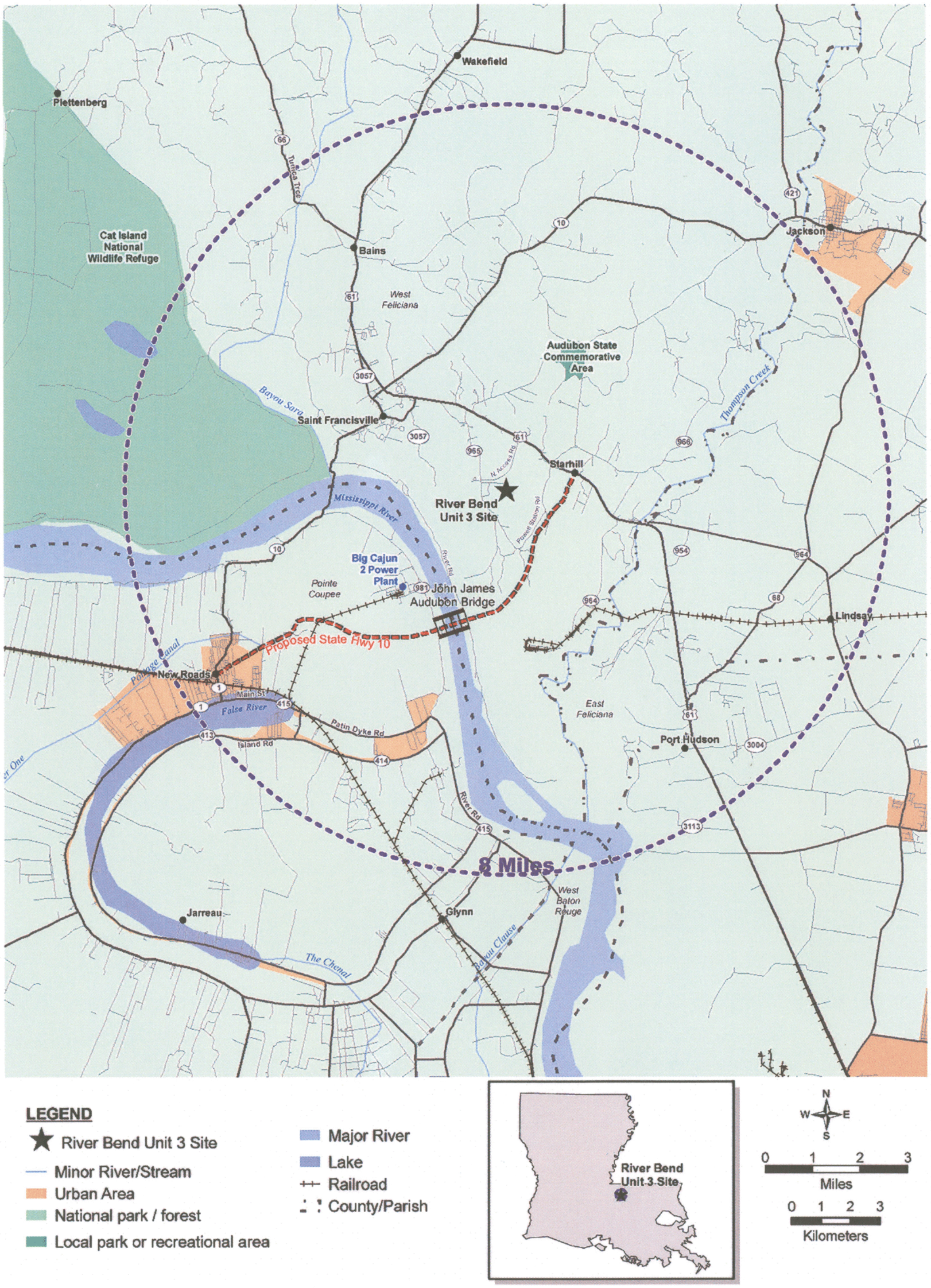

Figure 2.1-2. Unit 3 Site Location and Vicinity Within 8 Mi. (13 Km)

Revision 0

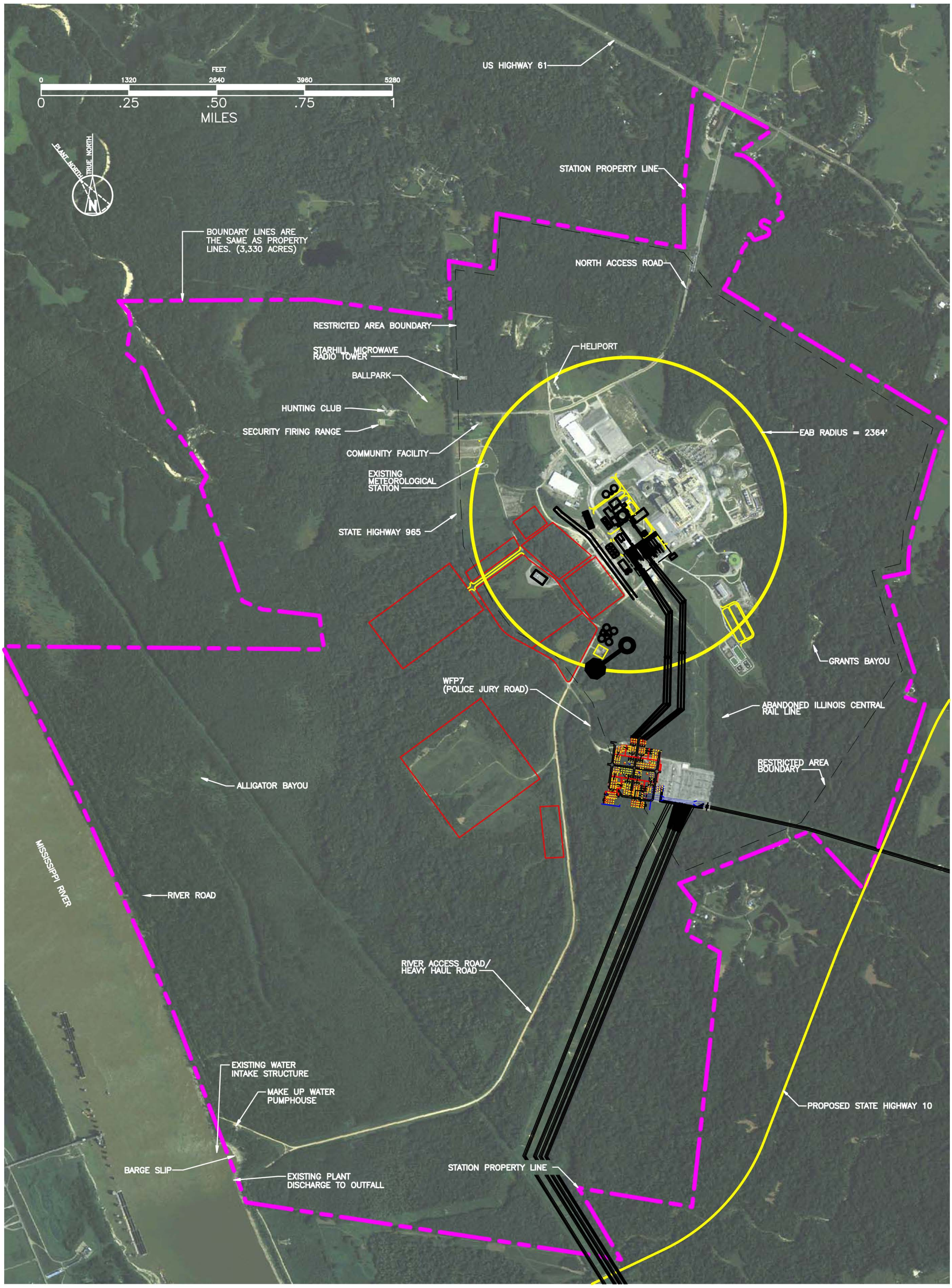

Figure 2.1-3. RBS Property Boundary

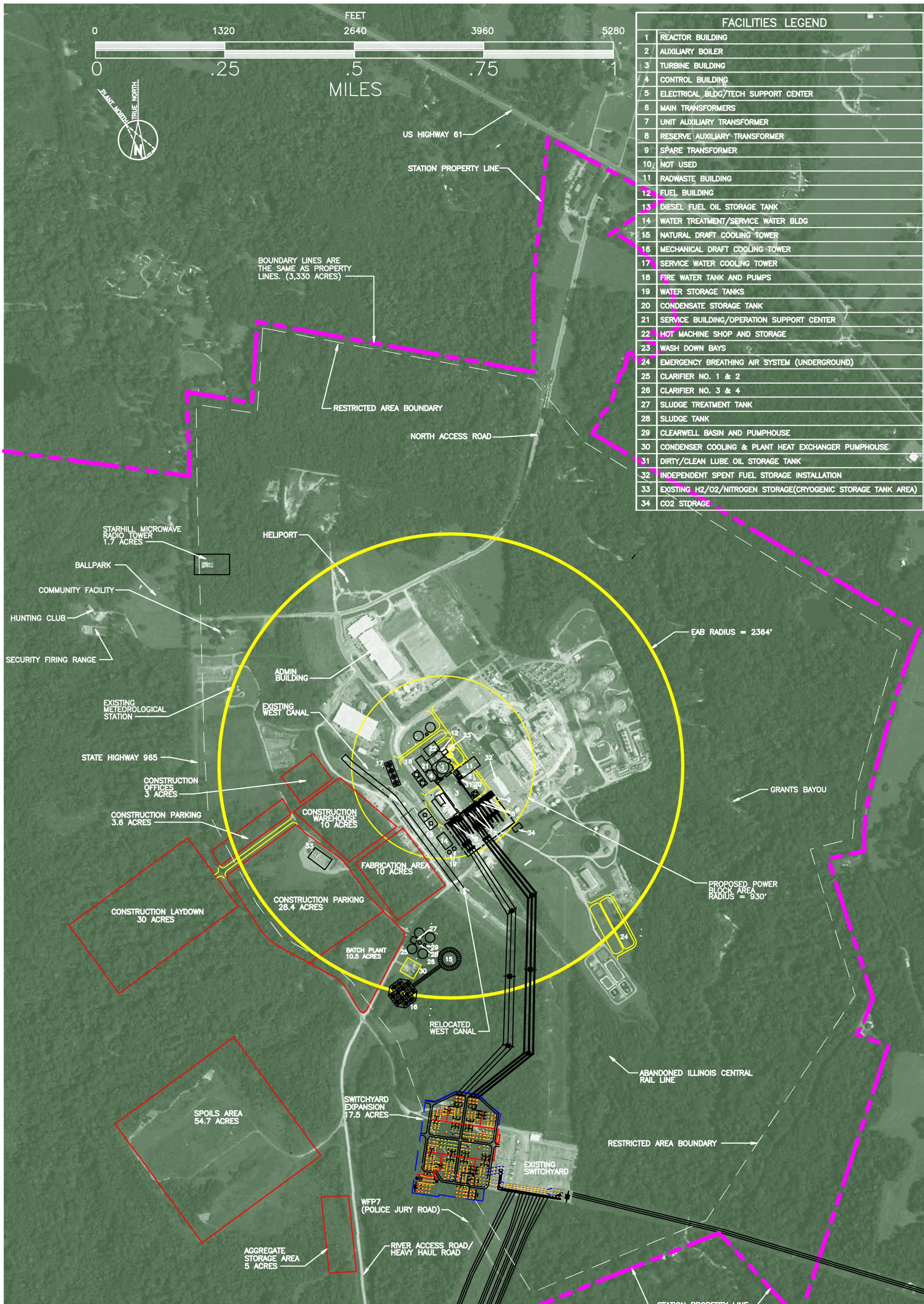

Figure 2.1-4. Unit 3 Site Plan

Figure 2.1-5. Oblique Aerial View of RBS
(RBS Main Plant Area Showing Unit 1, Facing South-Southwest)

2.2 LAND

The RBS Unit 3 site is the same site as the existing 3330-ac. RBS Unit 1 site within West Feliciana Parish, Louisiana, approximately 24 mi. north-northwest of Baton Rouge. West Feliciana Parish lies on the eastern boundary of Louisiana and is bordered on the west by the Mississippi River and Pointe Coupee Parish, Louisiana; on the north by Wilkinson County, Mississippi; on the east by East Feliciana Parish; and on the south by Pointe Coupee and West Baton Rouge Parishes.

The site is accessible both by the Mississippi River and by road. The major highways in the area are found mainly east and south of the site, and a number of county roads serve the area. U.S. Highway 61 connects St. Francisville with New Orleans, Louisiana, to the south and Natchez and Vicksburg, Mississippi, to the north. State Highway 965 provides access to the RBS site from U.S. Highway 61.

This section describes, in general terms, the RBS Unit 3 site and the land surrounding the entire RBS site. For this RBS Unit 3 COL Environmental Report (ER), the vicinity evaluated is the 8-mi. (13-km) radius area. Figures 2.2-1, 2.2-2, and 2.2-8 illustrate the site vicinity; Figures 2.2-3, 2.2-4, 2.2-5, and 2.2-6 present regional features; and Figure 2.2-7 shows the new off-site transmission corridor route.

Land use description for this section was based on a review of appropriate existing literature, information acquired through visits to the RBS site and contact with staff members, and information from local planning and agricultural contacts. It was assumed as part of this analysis that land use in the vicinity of the RBS has not changed significantly since RBS Unit 1 was constructed, but is beginning to change during the time frame of the COL Application (COLA).

2.2.1 THE SITE AND VICINITY

The property boundary shown in Figure 2.1-3 encompasses the approximately 3330 ac. that make up the RBS site. No new land would need to be acquired by the Applicant for RBS Unit 3. As explained in Chapter 1, three independent, wholly owned subsidiaries of Entergy Corporation will own the RBS Unit 3 site (EMI, ELC, and EGSL) and another subsidiary will operate RBS Unit 3 (EOI, the Applicant). The transmission system for the RBS Unit 1 site is owned and operated from the plant to the switchyard portion by EGSL, while transmission lines leaving the on-site switchyard are owned by ELL.

The Applicant currently controls the entire RBS site for the purpose of generating electricity; however, some of the area within the boundary is also used for other purposes, such as the Sportsman's Club (hunting club for past and current employees of the Applicant), recreational fishing, selective timber harvesting by the Applicant's real estate group, and occasional ecological study by state agencies or other parties. However, the Applicant maintains control of ingress to and egress from the RBS site property.

The approximate number of acres potentially affected by a new facility at the RBS site can be found in Table 2.2-1. There is no borrow area or pit on-site for RBS Unit 3, and construction spoils are placed in the same 54-ac. on-site location as was used for Unit 1 spoils (shown in Figure 2.1-4). Refer to Section 4.1 for further discussion of these construction-related areas.

The Unit 3 exclusion area is designated as the area encompassed by a 2364-ft. radius circle about the reactor center. This area is entirely within the 3330 ac. owned by the Applicant, and it is not traversed by any public highways, navigable waterways, or active railroads. The exclusion area is crossed by Grants Bayou, but this waterway is not used for navigation. The abandoned former Illinois Central rail corridor also crosses the exclusion area; however, the tracks have been removed from the site and the right-of-way (ROW) is owned by the Applicant. The RBS staff will coordinate with West Feliciana Parish to provide effective access control for State Highway 965 because it is in proximity, but not crossed by, the RBS exclusion area boundary (EAB). The EAB can be seen in Figures 2.1-3 and 2.1-4.

The RBS site is not within the coastal zone of Louisiana and is, therefore, not affected by the Coastal Zone Management Act of 1972 (Reference 2.2-1). There are no plans for other uses of the site nor for any modifications such as a visitor's center or park.

2.2.1.1 Site Accessibility

The RBS Unit 3 site is accessible by both river and road. The major highways in the area lie mainly to the north and south of the site, and a number of county roads serve the area (refer to Figures 2.1-1 and 2.1-2). U.S. Highway 61 is the major transportation route in the vicinity, roughly bisecting West Feliciana Parish and running within 1 mi. of the northeast side of the RBS site. U.S. Highway 61 parallels the Mississippi River from New Orleans, Louisiana, to St. Louis, Missouri, and is approximately 1 mi. from the RBS Unit 1 reactor at the closest point (References 2.2-2 and 2.2-3). From St. Francisville, the highway goes north to Natchez, Mississippi, and south to Baton Rouge, Louisiana. State Highway 10 runs northeast-southwest in the vicinity of the site, then east-west traveling east from the site through East Feliciana Parish. Going south and west from the site area, State Highway 10 runs south toward U.S. Highway 190, then parallels U.S. Highway 190 going west. Public transportation routes are very limited within the site vicinity (Reference 2.2-4).

State Highway 965 is a paved, two-lane, secondary road that runs north and south into the center of the property and passes within approximately 2800 ft. of the existing unit. Southeast of the intersection of State Highway 965 and River Access Road south of the existing reactor, State Highway 965 becomes a Police Jury (the authorized parish governing body) road called State Highway 965/West Feliciana Parish 7 (also called Powell Station Road) and continues south, then east and north, connecting back into U.S. Highway 61 east of the existing unit (Reference 2.2-3). State Highway 964 is also a paved, two-lane, secondary road that passes approximately 1.5 mi. east of the RBS site and runs from U.S. Highway 61 south to the location of the former Tembec Pulp and Paper Mill (which ceased operations on July 31, 2007, but may reopen as a different business at some time in the future) (Reference 2.2-5).

There are two main on-site roads at RBS. One road, called River Access Road, runs from River Road near the intake facilities to West Feliciana Parish 7 and is used as a river access and heavy haul road. The other, North Access Road, connects U.S. Highway 61 and State Highway 965. North Access Road is the main access road to the RBS site and passes within approximately 1770 ft. of Unit 1 (Reference 2.2-3).

No new roads would be needed to support RBS Unit 3; however, a portion of West Feliciana Parish 7 may be relocated around the switchyard expansion area. The exact routing of the road relocation will be determined during final design at a time closer to the RBS Unit 3 construction.

At the southwest corner of RBS property at the south end of River Access Road, there is a small barge slip that was used to offload equipment during RBS Unit 1 construction. This same barge slip would be used as necessary for offloading equipment during the construction of RBS Unit 3. The plant water intake structure is in the river west of the barge slip area, and the intake pump house is north of the barge slip area; the discharge outfall area is just south of the barge slip area. The environment of the barge slip is heavily wooded, and the offloading area consists of a small, sandy inlet with no permanent structures.

Along State Highway 965 and the Mississippi River, "no trespassing" signs are posted to discourage unauthorized access to RBS property. Thick forest vegetation around the site and regular security patrols also control accessibility to the RBS site.

The RBS site features a heliport, as illustrated in Figure 2.1-3. Airports in the vicinity of the RBS are described in Subsection 2.5.2.10.

South of the RBS site on the east side of the future John James Audubon Bridge (estimated summer 2010 completion), the state of Louisiana is constructing an extension of State Highway 10 from U.S. Highway 61 at Starhill to the Audubon Bridge (refer to Figure 2.1-2) (Reference 2.2-6). The new bridge and highway would replace the existing ferry service between New Roads and St. Francisville northwest of the RBS site. The Audubon Bridge will be a four-lane highway and bridge facility extending from a Pointe Coupee Parish terminus at the intersection of State Highway 1/10 and State Highway 3131 (Hospital Road) to a terminus at the town of Starhill in West Feliciana Parish at the intersection of U.S. Highway 61 and the proposed State Highway 10 (Reference 2.2-7). The Louisiana Department of Transportation and Development (LDOTD) has begun work on this highway segment and has cleared vegetation from the future highway and ROW (Reference 2.2-8). The proposed Highway 10 route is shown in Figure 2.1-2. With consideration to possible egress limitations from the RBS site area, a plant emergency or a national crisis could result in the closure of the Audubon Bridge and the new section of State Highway 10 because of their proximity to the RBS site. For further discussion of this and other potential egress limitations, refer to the RBS Evacuation Time Estimate included as an appendix to the RBS Unit 3 COLA Emergency Plan.

The LDOTD is converting the existing two-lane U.S. Highway 61 to a four-lane road from the area just south of St. Francisville to the Louisiana-Mississippi state line. The Mississippi Department of Transportation is undertaking a similar project, which will continue the conversion of U.S. Highway 61 from a two-lane to four-lane road from the Louisiana-Mississippi state line north to Vicksburg, Mississippi (Reference 2.2-7).

Traffic information is also addressed in Section 2.5 in relation to the socioeconomic conditions of the RBS site area.

2.2.1.2 Land Use

The land within the vicinity of the site is mainly rural. Figure 2.2-1 shows the land use within the vicinity of the site, which is largely forest and agricultural. No land claims were found for any Native American tribe involving the RBS site or the lands within the 8-mi. vicinity (Reference 2.2-9). The nearest population concentration is located in the town of St. Francisville, which lies 3 mi. northwest of the site (Reference 2.2-2).

Of the 3330 ac. on the site, approximately 364 ac. would be disturbed if RBS Unit 3 is constructed. Before Unit 1 construction, the site contained 1110 ac. of prime farmland and an additional 301 ac. of farmland of statewide importance. As a result of Unit 1 construction, 311 ac. of prime farmland were permanently lost and 12 ac. temporarily disturbed. Approximately 67 ac. of farmland of statewide importance were lost and 5 ac. temporarily disturbed (Reference 2.2-2). As a result of the construction of RBS Unit 3, acreages of farmland are anticipated to be reduced further; however, because a substantial portion of the RBS site is committed to urban development, soils on the site would no longer be considered prime farmland (Reference 2.2-10). In addition, many of the on-site soils in undeveloped areas are sloped, steep, or subject to periodic flooding.

Land use categories included in the 8-mi. (13-km) vicinity are included in the table below and shown in Figure 2.2-1.

USGS Land Use Category	Acreage (Hectares)	Percent of 8-Mi. Vicinity
Open Water	8049 (3257)	6.1
Developed, Open Space	3918 (1585)	3.0
Developed, Low Intensity	2165 (876)	1.6
Developed, Medium Intensity	497 (201)	0.4
Developed, High Intensity	177 (72)	0.1
Barren Land (Rock/Sand/Clay)	1942 (786)	1.5
Deciduous Forest	12,302 (4978)	9.3
Evergreen Forest	3554 (1438)	2.7
Mixed Forest	7960 (3221)	6.0
Shrub/Scrub	5501 (2226)	4.2
Grassland/Herbaceous	3375 (1366)	2.6
Pasture/Hay	23,077 (9339)	17.5
Cultivated Crops	12,561 (5083)	9.5
Woody Wetlands	45,610 (18,458)	34.6
Emergent Herbaceous Wetland	1187 (480)	0.9
TOTAL (rounded)	131,875 (53,368)	100

There are some known local development plans that have the potential to affect the RBS site. The state of Louisiana has begun construction of the Audubon Bridge and the extension of State

Highway 10 from the bridge to Starhill, as shown in Figure 2.1-2. The West Feliciana Community Development Foundation also has proposed plans for a small port facility and large industrial and commercial development area (business park) just south of the future Highway 10 (approximately 2.5 mi. south of the RBS) (Reference 2.2-6). The West Feliciana Community Development Foundation anticipates that the tenants of the proposed business park would consist largely of industries considered clean, or those with minimal potential environmental impacts to the community.

The former Tembec Pulp and Paper Mill, approximately 3.4 mi. south of the RBS, was closed indefinitely on July 31, 2007 (Reference 2.2-5). A similar paper-related business may open at some time in the future in the same location.

The Big Cajun 2 power plant, approximately 3 mi. southwest of the RBS across the Mississippi River in New Roads, has been permitted for the proposed addition of a fourth unit. This new unit has a forecast operation date of 2010. Big Cajun 1, approximately 7 mi. south-southeast of RBS, is also planning a repowering project expected to come on line in 2009 (Reference 2.2-11).

A small hydrokinetic run-of-river power project is proposed to be located in the Mississippi River just northwest of the RBS. This project, the Morgans Bend hydrokinetic power project, is anticipated to be located in the bend of the river that travels around Cat Island National Wildlife Refuge. The project would occupy a stretch of river approximately 9.4 mi. long and would be placed in areas with water depths ranging from less than 5 ft. to more than 100 ft. The project would involve the installation of multiple hydropower units spaced no less than 50 ft. apart. The exact number of units and location of each unit to be installed have not been finalized. There would be no consumptive or otherwise preemptive use of water resources for the Morgans Bend hydropower project, and the structures that may be placed on land in association with the project are very limited in size (Reference 2.2-12).

2.2.1.2.1 Agriculture

Agricultural information was obtained for the parishes in the vicinity of the RBS that are most likely to be directly affected in the event of an accident at the RBS. Year 2006 production estimates for corn, cotton, grain sorghum, oats, soybeans, and wheat for West Feliciana Parish, East Feliciana Parish, and District 6 are presented in Table 2.2-2. Similar data are provided for Pointe Coupee Parish and District 5 in Table 2.2-3. The average yields for these crops for the years 2002 through 2006 are presented in Tables 2.2-4 and 2.2-5.

There are beef cattle within a 5-mi. radius of the site, with the nearest cattle located in the north-northwest direction from the RBS (Sector R). No counts were made, but these cattle are assumed to be used for meat production. According to the RBS 2006 Radiological Environmental Operating Report land use survey, there are no dairy animals within 5 mi. (8 km) of the RBS; nor have there been for several years. Estimates of head of cattle produced for 2007 in West Feliciana and East Feliciana Parishes and District 6, as well as Pointe Coupee Parish and District 5, are presented in Table 2.2-6. East Feliciana, West Feliciana, and Pointe Coupee animal production estimates for 2006 are included in Table 2.2-7. Agriculture in the wider region is discussed in Subsection 2.2.3, and 2006 agricultural production for the region is detailed in Table 2.2-8.

2.2.1.3 Planning and Zoning

According to West Feliciana Parish's Feliciana Vision 2005 planning document, the RBS site and the surrounding properties are planned for industrial use. North of the RBS, closer to St. Francisville, the planned use is largely residential, with some commercial use in the more central areas of town (Reference 2.2-13).

No Native American tribes are located within the RBS vicinity, and no tribes have claims on land in the vicinity. Therefore, there are no Native American land use plans that would affect the site or vicinity (Reference 2.2-9).

2.2.1.4 Viewshed

There are several areas in the vicinity of the RBS that could be considered visually sensitive; these are most likely to be recreation areas and tourist attractions near St. Francisville such as Cat Island National Wildlife Refuge and Audubon State Commemorative Area. Refer to Subsection 2.5.2.7 for a discussion of the aesthetic aspects of the RBS site.

2.2.1.5 Natural and Recreational Areas

Natural features in the site vicinity include Thompson Creek to the east and southeast of the RBS, the Mississippi River and Bayou Sara to the west and northwest, False River southwest in New Roads, Wickliffe Creek and Alligator Bayou in the western portion of the RBS property, Grants Bayou East Fork in the southern part of RBS property, and oxbow lake remnants to the south. These oxbow lakes appear to be part of the former Thompson Creek channel.

No water detention or retention areas are planned during the construction or operation of the RBS Unit 3. Scattered industrial facilities are present southeast of the RBS property, mainly east of Thompson Creek in East Feliciana Parish (Reference 2.2-6). The RBS site is part of the Louisiana Department of Wildlife & Fisheries (LDWF) designated RBS Natural Area, a 550-ac. portion of the site that contains one of the most species-rich upland hardwood forests in the nation. This area also provides unique habitat for many plant and animal species that are rare in Louisiana (Reference 2.2-14).

There are a number of recreational areas within the vicinity of the site, including several plantations of historic interest and various wildlife management areas that provide hunting, fishing, and other recreation opportunities. Notable plantations in the vicinity of the RBS, generally to the northwest in the St. Francisville area, include The Myrtles, Butler Greenwood, and Greenwood Plantations, as well as the Rosedown Antebellum Home. Oakley House is part of the Audubon State Commemorative Area discussed below and is northeast of the RBS (Reference 2.2-15). In addition to plantations in the area, the following areas in the RBS vicinity are available for recreation:

- Gasper Creek Forest Conservation Area - A 56-ac. future green space north of the Ferdinand Street and Gasper Creek intersection in St. Francisville, approximately 3.5 mi. northwest of the RBS (Reference 2.2-13).

- Green Acres Campground - A quiet, shaded 46-site camping area with full hookups, tent area, restrooms, showers, and pavilion, approximately 4 mi. northeast of the RBS site (References 2.2-15 and 2.2-16).

- The Bluffs Country Club and Resort - A private golf resort development approximately 6 mi. northeast of the RBS site. The Bluffs is open year-round for public use (Reference 2.2-17).

- Hemingbough (formerly Audubon Lakes) - Located approximately 1 mi. northwest of the site.

- Cat Island National Wildlife Refuge - Located approximately 3 mi. west-northwest of the RBS, this 9623-ac. refuge was established to conserve, restore, and manage native forested wetland habitats for migratory birds, aquatic resources, and endangered and threatened plants and animals. It is one of the few remaining unleveed sections of floodplain along the Lower Mississippi River (LMR) and remains influenced by the natural flooding of the river. The Nature Conservancy plans to gradually acquire additional land for the refuge until it reaches the Congressionally approved acquisition boundary of 36,500 ac. (References 2.2-18 and 2.2-19).

- Audubon State Commemorative Area - Approximately 100 ac. of land and the Oakley House (state historic site) located approximately 3.5 mi. northeast of the RBS site. The Oakley House is open for tours year-round (References 2.2-20 and 2.2-21).

- Locust Grove State Commemorative Area - Located approximately 4.5 mi. northeast of St. Francisville on State Highway 10, this site features the gravesites of Sarah Knox Taylor, wife of Jefferson Davis, and General Eleazor Ripley, a distinguished soldier in the War of 1812 (Reference 2.2-22).

- West Feliciana Parish Sports Park - A recreation complex with facilities for baseball, soccer, tennis, basketball, and hiking accessible off U.S. Highway 61 north of St. Francisville and located approximately 5 mi. north-northwest of the RBS (Reference 2.2-23).

- Port Hudson State Commemorative Area - The site of the longest siege in American history, lasting 48 days, when 7500 Confederate soldiers resisted some 40,000 Union soldiers for almost 2 months during 1863. This National Historic Landmark site encompasses 889 ac. of the northern portion of the battlefield and features three observation towers, 6 mi. of trails, a museum, and a picnic area. The Port Hudson National Cemetery is the burial site of 4000 Civil War soldiers. This state historical area is located near Zachary, approximately 9 mi. southeast of the RBS site (Reference 2.2-24).

- Marydale Girl Scout Camp - Camp Marydale offers horseback riding, archery, swimming, and other activities; it operates for 6 weeks during June and July and features overnight accommodations for approximately 170 people. The camp is approximately 9 mi. northwest of the RBS site (Reference 2.2-25).

- False River - This horseshoe lake is part of the former course of the Mississippi River and is located in the northeast portion of New Roads west of the river, approximately 6.6 mi. southwest of the RBS. Near the town of New Roads and along both sides of False River, weekend and vacation homes have been developed. In addition to these vacation homes, the lake also attracts many people for boating, water skiing, and fishing (References 2.2-7 and 2.2-26).

- The Nature Conservancy's Mary Ann Brown Preserve - More than 100 ac. of deep ravines and loblolly pine forests donated for the enjoyment of the public. The site features interpretive trails and is open daily for hiking. Picnic areas and primitive camping sites are available by advance reservation. The preserve is approximately 7 mi. north of the RBS site (Reference 2.2-27).

No public or private land trust holdings were found, other than those discussed above and in Subsection 2.2.3.

2.2.1.6 Water and Rail Transportation

The Mississippi River is one of the nation's most important transportation networks for cargo movement. Grain and farm products from the Midwest, coal and minerals from Appalachia and the west, and petroleum and chemical products are transported through Louisiana for transfer to and from oceangoing vessels. Near Baton Rouge, the navigation channel is 40 ft. deep by 500 ft. wide and is maintained by dredging and training works. This shallow draft requires that commodities be transported by barge so that they can be loaded and unloaded to and from larger marine vessels for ocean transport throughout the world through the ports in and south of Baton Rouge (References 2.2-7 and 2.2-28).

Two rail lines enter the 8-mi. (13-km) vicinity surrounding the RBS site. A single track of the former Illinois Central Railroad at one time crossed the RBS site in a northwest-southeast direction outside the exclusion area, approximately 2000 ft. south of the proposed Unit 3 reactor. Coming from the south toward the RBS site, service on the former Illinois Central rail line (currently operated by Canadian National) ends at the former Tembec Pulp and Paper Mill. This Canadian National line enters the vicinity east of Lindsay and travels west to the former Tembec Pulp and Paper Mill. Portions of the track extend northwest toward the RBS site, but the line is closed and abandoned beyond the former Tembec Pulp and Paper Mill, and the tracks that once crossed the RBS site have been pulled up and removed (Reference 2.2-29). A Kansas City Southern rail line runs through the vicinity near New Roads and has a branch line to the northeast that serves the Big Cajun 2 Power Plant. No plans to expand the current level of rail service in the area are indicated in the Louisiana State Transportation Plan (Reference 2.2-30). The Applicant has no plans to use rail transport for materials needed during the construction of the proposed Unit 3. Rail lines beyond the 8-mi. radius are described in Subsection 2.2.3.

2.2.1.7 Pipelines

Pipelines in the vicinity of the RBS are located in the southern and eastern quadrants of the 8-mi. vicinity. They generally run from the New Roads area toward Jackson, crossing the Mississippi River near River Mile (RM) 261, approximately 1.5 mi. downstream of the RBS barge slip area (References 2.2-6 and 2.2-31). Locations of pipelines are shown in Figure 2.2-2.

There are three natural gas corridors and one petroleum corridor within the vicinity of the RBS (natural gas lines shown in Figure 2.2-2). The nearest natural gas corridor contains two 30-in. diameter Texas Eastern Transmission Corporation/Spectra Energy lines running from the area of New Roads northeast and passing approximately 2.1 mi. from the proposed RBS Unit 3 reactor, with a third 36-in. diameter natural gas pipeline starting at the valve site on the west side of the Mississippi River crossing and going south. The operating pressure is 1100 psig for these three lines, which were installed in 1955, 1960, and 1964.

Williams Gas Pipeline-Transco has a natural gas corridor running roughly east-west approximately 2.5 mi. south of the proposed RBS Unit 3 reactor. This corridor contains four lines: one of 30-in. diameter, two of 36-in. diameter, and one of 42-in. diameter. The operating pressure of the lines is 550 to 800 psig. The pipelines were installed in 1951, 1956, 1960, and 1985 and are at 30 in. minimum depth. The closest isolation valves are located on the east side of the Mississippi River approximately 3 mi. south of the RBS site near the Audubon Bridge and proposed Highway 10 route.

Enbridge Pipelines (Mid Louisiana), LLC operates an 8-in. diameter natural gas pipeline at 165 psig normal pressure. This line was constructed in 1959 at a 30-in. average depth of burial and starts approximately 3.4 mi. from the RBS at the former Tembec Pulp and Paper Mill, running east to connect with the Enbridge (Mid Louisiana) interstate pipeline near Lindsay, Louisiana. Mid Louisiana Gas Transmission Company, LLC has a 6-in. diameter natural gas line operating at 550 psig normal pressure. This line was constructed in 1985 at a 30-in. average depth of burial and runs from the Williams Gas Pipeline-Transco valve station east of the Mississippi River (approximately 3 mi. from the RBS), connecting with the Texas Eastern Transmission Corporation pipeline, then terminating at the former Tembec Pulp and Paper Mill site.

Colonial Pipeline Company has four petroleum pipelines in its east-west corridor approximately 4.3 mi. south-southeast of the RBS site. The petroleum lines are 6-, 36-, and 40-in. diameter lines operating at pressures from 590 to 800 psig at a depth of 36 in.

When contacted, the pipeline operators discussed above did not indicate future plans to carry products in their lines different than those they currently transport.

There are no major oil or gas pipelines crossing the Applicant's property. It was noted, however, that the Applicant will be provided water from the parish's Water District 13 and will install water pipelines on-site for the transport of this additional water.

2.2.1.8 Surface Rights

The Applicant has acquired and will maintain surface ownership of all the land within the RBS site property boundary, with the following exception:

- The 1.7-ac. Starhill Microwave Radio Tower property is surrounded on three sides by the RBS site property and on the west by Highway 965, but is not part of the RBS site. The tower is near the northwest portion of the site and is owned by PolAris (Figure 2.1-3). The Starhill Microwave Radio Tower is located north of the intersection of State Road 965 and North Access Road, approximately 0.5 mi. from RBS Unit 1 and the proposed RBS Unit 3. The Starhill Microwave Radio Tower is part of the long-distance telephone relay line between Lake City, Florida, and Houston, Texas. The installation requires 24-hour, 7-day-a-week access capability for routine maintenance and emergencies. The Starhill Radio Tower and its associated 1.7-ac. parcel will continue to be owned and operated by PolAris. Access to the radio tower will not be restricted during normal RBS operation, because it is accessible directly from State Road 965 and is not owned by the Applicant (Reference 2.2-3).

There are no active railroads or navigable waterways that traverse the site. West Feliciana Parish 7 (also called Police Jury Road and Powell Station Road) and River Road are the only parish roads that run through the RBS site. West Feliciana Parish 7 cuts through the southeast portion of the RBS site and becomes State Highway 965 as it crosses River Access Road and traverses the west and northwest sectors of the plant site. River Road is a gravel road paralleling the Mississippi River. There are no other industrial, commercial, or institutional structures on the site. The western portion of the site contains the hunting clubhouse, baseball park, security firing range, community facility, and outage RV park. There is one abandoned residence in the southeast corner of the intersection of North Access Road and Highway 61; several residences along State Road 965/West Feliciana Parish 7 are present just outside the property line near the RBS substation and along State Road 965/West Feliciana Parish 7.

The Applicant allows access to parts of the plant site property for private recreational and occasional agency research purposes. The site is posted with notifications around the perimeter to ensure that the public is aware of access restrictions.

2.2.1.9 Mineral Rights

The Applicant owns and/or controls 100 percent of the mineral rights within the RBS Units 1 and 3 plant exclusion areas, subject to reservations of mineral rights by predecessors-in-title, but controls the right to use the surface of the exclusion areas for the extraction or development of minerals. There is no activity at the RBS exclusion areas involving exploration for, or drilling for, or otherwise extracting minerals. The geological character of the subsurface structure in the vicinity of the RBS site indicates that commercial mineral production appears unlikely in the foreseeable future. This was confirmed in a geological appraisal, dated March 16, 1976. Under Louisiana law, ownership of land also includes ownership of all solid-state minerals under the land absent a prior mineral reservation. Louisiana law uses the "rule of capture" for liquid and gaseous minerals. Under this concept, landowners do not own minerals in the liquid or gaseous forms that may occur under the land, including oil and gas; however, the party that owns the land has the exclusive right to develop the land for those liquid or gaseous minerals. The Applicant owns the entire RBS site and the associated exclusion areas for Unit 1 and the proposed Unit 3, subject to reservations of mineral rights by predecessors-in-title, but the Applicant effectively controls the right to use the surface of the exclusion areas for the extraction or development of minerals (Reference 2.2-32).

2.2.1.10 Easements

The Applicant owns all the RBS site, and the Units 1 and 3 plant exclusion areas, with the exception of the 1.7-ac. Starhill Microwave Radio Tower parcel, which is located outside the exclusion area boundary and owned by PolAris. The exclusion areas are subject to no easements/servitudes except such easements/servitudes that grant EGSL the right to exclude or remove persons or property from the exclusion area consistent with the safety and security requirements of EGSL, and none of which convey fee ownership of the property burdened by these easements/servitudes.

2.2.2 TRANSMISSION CORRIDORS AND OFF-SITE AREAS

According to the Applicant's transmission system impact study described in Section 3.7, the existing transmission corridor and Fancy Point Substation on the RBS site would need expansion to adequately transmit the power anticipated to be produced by RBS Unit 3. A new 500 kV line would be added on the RBS site adjacent to and west of the existing 230 and 500 kV lines in an expanded corridor from RBS Unit 3 to the RBS property boundary along the Mississippi River. The new off-site 500 kV corridor, which is an extension of the expanded on-site 500 kV corridor, was selected through the Applicant's Route Selection Study described in Section 3.7. The goal of the routing study was the selection of an environmentally preferable approximate transmission corridor route.

Because the proposed new transmission corridor has not been finalized and is still subject to change, no field studies were performed along the new corridor to support this ER. An analysis of the proposed new Unit 3 transmission corridor was conducted using publicly available data and Environmental Systems Research Institute (ESRI) ArcGIS 9.2 mapping and analysis software, as described in the Applicant's Route Selection Study.

It should be noted that the Route Selection Study provides representative information for a likely transmission corridor route. Because the route has not been precisely defined at the time of this COLA, no agency contacts have been made to determine potential areas of concern along the route. Specific impacts cannot be determined until the route has been finalized and the appropriate agencies have been consulted at a time closer to construction. Information provided in the Applicant's Route Selection Study was used as the basis for analyses of preliminary transmission corridor impacts as far as they could be determined at the time of this COLA. The Route Selection Study was considered to provide sufficient information to complete the land use analysis for this ER. The proposed new transmission corridor alignment is described in this Subsection 2.2.2 and in Section 3.7.

No off-site areas are associated with RBS Unit 3.

2.2.2.1 Existing Transmission Corridors

The Applicant's transmission business unit owns and operates the five transmission lines that exit the RBS site in three separate ROWs. One 500 kV line runs due east from the site, crossing mostly agricultural and forested land to a substation near the junction of State Highways 959 and 63 (McKnight Substation). Another 500 kV line runs south-southwest from the site, crosses the Mississippi River and connects to the Big Cajun 2 switchyard, and then runs across agricultural and forested land to a substation near Rosedale, Louisiana (Webre Substation). Three 230 kV lines run south-southeast, paralleling the Mississippi River and U.S. Highway 61, and then across lowlands and swamps to a substation near Irene, Louisiana (Jaguar Bulk Substation). There is also a 69 kV transmission line that runs through the RBS property along River Road. None of these transmission line ROWs cross any known protected land designations or special land uses (Reference 2.2-3).

The following data apply to the existing transmission lines:

Existing Transmission Line	Length (mi.)	Acreage, acres (hectares)[(a)]
Route I (RBS to Webre Substation)	20.29.	492 [199]
Route II (RBS to Jaguar Bulk Substation)	23.75	576 [233]
Route III (RBS to McKnight Switching Station)	27.20	659 [267]
Total	71.24	1727 [699]

a) These approximate acreages do not account for shared segments of transmission routes. According to Reference 2.2-3, approximately 80 percent of the existing transmission corridors are partially or completely shared. Acreage is overestimated by assuming an individual 200-ft. wide corridor along the entire length of each line.

Land use within the existing transmission line ROWs consists mainly of forest and agricultural lands, with small parts of the corridors crossing residential and undeveloped areas. The Applicant's transmission line ROWs are 200 ft. wide, with vegetation managed within that area. Portions of the existing transmission ROWs are less than 200 ft. wide because many of them are shared ROWs with transmission lines not related to the RBS. The land currently dedicated to transmission line ROWs within the RBS property boundary represents a total area of approximately 58 ac. (Reference 2.2-3). There are no land use restrictions in the existing transmission line corridors (Reference 2.2-3).

The existing transmission system leaving the RBS Fancy Point Substation would need expansion and additions to accommodate the power generated by the proposed RBS Unit 3. The existing RBS Fancy Point Substation was built with provisions for equipment installation and operation of a second unit. The substation will be expanded and modified for new RBS unit switching equipment and connection to existing and new transmission lines.

2.2.2.2 Proposed RBS Unit 3 Transmission Corridor

According to the Applicant's load flow study as described in Section 3.7, a new transmission line (on-site and off-site) would need to be added for the accommodation of power output from the proposed Unit 3. The new transmission line at the RBS will be 500 kV. The proposed on-site expansion of the transmission corridor would affect an area of approximately 15 ac. of forest, while the new off-site transmission corridor would involve approximately 3334 ac. of various land uses along its 148-mi. route.

The construction and operation of a new single-circuit 500 kV transmission line that will interconnect with the existing Hartburg to Mount Olive 500 kV transmission line would be needed to accommodate power output from RBS Unit 3. This new line would also provide additional backup capacity to the electric grid in western Louisiana and southeast Texas to protect against outages on existing high voltage lines in the area. The Hartburg to Mount Olive 500 kV line extends from southeast Texas north through western Louisiana (refer to Figure 2.2-7) to the Mount Olive 500 kV Substation in northern Louisiana. The new RBS off-site transmission line would cross portions of Pointe Coupee, Avoyelles, Rapides, Grant, and Natchitoches Parishes. The new line to serve RBS Unit 3 would be constructed along a new, approximately 200-ft. wide corridor not currently used for transmission purposes. The proposed transmission line would measure approximately 148 mi. in length. This new corridor route was selected because it best avoided environmentally sensitive areas, including population concentrations, national forest lands, military installations, large water bodies, public wildlife preserves and refuges, state parks, state commemorative areas, and the Alexandria International Airport, compared to other routes considered in the Route Selection Study. The transmission corridor route would have an estimated 318 open water and wetland crossings, with 29 of those crossings more than 1000 ft. wide. These water features would be spanned or the route adjusted to avoid them whenever possible to minimize environmental impacts.

The Federal Energy Regulatory Commission (FERC) has jurisdiction over the connection of RBS Unit 3 to the existing transmission grid. The FERC established regulations governing such interconnections in FERC Order 2003, which mandates the undertaking of specific studies to demonstrate that the location and design of interconnecting equipment is sufficient to protect overall system stability and integrity. These studies were performed by the Southwest Power Pool - Independent Coordinator of Transmission (SPP-ICT), which has been delegated oversight responsibilities by the FERC.

Transmission line construction is subject to oversight by the Louisiana Public Service Commission (LPSC). Entergy's transmission business unit will operate the proposed new 500 kV transmission line that will connect to the RBS Fancy Point Substation and transmit power to customers connected to the grid. There is no direct federal authorization issued for transmission line construction; however, related approvals for specific activities, such as placement of fill in wetlands or incidental taking of threatened or endangered species, can be appended as conditions to the CPCN approval, depending on characteristics specific to the final transmission line route.

The new transmission line will be built in accordance with Entergy standards; structure design is not anticipated to be finalized, however, until a time closer to the construction of the new line. The single-circuit conductors are anticipated to be arranged in bundles of three or four subconductors and would be suspended on Vee-string insulators in a horizontal or triangular (delta) configuration. Shield wires would be placed at the tops of the tower structures to protect against lightning strikes. The height of the transmission line support structures would be approximately 150 ft., with the exception of those towers closest to the Mississippi River crossing, which would have much greater heights. The distance between towers would be between 1000 and 1200 ft., depending on the features in the segment of land being spanned. Structure bases would measure approximately 50 by 50 ft. Guy wires may be used for towers, depending on final design; if they are used, some may extend outside the ROW and require additional easements. The minimum ground clearance would be maintained at 26 to 28 ft. along the new line, with 40 ft. of clearance at public road crossings.

A new 500 kV switching station with an approximate 1000 ft. by 1000 ft. area will be required at the interconnection point of the new 500 kV line with the Hartburg to Mount Olive 500 kV transmission line. The switching station would be located approximately 4 mi. east of Marthaville and 14 mi. west of Natchitoches, Louisiana, on Brandon Cotton Road. The exact location of the switching station is to be determined at a later time closer to the proposed RBS Unit 3 construction period. The Applicant has not yet acquired property for the new transmission line or the new switching station. Final determination of the switching station site depends on the Applicant's engineering parameters and the selection of an environmentally acceptable final preferred route from the existing Fancy Point Substation at the RBS to this western interconnection point.

Water bodies crossed by the proposed transmission line corridor are noted in the Route Selection Study. These water bodies include the Mississippi River, Red River, and many smaller creeks and streams. The proposed transmission line would traverse many small local and parish roads, with at least one likely crossing of Louisiana Highways 49 and 71. The criteria for the selection of this transmission corridor route included avoidance of federal lands, so it is not likely that federal lands would be crossed by the corridor once the route is finalized. Since the transmission corridor route has not been finalized at the time of this COLA, it is not possible to state definitively the particular Native American lands, state or local parks, or other public or conservation lands that may fall within the new corridor. Informal consultation letters to obtain information on any threatened or endangered species or cultural resource concerns within the proposed new off-site transmission corridor have not yet been submitted to the U.S. Fish & Wildlife Service (USFWS), the LDWF, State Historic Preservation Office (SHPO), and appropriate Native American tribal representatives. These consultation letters are not expected to be submitted to agencies until plans for the transmission corridor have been finalized and the beginning of the construction of the new transmission lines and structures draws closer.

The future expansion of the transmission system at the RBS is likely to affect similar land uses (largely forest) as those traversed by the existing transmission corridors. Figure 2.2-7 illustrates the proposed new off-site transmission corridor from the RBS Fancy Point Substation and continuing farther west, then connecting into the existing 500 kV Mount Olive to Hartburg transmission line corridor.

The primary land use categories located within the proposed new transmission corridor are hayfields and pasture (26 percent), cultivated crops (20 percent), and woody wetlands (16 percent). Areas classified as developed open spaces, developed low-intensity, and developed medium-intensity constitute only 7 percent of the total area covered by the transmission corridor. According to data derived from the U.S. Geological Survey National Land Cover Database, approximately 18 percent of the new transmission corridor overlays areas with wetland characteristics. Acreages for each land use type along the proposed RBS Unit 3 off-site corridor are provided below:

Natchitoches Corridor (147.71-mi. route length)

Land Use Type	Acreage (hectares)
Barren Land	0.7 (0.3)
Cultivated Crops	675.4 (273.3)
Deciduous Forest	73.4 (29.7)
Developed, High Intensity	1.1 (0.5)
Developed, Low Intensity	100.7 (40.8)
Developed, Medium Intensity	6.7 (2.7)
Developed, Open Space	135.4 (54.8)
Emergent Herbaceous Wetlands	44.3 (17.9)
Evergreen Forest	298.5 (120.8)
Hay/Pasture	862.5 (349.0)
Herbaceous	41.6 (16.8)
Mixed Forest	96.3 (39.0)
Open Water	92.1 (37.3)
Shrub/Scrub	357.8 (144.8)
Woody Wetlands	547.6 (221.6)
Total	3334.1 (1349.3)

The Applicant expects to work with landowners adjacent to the new transmission line to minimize impacts to land use on properties crossed by transmission line easements.

Routes of access corridors or access roads for construction and maintenance of the new off-site transmission line will not be determined until the route is finalized at a time closer to the beginning of construction of the transmission expansion. Existing roads and infrastructure would be used to the maximum extent possible to minimize areas of disturbance along the route.

Before the transmission line portion of the project moves forward to ROW acquisition, it is anticipated that a more detailed environmental route selection study would be completed to define a specific route between the existing Fancy Point 500 kV Substation and the preferred interconnection location. At that time, special land use classifications, federal, state, regional, local, and Native American land use plans, specific utility and other crossings, and natural area crossings that could affect the transmission corridor would be investigated.

2.2.3 THE REGION

2.2.3.1 Regional Transportation

Transportation infrastructure within the region includes the Mississippi River, U.S Interstate Highway 61, and State Route 965, a portion of which traverses the RBS site. Interstate Highway 61 runs southeast-northwest, connecting New Orleans with the site and St. Francisville to the northwest and Natchez, Mississippi, farther north. State Route 965 runs southeast to north, connecting the RBS site with U.S. Highway 61 to the north. State Highway 10 is proposed to pass just southeast of the RBS site boundary and will run southwest to northeast, passing through New Roads and Starhill on its way through the RBS site vicinity (Reference 2.2-6). Figure 2.2-4 shows the locations of highways, railroads, and major airports in the 50-mi. area; airports are also shown in Figure 2.2-6 because many of the smaller airports in the region may be used for recreational flying.

The Mississippi River, which passes approximately 2 mi. east of the RBS site, provides another mode of transportation in the region. The nearest river port facility is the Port of Greater Baton Rouge, which operates between RMs 168 and 253. The Port of Greater Baton Rouge is a large river port facility and U.S. customs port of entry that lies south of the site near RM 253 at its closest point to the RBS site (References 2.2-31 and 2.2-33).

A transcontinental highway (future Interstate 49/90) from New Orleans, Louisiana, to Kansas City, Missouri, and extending into Canada via existing Interstate 29 is in the planning stage for the region. This highway is proposed to connect the ports of Louisiana to expanded markets across the United States and Canada. The future extension of Interstate 49 to the south includes parts of U.S. 167 and U.S. 90 from the Interstate 49/Interstate 10 interchange in Lafayette to the Interstate 10/U.S. 90 business interchange in downtown New Orleans (Reference 2.2-34). The Huey P. Long Bridge on U.S. 90 in New Orleans is also currently being expanded (Reference 2.2-35).

Preliminary plans and analyses are ongoing to support the eventual construction of the Baton Rouge Loop, a circular highway that is expected to ease traffic congestion by diverting a portion of the current traffic flow around Baton Rouge. The exact route of the Baton Rouge Loop has not been chosen; however, the closest proposed route option is at least 16 mi. southeast of the RBS site (Reference 2.2-36).

The region surrounding the site includes a Canadian National rail line traveling roughly north-south in the easternmost portion of the region in Tangipahoa Parish. Other rail lines in the region travel through the Baton Rouge area in a generally southeast-northwest direction. Rail lines traversing the region include a Gloster Southern Railroad Corporation line from Slaughter, Louisiana, into Gloster, Mississippi; and Kansas City Southern, Union Pacific, and Canadian National lines traveling through Baton Rouge from the New Orleans area into the Midwest.

2.2.3.2 Regional Land Use

The region consists mainly of forest and agricultural lands. Land cover information for West Feliciana Parish and the adjoining parishes is presented in Figure 2.2-1, and in Figure 2.2-3 for the 50-mi. (80-km) region. The following table presents land uses within the 50-mi. region around the RBS and the portion of the region that each land use comprises.

Land Use	Acreage (Hectares)	Percentage of 50-mi. Region (rounded)
Open Water	152,351 (61,654)	3.1
Developed, Open Space	132,225 (53,510)	2.7
Developed, Low Intensity	126,187 (51,066)	2.5
Developed, Medium Intensity	0 (0)	0
Developed, High Intensity	41,566 (16,821)	0.8
Barren Land (Rock/Sand/Clay)	25,158 (10,181)	0.5
Deciduous Forest	229,671 (92,945)	4.6
Evergreen Forest	454,096 (183,766)	9.1
Mixed Forest	174,320 (70,545)	3.5
Shrub/Scrub	325,878 (131,878)	6.6
Grassland/Herbaceous	98,963 (40,049)	2.0
Pasture/Hay	480,189 (194,326)	9.7
Cultivated Crops	793,216 (321,003)	16.0
Woody Wetlands	1,859,833 (752,648)	37.4
Emergent Herbaceous Wetland	74,257 (30,051)	1.5
Total	4,967,910 (2,010,442)	100

Louisiana State Penitentiary (LSP) in Angola, Louisiana, is the state's only maximum security prison. The prison is located approximately 20 mi. northwest of the RBS site on 18,000 ac. and houses more than 5100 inmates. The prison property features a museum and golf course, and a rodeo is held on the property annually. These activities are open to the public (Reference 2.2-37).

2.2.3.3 Regional Transmission Lines and Pipelines

There are various voltages of transmission lines, including 500 kV, 230 kV, 138 kV, and 69 kV, that serve the region. Most of the higher voltage lines follow an east-west path from Lafayette through Baton Rouge and on to either New Orleans or southern Mississippi. Most lower voltage lines can be found in the same areas as high voltage lines, but there are scattered branches from the main lines to serve the less populated parishes in the RBS region.

Natural gas pipelines are found throughout the region, and several gas lines exist within the site vicinity (Reference 2.2-8). The major gas pipelines pass through the RBS vicinity in a generally east-west direction from Evangeline and St. Landry Parishes in the western part of the region into East Feliciana and St. Helena Parishes, where they turn northeast and branch into two main lines: one through Amite and Franklin Counties and the other through Pike County, Mississippi. Other gas lines run through Livingston and Tangipahoa Parishes in the eastern part of the region.

Several major north-south lines travel through the western part of the region, coming south from Ouachita Parish in northern Louisiana through Avoyelles, Evangeline, and St. Landry Parishes to the southwest Louisiana parishes near the Gulf of Mexico (refer to Figure 2.2-5).

2.2.3.4 Regional Natural and Recreational Areas

In addition to those discussed previously in Subsection 2.2.1, the major recreational areas of the 50-mi. region include the following:

- Tunica Hills Wildlife Management Area, a 5905-ac. expanse approximately 14 mi. northwest of RBS, is composed of two separate tracts lying northwest of St. Francisville in West Feliciana Parish. The northern Angola Tract (2345 ac.) is adjacent to the LSP. The South Tract (3560 ac.) is approximately 17 mi. west on Highway 66 from U.S. Highway 61. The Old Tunica Trace, which has been a travel route since colonial times, turns to the left and bisects the management area. The terrain in the area is composed of rugged hills, bluffs, and ravines. The area is at the southern end of the Loess Blufflands escarpment that follows the east bank of the Mississippi River. These blufflands offer a diverse habitat that supports some species of plants and animals not found elsewhere in Louisiana. Most public uses are allowed in this wildlife management area (WMA), with the exception of camping (Reference 2.2-38).

- Atchafalaya National Wildlife Refuge is approximately 25 mi. southwest of the RBS and just west of Maringouin, Louisiana, in northwest Iberville and southwest Pointe Coupee Parishes. The refuge features bottomland hardwood forest, cypress mixed with bottomland hardwoods, open water, willow, smartweed, water hyacinth, frog's bit, and cattail and is managed for all public uses (Reference 2.2-38).

- Lake Ophelia National Wildlife Refuge, approximately 42 mi. northwest of RBS, was established in 1988 to protect the important Mississippi/Red River floodplain ecosystem. The refuge was once part of a vast bottomland hardwood wilderness. The hydrology has been changed by levees, but the underlying ridge topography supports a variety of habitat types. The variety of vegetative communities supports diverse wildlife (Reference 2.2-38).

- Grand Cote National Wildlife Refuge, approximately 47 mi. northwest of the RBS, provides valuable waterfowl habitat in the Mississippi/Red River floodplain ecosystem. Agricultural fields cover approximately half of the refuge lands. Other habitats include bottomland hardwood forest, bayous, willow sloughs, open marsh, and small ponds (Reference 2.2-38).

- Bayou Cocodrie National Wildlife Refuge lies just outside the 50 mi. area, approximately 54 mi. northwest of the RBS. Bayou Cocodrie has some of the least disturbed bottomland hardwoods in the Mississippi River Valley. This refuge was established in 1992 to provide wintering habitat for waterfowl and to protect the pristine hardwood found there (Reference 2.2-38).

- Clark Creek Natural Area (State Park), located approximately 24 mi. north of the RBS near Woodville, Mississippi, features beech- and magnolia-dominated hardwood and pine forest. The state park encompasses more than 700 ac. that contain approximately

50 waterfalls. This area, also referred to as Tunica Falls, offers opportunities for bird watching, hiking, and photography. The park is open for public use through foot traffic only (Reference 2.2-39).

- Saint Catherine Creek National Wildlife Refuge is just southwest of Natchez, Mississippi, approximately 46 mi. north of the RBS. The refuge is inside the Mississippi River floodplain approximately 10 mi. south of Natchez. Available wildlife habitat consists of bottomland and upland hardwoods, cleared land, cypress swamps, accredit land, and fallow fields. Most public uses are allowed on the refuge (Reference 2.2-38).

- Percy Quin State Park is approximately 51 mi. northeast in Mississippi and includes a visitor's center, a game room, nature trail, swimming pool, miniature golf course, playground, and picnic area (Reference 2.2-38).

- Natchez National Historical Park, approximately 52 mi. north of the RBS, celebrates the history of Natchez, Mississippi and interprets the pivotal role the city played in the settlement of the old southwest, the Cotton Kingdom, and the Antebellum South (Reference 2.2-38).

- Homochitto National Forest in Mississippi is located just outside the 50-mi. area, approximately 54 mi. north-northeast of RBS. Most of the recreation in this part of the forest is centered around the Pipes Lake Recreation Area, which has a 14-ac. lake and a picnic area. Hunting, picnicking, fishing, and boating are the primary activities available in this portion of the forest (Reference 2.2-38).

- Natchez State Park is 10 mi. north of Natchez, Mississippi, and approximately 60 mi. north of the RBS. Prior to the Civil War, more than half of the millionaires in the United States lived in Natchez in large, elegant mansions. Most of these homes were spared during the Civil War, and many are now open for tours. Natchez State Park also features a fishing lake, camping, and nature trails (References 2.2-38 and 2.2-40).

Several other WMAs are located in the northeast portion of the 50-mi. region in the area between Marksville, Louisiana, and Natchez, Mississippi. These include Three Rivers, Red River, Grassy Lake, Pomme de Terre, Spring Bayou, and Dewey W. Wills WMAs. These areas are generally managed for most public uses, with some site-specific restrictions (Reference 2.2-38).

2.2.3.5 Agriculture

The states of Louisiana and Mississippi are each divided into nine districts by the U.S. Department of Agriculture (USDA) National Agricultural Statistics Service (NASS) for reporting agricultural information. The RBS site area is located in Louisiana District 60. The parishes in this district include East Baton Rouge, East Feliciana, Livingston, St. Helena, St. Tammany, Tangipahoa, Washington, and West Feliciana (Reference 2.2-41). The 50-mi. region also includes portions of Louisiana Districts 50, 80, and 90 and Mississippi Districts 70 and 80. For purposes of this section, only the parishes and counties that have substantial portions of their land areas inside the 50-mi. radius circle around the RBS are included in the discussion.

Information about agricultural products and practices in the RBS region is provided to enhance the understanding of radiation exposure pathways. Some of the major agricultural products of the region are cattle and calves, beef, cow's milk, corn, wheat, rice, soybeans, sugarcane, and cotton. According to the 2006 parish estimates, soybeans are a major product of the region, with Pointe Coupee, Concordia, and St. Landry Parishes ranked third, fourth, and fifth, respectively, among the top five soybean-producing parishes in Louisiana. Pointe Coupee Parish is also the top wheat-producing parish in Louisiana. Evangeline Parish, just outside the 50-mi. region to the west, is third among the top five rice-producing parishes of the state. Iberville Parish, in the southern part of the 50-mi. region, is ranked fourth of the top five sugarcane-producing parishes, and Iberia Parish, just south-southwest of the 50-mi. region, is the top sugarcane-producing parish in Louisiana (Reference 2.2-42).

Poultry production and other products associated with poultry have contributed increasingly to Louisiana's state economy since about 1998; the poultry industry came close to doubling its contribution to the state economy between 1998 and 2004 (Reference 2.2-43). Livingston Parish, on the east side of the 50-mi. region, had 1.76 million broilers and other meat type chickens sold, according to the 2002 Census of Agriculture; however, most of the other parishes in Louisiana and the few counties in Mississippi that are part of the 50-mi. region do not have significant poultry production (References 2.2-43 and 2.2-44).

Forestry is an important industry in the southern United States, including the area within the 50-mi. region of the RBS. As shown in Figure 2.2-3, the Mississippi counties within the region have a greater proportion of forested lands compared to cropland, whereas crop fields are more dominant closer to the site in Louisiana. Southern Mississippi is well known for its large areas of pine plantations that are harvested to supply the pulp and paper industry. Forestland cover in Mississippi has shown a significant increase since the 1950s. Louisiana, on the other hand, is one of the southern states that has shown the highest losses of forest land cover, primarily from clearing for agriculture, in the same time period (Reference 2.2-45).

There are an estimated 45 to 50 dairies in the eastern portion of the 50-mi. area and a few near Opelousas, Ville Platte, and Lafayette in the south and southwest portions of the region. Pointe Coupee Parish produces many truck-farming products such as sugar cane, soybeans, wheat, and other crops. East and West Feliciana Parishes have an estimated 18 vegetable and fruit truck-farming operations. Three dairies are present in East Feliciana Parish in the Clinton area. Grazing season is April through September, and many livestock producers also plant winter forage in the form of ryegrass, which grows from about November 15 until April 15 and into May.

An estimated 400 to 500 head of beef cattle are raised within the area of East and West Feliciana Parishes and St. Helena Parish. The remainder of the 50-mi. region probably has approximately 500 to 800 beef cattle, for an estimated total of 1200 to 1300 in the entire region.

The main crop used to feed cattle in the region is hay, especially for beef cattle. Some dairy cattle in the eastern area of the region are also fed corn and ryegrass silage, but beef cattle are not usually fed silage. Most producers keep one cow and calf pair for every 3 ac. of pasture. Information on pasture grass density in the RBS area was not readily available.

Agricultural product distribution within the region varies by product. Meat is not distributed in the immediate region around the RBS; the cattle are instead shipped to feedlots in Texas, Oklahoma, and Kansas. Dairy products generally go to a processing plant within the region. Truck-farm produce (e.g., fruit and vegetable) distribution is generally through the farmer's markets, especially the Baton Rouge market. Besides the farmer's market in Baton Rouge, there are many local fruit and vegetable stands and farmer's markets in the various parishes where agricultural products are sold. There are also three "you-pick" blueberry farms in the region.

2.2.3.6 Planning and Zoning

The Capital Region Planning Commission (CRPC) is a council of governments serving the eleven-parish capital region, which includes the following parishes: Ascension, East Baton Rouge, East Feliciana, Iberville, Livingston, Pointe Coupee, St. Helena, Tangipahoa, Washington, West Baton Rouge, and West Feliciana. CRPC gets its authority under Louisiana Revised Statutes 33:131 et seq., as amended. Because of its funding structure, the CRPC focuses on transportation planning and air quality issues (Reference 2.2-46). No CRPC plans were found that would affect activities related to RBS Unit 3 construction.

One regional land use plan, Louisiana Speaks, includes the RBS area in its extreme northern reach. This plan is focused mainly on assisting the recovery of areas of southern Louisiana that were most heavily affected by Hurricane Katrina in 2005 and does not affect plans for a new unit at the RBS (Reference 2.2-47).

The Center for Planning Excellence (CPEX), an organization advising the Louisiana Speaks plan developers on planning and urban design best practices, initiated the Louisiana Community Planning Program in the fall of 2006. Under this program, CPEX provides funding, staff support, and model processes to assist in the creation of Louisiana community plans that demonstrate "smart growth" best practices. CPEX also assists communities with initiating and creating smart growth plans at the neighborhood, community, town, city, or parish-wide scale (Reference 2.2-47).

CPEX is currently developing parish-wide comprehensive master plans for Tangipahoa Parish and West Feliciana Parish. The comprehensive master plans focus on developing consolidated growth management plans for housing, economic development, transportation, conservation of natural resources, public facilities, and land use. Because the RBS site is already developed and zoned for industrial development, the parish comprehensive plan would not affect RBS Unit 3 activities (Reference 2.2-47).

The ongoing planning processes in various areas of the RBS region may result in zoning for many areas that did not formerly have zoning or planning ordinances, such as Pointe Coupee Parish. Most parishes in the region surrounding the RBS site have land use plans in development; however, these plans would not affect activities at the RBS site (References 2.2-47 and 2.2-48).

The Tunica-Biloxi Tribe is located in Marksville, Avoyelles Parish, Louisiana, the outer western edge of the region surrounding the RBS. The tribe is federally recognized and runs a casino, cattle herd, major museum, and anthropological laboratory. The Tunica-Biloxi Tribe has lived on the same reservation in Marksville for approximately 200 years and does not have land use plans that could affect the RBS site (References 2.2-49 and 2.2-50).

2.2.4 REFERENCES

2.2-1 U.S. Department of the Interior, "Minerals Management Service, Gulf of Mexico OCS Region, Outer Continental Shelf Pipelines Crossing the Louisiana Coastal Zone: A Geographical Information System Approach Final Report," Study MMS 2002-038, p. 16, August 2002, Website, http://www.gomr.mms.govPIPDFImages ESPIS33096.pdf, accessed February 2008.

2.2-2 U.S. Nuclear Regulatory Commission, *Final Environmental Statement Related to the Operation of River Bend Station*, NUREG-1073, Docket No. 50-458, January 1985.

2.2-3 Gulf States Utilities Company, "River Bend Station Environmental Report, Operating License Stage," Volumes 1-4, Supplements 1-9, November 1984.

2.2-4 American Public Transportation Association, "Louisiana Transit Links," 2003, Website, http://www.apta.com/links/state_local/la.cfm, accessed June 13, 2007.

2.2-5 Tembec Inc., "Tembec to idle its coated paper mill located in St. Francisville, Louisiana," June 1, 2007, Website, http://www.tembec.com/public/Salle-de-presse/2007-06-01.html?isRecent=true&search=all, accessed July 2, 2007.

2.2-6 West Feliciana Parish Community Development Foundation, "West Feliciana Parish Business Park Conceptual Plan," Website, www.stfrancisville.org, accessed March through August 2007.

2.2-7 U.S. Coast Guard and Louisiana Department of Transportation and Development, *Mississippi River Bridge Final Environmental Assessment, Route LA 10, Mississippi River Bridge, St. Francisville-New Roads, West Feliciana-Pointe Coupee Parishes*, State Project No. 700-28-0022, March 2003.

2.2-8 Louisiana Timed Program, John James Audubon Bridge (Current Activity/Progress), October, 12, 2006, Website, http://www.timedla.com/bridge/audubon/current_activity/, accessed 16 May 2007.

2.2-9 U.S. Department of the Interior, National Park Service, Indian Land Areas Judicially Established 1978, Website, http://www.nps.gov/history/nagpra/documents/ClaimsMAP.htm, accessed August 6, 2007.

2.2-10 U.S. Department of Agriculture, Environmental Compliance Library, Farmland Protection Policy Act, Website, http://www.nrcs.usda.gov/programs/fppa/pdf_files/FPPA_Law.pdf, accessed August 23, 2007.

2.2-11 NRG Energy, Inc., "NRG Announces Comprehensive Repowering Initiative," Press Release, June 21, 2006, Website, http://www.snl.com/irweblinkx/file.aspx?IID=4057436&FID=2499948, accessed September 25, 2007.

2.2-12 Federal Energy Regulatory Commission, "Issued Hydrokinetic Projects Preliminary Permits 2008, Morgan Bend Crossing Pr, P-12927," Website, http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/permits-issued.asp, accessed March 2, 2008.

2.2-13 Feliciana Vision, Inc., "Land Use and Growth Management Plan: for West Feliciana Parish," St. Francisville, Louisiana, 2005.

2.2-14 Louisiana Department of Wildlife & Fisheries, "LDWF and Entergy's River Bend Station Team Up to Preserve River Bend Natural Area," *LDWF Newsletter*, Volume 9, Number 2, February 17, 2005, Website, http://www.wlf.louisiana.gov/pdfs/about/Feb.%2017%20Newsletter.pdf, accessed May 2, 2007.

2.2-15 West Feliciana Parish Community Development Foundation, *West Feliciana Parish Map*, Website, www.stfrancisville.org, accessed March through June 2007.

2.2-16 *US-Rooms.com*, "Green Acres Campground, St. Francisville, Louisiana," Website, http://www.us-rooms.com/usmem/22569.htm, accessed June 28, 2007.

2.2-17 The Bluffs Country Club and Resort, "Golf FAQs," July 12, 2007, Website, http://www.thebluffs.com/index.php?option=com_content&task=view&id=16&Itemid=36, accessed August 23, 2007.

2.2-18 The Nature Conservancy, "Congress Approves $4 Million for Acquiring Lands within Cat Island," Media Release, October 17, 2001, Website, http://www.nature.org/wherewework/northamerica/states/louisiana/press/press549, accessed September 14, 2007.

2.2-19 U.S. Fish & Wildlife Service, "Cat Island National Wildlife Refuge, Refuge Facts," Website, http://www.fws.gov/catisland/, accessed May 22, 2007.

2.2-20 Louisiana Department of Culture, Recreation, & Tourism, Office of State Parks, Audubon State Historic Site, Website, http://www.crt.state.la.us/parks/iaudubon.aspx, accessed June 5, 2007.

2.2-21 City of St. Francisville, "Attractions in Our Area - Historic Homes and Gardens," Website, http://www.stfrancisville.net/town_new/index.html, accessed April through July 2007.

2.2-22 Louisiana Department of Culture, Recreation, & Tourism, Office of State Parks, Locust Grove State Historic Site, Website, http://www.crt.state.la.us/parks/ilocust.aspx, accessed May and June 2007.

2.2-23 West Feliciana, West Feliciana Sports Park Website, http://www.wfsportspark.org/, accessed May 24, 2007.

2.2-24 Louisiana Department of Culture, Recreation, & Tourism, Office of State Parks, Port Hudson State Historic Site, Website, http://www.crt.state.la.us/parks/ipthudson.aspx, accessed May 11, 2007.

2.2-25 Girl Scouts of America - Audubon Council, Inc., Camp Marydale, 2007, Website, http://www.girlscoutsaudubon.org/marydale.html, accessed May 10, 2007.

2.2-26 Fishing Louisiana, Area 2, 2007, Website, http://www.fishinglouisiana.com/area2/#False%20River, accessed July 3, 2007.

2.2-27 The Nature Conservancy, Mary Ann Brown Preserve, 2007, Website, http://www.nature.org/wherewework/northamerica/states/louisiana/preserves/art6857.html, accessed May 8, 2007.

2.2-28 U.S. Army Corps of Engineers, Lower Mississippi Valley Division, Mississippi River Commission, Mississippi River Navigation, Website, https://www.mvn.usace.army.mil/PAO/BRO/Navigation.pdf, accessed June 27, 2007.

2.2-29 Abandoned Railroads, Woodville Branch - Illinois Central/ICG RR, February 1, 2007, Website, http://abandonedrailroads.homestead.com/la_ic_woodvillebranch.html, accessed from February through May 2007.

2.2-30 Louisiana Department of Transportation and Development, "Louisiana Statewide Transportation Plan Update," December 2003, Website, http://www.dotd.state.la.us/study/, accessed June 8, 2007.

2.2-31 U.S. Army Corps of Engineers, Mississippi Valley Division, Mississippi River, Map No. 117, Website, http://www.mvd.usace.army.mil/Gis/navbook/html/corps4.htm, accessed September 14, 2007.

2.2-32 Louisiana Mineral Code, Revised Statutes Title 31, Chapter 1, §1-8, January 1, 2005, Website, http://www.legis.state.la.us/, accessed April 11, 2007.

2.2-33 Port of Greater Baton Rouge, About the Port, Website, http://www.portgbr.com/, accessed June 6, 2007.

2.2-34 Louisiana Department of Transportation and Development, 2004 Official Highway Map of Louisiana, Website, http://www.dotd.state.la.us/, accessed May 21, 2007.

2.2-35 Louisiana TIMED Program, "Huey P. Long Bridge Widening: Bridge Overview/News," Website, http://www.timedla.com/bridge/long/overview/, accessed September 4, 2007.

2.2-36 Baton Rouge Loop, Agency Coordination Meeting, Agency Kickoff Meeting, August 28, 2007, Website, http://www.brloop.com/frmMediaCenter.aspx, accessed September 25, 2007.

2.2-37 Louisiana Department of Public Safety and Corrections, Corrections Services, Louisiana State Penitentiary, Website, http://www.corrections.state.la.us/lsp/general.htm, accessed August 3, 2007.

2.2-38 The Weather Channel, Sports and Recreation: Outdoors and Fishing, Recreation Areas within 60 miles of 70775, Website, http://www.weather.com/outlook/recreation/outdoors/results/USLA0412?x=14&lswe=&search=search&lswa=&distance=60&y=1, accessed July 9, 2007.

2.2-39 Feliciana Guide Post, Clark Creek Natural Area (Tunica Falls), Website, http://www.where2guide.com/TouristTrail/outdoors/ClarkCreek.html, accessed August 20, 2007.

2.2-40 Mississippi Department of Wildlife, Fisheries, & Parks, Natchez, Website, http://home.mdwfp.com/parks.aspx, accessed August 2, 2007.

2.2-41 U.S. Department of Agriculture, National Agricultural Statistics District, Louisiana Agricultural Statistics District, Website, http://www.usda.gov/nass/graphics/district-county-maps/la.gif>, accessed June 25, 2007.

2.2-42 U.S. Department of Agriculture, National Agricultural Statistics Service, 2006 Louisiana Soybean Parish Estimates, March 2007, Website, http://www.nass.usda.gov/Statistics_by_State/Louisiana/Publications/Parish_Estimates/index.asp, accessed May 2007 through February 2008.

2.2-43 Louisiana State University Agricultural Center, Louisiana Poultry Industry Major Economic Factor, Website, http://www.lsuagcenter.com/en/crops_livestock/livestock/poultry/Broiler+Production/Louisiana+Poultry+Industry+Major+Economic+Factor.htm, accessed February 5, 2008.

2.2-44 U.S. Department of Agriculture, National Agricultural Statistics Service, *2002 Census of Agriculture - Parish Data*, Website, http://www.nass.usda.gov/census/census02/volume1/la/st22_2_001_001.pdf, accessed February 5, 2008.

2.2-45 Wear, D. N., D. R. Carter, and J. Prestemon, "The U.S. South's Timber Sector in 2005: A Prospective Analysis of Recent Change," January 2007, Website, http://www.srs.fs.usda.gov/pubs/26156, accessed February 5, 2008.

2.2-46 Louisiana Department of Environmental Quality, Capital Region Planning Commission, Website, http://www.deq.louisiana.gov/portal/Default.aspx?tabid=1778, accessed August 16, 2007.

2.2-47 Center for Planning Excellence, "About CPEX," Website, www.planningexcellence.org, accessed May 24, 2007.

2.2-48 Clark, S., "A bridge too near," *Business Report.com*, May 8, 2007, Website, http://www.businessreport.com/news/2007/may/08/bridge-too-near/, accessed May 18, 2007.

2.2-49 U.S. Army Corps of Engineers, New Orleans District, "PAS - Tunica - Biloxi Tribe of Louisiana Master Plan," June 15, 2007, Website, http://www.mvn.usace.army.mil/pd/projectsList/home.asp?projectID=70&directoryFilePath=ProjectData%5C, accessed June 29, 2007.

2.2-50 Tunica-Biloxi Tribe of Louisiana, Tribal History, Website, http://www.tunicabiloxi.org/tribal_history.php, accessed March 13, 2008.

2.2-51 U.S. Department of Agriculture, National Agricultural Statistics Service, Parish Estimates 2006 (corn, cotton, soybeans, wheat), Website, http://www.nass.usda.gov/Statistics_by_State/Louisiana/Publications/Parish_Estimates/index.asp, accessed May 2007 through February 2008.

2.2-52 U.S. Department of Agriculture, National Agricultural Statistics Service, Parish Estimates 2006 (corn, cotton, soybeans, wheat, sorghum, rice, sugar cane), Website, http://www.nass.usda.gov/Statistics_by_State/Louisiana/Publications/Parish_Estimates/index.asp, accessed May 2007 through February 2008.

2.2-53 U.S. Department of Agriculture, National Agricultural Statistics Service, Parish Estimates 2002 through 2006 (corn, cotton, soybeans, wheat, rice, sugar cane), Website, http://www.nass.usda.gov/Statistics_by_State/Louisiana/Publications/Parish_Estimates/index.asp, accessed May 2007 through February 2008.

2.2-54 U.S. Department of Agriculture, National Agricultural Statistics Service, "USDA-NASS QuickStats," Louisiana County Data - Livestock (all cattle and calves, beef cattle, and milk cows), Website, http://www.nass.usda.gov/QuickStats/PullData_US_CNTY.jsp, accessed February 9, 2008.

2.2-55 Louisiana State University, AgCenter, Research & Extension, Louisiana Summary, Agriculture and Natural Resources, 2006, CD-ROM.

Table 2.2-1
Approximate Acreages of Various Facilities Associated with the RBS

Location	Area	
	Acres	**Hectares**
Total RBS Site	3330	1348
Existing Unit 1		
Station Area		
Permanent Buildings	21.4	8.7
Cooling Tower Areas	13.9	5.6
Switchyard	12.7	5.1
Plant Service Water Supply and Discharge Line, Heavy Haul Road	45.1	18.3
Barge Slip Area	2.6	1.1
Borrow Pit	NA	NA
Spoils Area	54.7	20.2
Total RBS Unit 1 Footprint	**515**	**208**
Proposed Unit 3		
Construction Areas		
Construction Warehouse	10	4.1
Fabrication Area	10	4.1
Construction Offices	3	1.2
Construction Parking (two areas)	32	13
Construction Laydown	30	12.1
Aggregate Storage Area	5	2
RBS Unit 3 Switchyard	10	7.4
New On-Site Transmission Corridor	15	6.1
New Waste Treatment Facility	23	9.3
Batch Plant	10.5	4.3
Cooling Tower	8.7	3.5
Power Block/Reactor Area	22.4	9.1
Barge Slip Expansion Area	12.4	5
Total RBS Unit 3 Construction Areas	**192**	**77.7**
Use of RBS Unit 1 Main Plant Area Already Developed	117	47.3
Previously Used RBS Unit 1 Spoils Area	54.7	20.2
Total Proposed RBS Unit 3 Footprint	**364**	**147**

Table 2.2-2
East and West Feliciana Parishes and District 6 (60) Crop Estimates for 2006

Parish	Crop	Acreage Planted	Acreage Harvested	Yield per Acre (Bushels except where noted)	Production (Bushels except where noted)
West Feliciana	Corn (for grain)	NR	NR	NR	NR
East Feliciana	Corn (for grain)	1000	900	72.2	65,000
District 6	Corn (for grain)	4800	3000	98.3	295,000
West Feliciana	Cotton	NR	NR	NR	NR
East Feliciana	Cotton	NR	NR	NR	NR
District 6	Cotton	500	500	768 lb.	800 bales
West Feliciana	Soybeans	1700	1600	34.4	55,000
East Feliciana	Soybeans	1300	1100	22.7	25,000
District 6	Soybeans	4500	4000	30	120,000
West Feliciana	Wheat	NR	NR	NR	NR
East Feliciana	Wheat	NR	NR	NR	NR
District 6	Wheat	1800	1500	63.3	95,000

Notes:

- Data for rice, oats, and grain sorghum were not included in this table because no numbers were available for the parishes or the district.
- NR = Not reported or not available.
- Louisiana Agricultural District 6 includes West Feliciana, East Feliciana, East Baton Rouge, St. Helena, Livingston, Tangipahoa, Washington, and St. Tammany Parishes.

Source: Reference 2.2-51.

Table 2.2-3
Pointe Coupee Parish and District 5 (50) Crop Estimates for 2006

Parish	Crop	Acreage Planted	Acreage Harvested	Yield per Acre (Bushels except where noted)	Production (Bushels except where noted)
Pointe Coupee	Corn (for grain)	9400	9100	152.7	1,390,000
District 5	Corn (for grain)	55,000	53,000	128.5	6,810,000
Pointe Coupee	Cotton	10,900	10,900	995 lb	22,600 bales
District 5	Cotton	162,000	161,300	986 lb	331,300 bales
Pointe Coupee	Grain Sorghum	6200	6000	110	660,000
District 5	Grain Sorghum	73,500	72,400	95.9	6,940,000
Pointe Coupee	Rice	2200	2100	5710 lb.	120,000 cwt
District 5	Rice	91,000	90,000	5890 lb.	5,305,000 cwt
Pointe Coupee	Soybeans	56,800	54,900	44.1	2,420,000
District 5	Soybeans	377,000	365,000	34.8	12,700,000
Pointe Coupee	Wheat	25,000	23,700	57.8	1,370,000
District 5	Wheat	48,500	44,500	56.6	2,520,000
Pointe Coupee	Sugarcane (for sugar)	NR	30,100	25.1 tons	755,000 tons
District 5	Sugarcane (for sugar)	NR	83,500	25.5 tons	2,127,000 tons

Notes:

- NR = Not reported.
- Louisiana Agricultural District 5 includes West Baton Rouge, Pointe Coupee, St. Landry, Evangeline, Avoyelles, Rapides, Grant, La Salle, Catahoula, and Concordia Parishes.

Source: Reference 2.2-52.

Table 2.2-4
Average Crop Yields for West and East Feliciana Parishes, Louisiana and District 6 (60)
2002 to 2006

Parish	Crop[(a)]	Number of Years	Average Yields (Bushels except where noted)
West Feliciana	Corn (for grain)	0	NR
East Feliciana	Corn (for grain)	5	108,000
District 6	Corn (for grain)	5	532,000
West Feliciana	Cotton	0	NR
East Feliciana	Cotton	0	NR
District 6	Cotton	3	570 bales
West Feliciana	Soybeans	4	57,500
East Feliciana	Soybeans	1	25,000
District 6	Soybeans	5	111,000
West Feliciana	Wheat (all)	1	55,000
East Feliciana	Wheat (all)	0	NR
District 6	Wheat (all)	5	91,000

a) Rice, oat, and grain sorghum data available for this time period were insufficient for inclusion in this table.

Source: Reference 2.2-53.

Table 2.2-5
Average Crop Yields for Pointe Coupee Parish, Louisiana and District 5 (50)
2002 to 2006

Parish	Crop	Number of Years	Average Yields (Bushels except where noted)
Pointe Coupee	Corn (for grain)	5	1,472,000
District 5	Corn (for grain)	5	10,518,000
Pointe Coupee	Cotton	5	15,860 bales
District 5	Cotton	5	247,180 bales
Pointe Coupee	Rice	5	129,000 cwt
District 5	Rice	5	6,100,000 cwt
Pointe Coupee	Soybeans	5	2,264,000
District 5	Soybeans	5	11,670,000
Pointe Coupee	Wheat (all)	5	1,166,000
District 5	Wheat (all)	5	2,540,000
Pointe Coupee	Sugarcane (for sugar)	5	791,000 tons
District 5	Sugarcane (for sugar)	5	2,404,000 tons

Source: Reference 2-2-53.

Table 2.2-6
Livestock Commodity Estimates for Local Parishes and Districts, 2007

	All Cattle and Calves	Beef Cows	Milk Cows
East Feliciana Parish	22,500	14,400	450
West Feliciana Parish	9000	5200	NR
District 6	165,000	68,000	24,500
Pointe Coupee Parish	19,000	12,100	NR
District 5	144,000	91,000	250

Notes:

- NR - Not reported.
- District 6 includes West Feliciana, East Feliciana, East Baton Rouge, St. Helena, Livingston, Tangipahoa, Washington, and St. Tammany Parishes in Louisiana.
- Louisiana Agricultural District 5 includes West Baton Rouge, Pointe Coupee, St. Landry, Evangeline, Avoyelles, Rapides, Grant, La Salle, Catahoula, and Concordia Parishes.

Source: Reference 2.2-54.

Table 2.2-7
Local Parish Livestock Production for 2006

Livestock	Numbers
Cattle and Calves	
East Feliciana	19,550
West Feliciana	4500
Pointe Coupee	15,000
Swine	
East Feliciana	2550
West Feliciana	65
Pointe Coupee	550
Milk Cows	
East Feliciana	300
West Feliciana	Not reported
Pointe Coupee	Not reported
Sheep	
East Feliciana	Not reported
West Feliciana	Not reported
Pointe Coupee	Not reported
Goats	
East Feliciana	Not reported
West Feliciana	8
Point Coupee	84

Source: Reference 2.2-55.

Table 2.2-8 (Sheet 1 of 2)
Agricultural Statistics for 50-Mi. Radius

		Cattle and Calves Head	Milk Cows Head	Beef Cows Head	Wheat Bushels	Soybean Bushels	Rice x 100 lb.	Corn Bushels
Louisiana								
District V	Avoyelles	24,500	-	15,700	210,000	2,170,000	840,000	415,000
	Concordia	5000	-	2200	140,000	2,400,000	480,000	1,500,000
	Pointe Coupee	19,000	-	12,100	1,370,000	2,420,000	120,000	1,390,000
	St. Landry	31,000	-	19,900	405,000	2,350,000	1,210,000	770,000
	West Baton Rouge	2500	-	1500	80,000	-	-	-
	Other Parishes	-	250	-	45,000	140,000	-	170,000
District VI	East Baton Rouge	20,000	450	10,600	-	-	-	-
	East Feliciana	22,500	450	14,400	-	25,000	-	65,000
	Livingston	9000	-	4800	-	-	-	-
	St. Helena	13,500	2500	5300	-	-	-	-
	West Feliciana	9000	-	5200	-	55,000	-	-
	Other Parishes	-	200	-	95,000	9000	-	230,000
District VIII	Iberville	10,500	-	-	180,000	290,000	-	
	St. Martin	3500	-	-	-	150,000	-	
	Other Parishes	-	-	-	60,000	100,000	264,000	155,000
District IX	Ascension	10,500	-	6000	-	35,000	-	-

Table 2.2-8 (Sheet 2 of 2)
Agricultural Statistics for 50-Mi. Radius

	Cattle and Calves Head	Milk Cows Head	Beef Cows Head	Wheat Bushels	Soybean Bushels	Rice x 100 lb.	Corn Bushels
Mississippi							
Adams	4100	-	2500	-		-	-
Amite	16,000	1600	7000	-		-	-
Wilkinson	13,500	-	8500	-		-	-
Other Counties		3300	-	-	534,000	-	478,000
District 70 Total	-	-	-	292,000	-	-	-
Other Districts						54,000	-
SUM	214,100	8750	115,700	2,877,000	10,678,000	2,968,000	5,173,000
Weight (lb.) per Unit		14,000	750	60	60	100	56
Weight (lb.) Total		122,500,000	86,775,000	1.726E+08	6.407E+08	2.968E+08	2.897E+08
Weight (kg) Total		55,565,058	39,360,473	7.830E+07	2.906E+08	1.346E+08	1.314E+08
Density (lb/cu. ft.)		64.00					
Volume (cu. ft.)		1,914,063		Total Grain	6.349E+08 kg		
Volume (gal.)		14,317,188					
Volume (L)		54,208,243					

1. The USDA information provides statistics for individual counties and/or parishes when the total value is above a certain threshold. Values for areas below the threshold are included in the "District," "Other Counties," "Other Districts," or "Other Parishes," as appropriate. For example, for wheat production in Mississippi, Adams County did not have sufficient production to include the individual county data. Therefore, the data for Adams County is included in the "Other Counties" line item. This method overestimates the amount of each crop.

ER 2.2 Figures

Due to the large file sizes of the figures for ER Section 2.2, they are collected in a single .pdf file, which you can navigate via the figure numbers in the Bookmark pane. When cited in the text, the links for these figures will launch the .pdf file.

2.3 WATER

The RBS is located on the east bank of the Mississippi River in the vicinity of RM 262, approximately 24 mi. north-northwest of Baton Rouge, Louisiana. The RBS is located in the southeastern corner of West Feliciana Parish in eastern Louisiana, between U.S. Highway 61 and the east bank of the Mississippi River (Reference 2.3-1). The site is near the southwest corner of Mississippi, about 16 mi. south of the Louisiana-Mississippi border. The community of St. Francisville is approximately 3 mi. northwest of the RBS site. The town of New Roads is approximately 7 mi. southwest. The location of the proposed Unit 3 reactor at the RBS site is specified by the following latitude, longitude, and Universal Transverse Mercator (UTM) coordinates:

RBS	Latitude	Longitude
Unit 3 (proposed)	30º 45' 23" N	91º 20' 02" W
	Zone 15 UTM (NAD83) Coordinates	
	3,403,793 m Northing	659,460 m Easting

The site is bounded on the west by the Mississippi River and on the east by loessial bluffs forming part of the hilly region that extends from Vicksburg, Mississippi, to Baton Rouge, Louisiana.

The following subsections describe the hydrological, physical, chemical, and biological characteristics of the hydrologic environment in the vicinity of the RBS site. The hydrological environment is divided into surface water and groundwater environments. The characteristics of each of the two separate environments are described separately.

2.3.1 HYDROLOGY

Site and Facilities

The RBS is located above the Mississippi River floodplain on elevated, gently sloping terrain at approximately RM 262. The plant is separated from the river by a natural levee formed above the riverbank and by the lower floodplain area, which is crossed by Alligator Bayou and its tributaries. The site includes two general levels of terrace. The alluvial floodplain on the east side of the Mississippi River varies from 3000 to 4000 ft. wide and is at approximately 35 ft. above msl. The upper terrace has an average elevation of more than 100 ft. msl. The station buildings and all safety-related equipment are located on the upper terrace. The original ground grade in this area was about 110 ft. msl. The finished ground grade is a nominal 95 ft. msl. (Grade varies from 97 ft. msl, maximum, to 90 ft. msl, minimum.)

A cross section showing the topography between the river and the plant is provided in Figure 2.3-1.

Figure 2.1-3 identifies the property boundary and features in the site area. The property boundary shown in Figure 2.1-3 encompasses the approximately 3330 ac. that comprise the RBS site. At this site, the river's natural levee has an elevation of about 46 ft. above msl; the ground surface slopes downward toward the valley wall to the east, where its elevation is about 35 ft. msl. The southern portion of the RBS site is rough and irregular, with steep slopes and deep-cut stream valleys and drainage courses. Ground elevations in this portion of the plant site range from about 35 ft. msl to more than 95 ft. msl inland. Elevations up to 150 ft. msl occur on the hilltops; most hilltop areas are at elevations near 100 ft. msl.

RBS Unit 1 plant makeup and service water is supplied by an intake structure on the Mississippi River. During normal operation of RBS Unit 1, plant service water is discharged to the circulating water system to supply the required circulating water system makeup water.

Plant makeup (cooling tower makeup and other raw water needs) for a new facility would be supplied from the Mississippi River.

The existing intake structure system would be modified to service both Units 1 and 3. The circulating water system blowdown for the existing RBS Unit 1 plant is discharged by pipeline to the Mississippi River. Effluent from the RBS Unit 3 facility would be combined with that from the RBS Unit 1 facility and would be discharged into the river downstream of the intake so that recirculation to the embayment area and intake pipes would be precluded. A bathymetric survey map, from the 1972 survey, showing the river channel contours near the embayment area is presented in Figure 2.3-2 (Reference 2.3-2). Updated bathymetry of the embayment area (from the 1992 survey) is provided in Figure 2.3-3 (Reference 2.3-3). Bathymetry from the U.S. Army Corps of Engineers (USACE) "2007 Mississippi River Navigation & Hydrographic Survey Books" is provided in Figure 2.3-19 (Reference 2.3-4).

The ESBWR ultimate heat sink (UHS) is provided by safety systems integral and interior to the reactor plant. This system ultimately uses the atmosphere as the eventual heat sink. These systems have no cooling towers, basins, or cooling water intake/discharge structures external to the reactor plant.

2.3.1.1 Surface Water

2.3.1.1.1 Mississippi River

The dominant hydrologic feature in the vicinity of the site is the Mississippi River. The river location of the station site is midway between the Bayou Sara Bend and the False River cutoff on a 6-mi. reach of straight river channel alignment. At the station site, the channel width is approximately 1700 ft., but it increases in width downstream to more than 4000 ft. within 4 mi.

The Mississippi River at Bayou Sara (RM 265.4) has a drainage area of 1,129,400 sq. mi. Of this area, about 1 percent (13,000 sq. mi.) is in Canada, and the rest is located mainly in the central United States. Tributaries to the river extend into the state of New York in the east and into Wyoming and Montana in the west. The drainage area is shown in Figure 2.3-4, and major sub-basin areas are listed in Table 2.3-1. A general Mississippi River map is provided in Figure 2.3-21.

The watershed of the Mississippi River covers 41 percent of the conterminous United States and supplies a reliable flow. Variations in the river flow are primarily seasonal. A large peak can be expected in the normal spring flow; the annual low flow is usually experienced during the summer. Runoff characteristics of the Mississippi River watershed are presented in Table 2.3-1 (Reference 2.3-5).

Monthly mean flow data for the Mississippi River for the period 1956 to 1978 was analyzed in the RBS Unit 1 ER (Reference 2.3-2). Monthly mean flow variation and monthly mean flow occurrence for that period of record are presented in Figures 2.3-5 and 2.3-6. Based on flow data from 1956 to 1978, the monthly mean discharge of the river near the site varies such that 900,000 cubic feet per second (cfs) is exceeded less than 5 percent of the time, and 175,000 cfs is exceeded 95 percent of the time. The monthly mean for the period 1956 to 1978 is about 447,000 cfs.

For the RBS Unit 3 ER, the monthly mean flow data for the period 1979 to 2006 were analyzed and compared to the data in the Unit 1 report. Monthly mean flow variation and monthly mean flow occurrence for 1979 to 2006 are presented in Figures 2.3-7 and 2.3-8. Based on flow data from 1979 to 2006, the monthly mean discharge of the river near the site varies such that 1,050,000 cfs is exceeded less than 5 percent of the time, and 195,000 cfs is exceeded 95 percent of the time. The monthly mean for the period 1979 to 2006 is about 532,000 cfs. Compared to 1956 - 1978, the period from 1979 to 2006 had slightly higher monthly mean discharges. The pattern of seasonal flow variation was similar for the two periods of record.

Based on USACE flow records at Tarbert Landing, Mississippi, and Red River Landing, Louisiana, the estimated mean annual discharge at the site for the period 1900 to 2006 is about 503,000 cfs. Annual maximum, minimum, and mean flow rates for the Mississippi River at the site are provided in Table 2.3-2. The construction of flow control structures in the Mississippi River Basin since 1956 has altered hydrologic relationships from the historical precedent. This development has tended to increase the low flows and decrease the periods of high flow. This is supported by data in Table 2.3-2. For the period 1956 through 2006, the average annual peak flow decreased and the average annual low flow increased compared to the period from 1900 through 1955 (References 2.3-2 and 2.3-6).

Flow of the LMR in the site area is affected by diversions into the Atchafalaya River through the Old River diversion channel near Coochie, Louisiana, about 53 river miles upstream of the site. Records collected by the USACE from 1930 to 1963 at Red River Landing, Louisiana, about 12 river miles below the diversion, and from 1963 to date at Tarbert Landing, Mississippi, about 6 river miles below the diversion, indicate that the minimum daily discharge is 75,000 cfs, which occurred on November 4, 1939. On that day, the flow into the Old River diversion was 13,400 cfs. A control structure on the diversion canal was completed in 1963, and minimum flows are now somewhat controlled. Based on these flow controls and recorded flow data, it is doubtful that the daily flow in the river downstream of the Old River diversion would ever be lower than 100,000 cfs. Since 1963, the lowest recorded flow at Tarbert Landing is 111,000 cfs, which occurred in the 1988 water year.

Major floods on the LMR (below the confluence with the Ohio River at RM 954) generally coincide with floods of the major tributaries. A substantial contribution from the Ohio River is required to produce a major flood. The flood season extends from mid-January to July. The flood of record occurred during the spring of 1927 and had an estimated confined discharge of 2,345,000 cfs at the latitude of Red River Landing. The estimated historic water level at the site for this flood is 55.5 ft. msl. The USACE determined a project design flood (PDF) discharge at the latitude of Red River Landing of 3,030,000 cfs. A portion of this flow would be diverted upstream of the site into the Atchafalaya Floodway (Old River Control Structure, RM 314.5) and the Morganza Floodway (RM 285). The PDF passing the site would be approximately 1,500,000 cfs. The water level at the site for this flood is estimated by the USACE to be 54.5 ft. msl, about 40 ft. below plant grade.

Upstream of the RBS site, control structures divert a portion of the Mississippi River flow to the Atchafalaya River. At the RBS site, the Atchafalaya River is located about 25 mi. west of the Mississippi River, in the Mississippi River floodplain. For the PDF developed by the USACE, about 1,530,000 cfs would be diverted into the Atchafalaya River, and about 1,500,000 cfs would remain in the Mississippi River. The stage at the RBS site for this event is Elevation 54.5 ft. msl. The anticipated flow distribution to the Mississippi River floodway during a PDF, utilizing upstream reservoir storage, is shown in Figure 2.3-20. Additional discussion on the Mississippi River floodway system is provided in the FSAR Subsection 2.4.3.

An event exceeding the PDF would be very rare; the frequency of occurrence is much greater than 100 years. Inundation of the plant area from Mississippi River flooding is extremely unlikely. The water surface elevation in the Mississippi River at the RBS site in response to design flood events was determined based on available data and also by an HEC-RAS[a] analysis. This program allows the user to perform steady and unsteady flow river hydraulics calculations. The HEC-RAS software supersedes the HEC-2 river hydraulics program. A verification and validation of the HEC-RAS software package was performed for this analysis.

The analysis of river capacity at the RBS site determined that a flood event 20 times larger than the PDF would not inundate the site. The PDF has been estimated to be 50 to 60 percent of the probable maximum flood (PMF) (Reference 2.3-1). Conservatively assuming 50 percent, the PMF passing the site would be 6,060,000 cfs, including flow diverted into the Atchafalaya Floodway. At the RBS site, the top of levee elevation on the west side of the Mississippi River is approximately 57.5 ft. msl. From the Mississippi River Capacity Analysis (FSAR Subsection 2.4.3.5.1), a flood just overtopping the levee (Elevation 57.54 ft. NGVD) has a capacity of 15,500,000 cfs. Of this total capacity, approximately 13,876,000 cfs occurs in the floodplain west of the Mississippi River main channel. This overbank capacity, neglecting the main channel flow capacity, is more than twice the estimated PMF flow rate. Thus, during a PMF, the levee at the site would be overtopped, but storage and conveyance capacity in the floodplain would prevent the water surface elevation from significantly exceeding the top of levee elevation.

Annual stage data at Bayou Sara, Louisiana (at about RM 265) are presented in Table 2.3-3 for the period 1889 to 2006. Based on stage data from Bayou Sara for the period 1956 to 1979 (Reference 2.3-7), the mean annual river water level at the site was approximately 20.4 ft. NGVD. For the period 1980 to 2006 (Reference 2.3-8), the mean annual river water level at the site was approximately 25.0 ft. NGVD. The higher mean annual river water levels for the period 1980 to 2006 are consistent with the higher river flow rates for this period, as discussed above. Based on the period 1956 to 2006, the minimum water level at Bayou Sara was 2.9 ft. NGVD (2.5 ft. NGVD at the site), and the mean annual low water level was 8.2 ft. NGVD (7.8 ft. NGVD at the site). Since 1965, the minimum water level at Bayou Sara was 4.8 ft. NGVD (4.4 ft. NGVD at the site), which occurred on July 5, 1988. The mean annual flood elevation at Bayou Sara for the

a. HEC-RAS is the USACE's River Analysis System software.

period 1956 to 2006 is approximately 42.0 ft. NGVD. Water levels at the RBS site are approximately 0.4 ft. NGVD lower than Bayou Sara levels.

A daily stage-occurrence curve for the Mississippi River at Bayou Sara during the period 1956 to 1978 is shown in Figure 2.3-9. A daily stage-occurrence curve for the Mississippi River at Bayou Sara during the period 1979 to 2006 is shown in Figure 2.3-10. The annual maximum river stage frequency relationship during the periods 1956 to 1979 and 1980 to 2006 is shown in Figure 2.3-11. This figure shows that the increase in stage flattens out for larger recurrence interval flood events. This is expected because of the diversion of flood discharge to the Atchafalaya River during these events (Reference 2.3-9).

Monthly average stage variation during the period 1956 to 1979 is depicted in Figure 2.3-12. Monthly average stage variation during the period 1980 to 2006 is depicted in Figure 2.3-13. The seasonal pattern of average stage at the Bayou Sara gage is similar for the two periods analyzed in the figures.

2.3.1.1.2 Local Streams

The RBS is located on high ground approximately 2 mi. east of the Mississippi River. Surface drainage of the property is maintained by Alligator Bayou and its tributary, Grants Bayou. Flow from Alligator Bayou enters Thompson Creek and then passes to the Mississippi River. The main plant and construction areas are primarily drained by West Creek.[b] Local drainage is depicted in Figure 2.3-14. Surface soils affecting local runoff characteristics are primarily loessial deposits with moderate-to-well drained features.

The flow of streams in the site area consists primarily of surface runoff during periods of precipitation and the days immediately following. Based on 21 years of U.S. Geological Survey (USGS) data (1950 to 1970) for the nearby West Fork Thompson Creek drainage area (35.3 sq. mi.), the average annual surface runoff is 16.5 in., or 1.2 cfs per sq. mi. Average monthly runoff varies seasonally, as shown in Table 2.3-4. Generally, the greatest runoff occurs in February and March. June to November is the period of low runoff.

Plant area runoff flows to West Creek, which drains about 1.0 sq. mi. before joining the main stem of Grants Bayou. West Creek flows intermittently. During Unit 1 construction, a 110-ft. wide (50-ft. base width) Fabriform ditch was constructed in the plant area to contain West Creek flow and to minimize the potential of plant flooding during extreme rainfall events. The Fabriform-lined portion of the ditch is approximately 2800 ft. in length. Prior to Unit 3 construction, the Fabriform-lined portion of the ditch is to be shifted to a location just west of its current alignment. The ditch location is being shifted to provide room for RBS Unit 3 facilities. The ditch alignment is shown in Figure 2.3-15. The ditch bed gradient for West Creek is shown in Figure 2.3-16.

b. West Creek is not an actual creek by State and COE (Common Operating Environment) standards. It is actually an on-site man-made drainage ditch that begins on the RBS property and resides on the west side of the plant. There is no off-site stream or creek that feeds it. Therefore, West Creek is by name only and will be carried onward in the ER as West Creek.

Grants Bayou

Grants Bayou is a small intermittent stream that flows from north to south and drains an area adjacent to the southeastern boundary of the Alligator Bayou watershed. Grants Bayou carries runoff from the alluvial uplands at 230 ft. msl to the lower Mississippi River floodplain at 33 ft. msl. Average channel gradient is approximately 16.5 ft. per mi. The bayou is fed by East and West Fork tributaries and by West Creek. A watershed area of approximately 15.3 sq. mi. is served as the bayou enters the river floodplain. Channel length from headwater to confluence with Alligator Bayou is about 12 mi.

In its reach across plant property, the bayou has cut a channel bed 12 to 15 ft. deep and 30 to 60 ft. wide. Upper Grants Bayou, that portion of Grants Bayou above the point where East Fork Grants Bayou joins the main stem, drains an area of about 9.6 sq. mi. A profile of the Grants Bayou channel bed is shown in Figure 2.3-16. Estimated flood flows based on nearby Alexander Creek gaging station data (21 years) are provided in Figure 2.3-17.

Alligator Bayou

Alligator Bayou is a small intermittent stream that traverses the plant property, flowing roughly parallel to the Mississippi River. A total drainage area of 30.4 square miles (sq. mi.) is included upstream of the southern plant property line. Within the portion of the drainage basin upstream of the Mississippi River floodplain, the same stream is known as Alexander Creek. Barrow Fork and Wickliffe Creek are the principal tributaries upstream from this point. About 0.5 mi. downstream of the property line, the flow is joined by Grants Bayou. Alligator Bayou empties into Thompson Creek approximately 3 mi. from the Mississippi River.

Alligator Bayou (Alexander Creek) falls from a maximum elevation of about 230 ft. msl near its source to about 40 ft. msl, where it leaves the hills and enters the alluvial valley. Average channel gradient is about 11 ft/mi. In the upper reaches, the stream flows through a narrow, entrenched valley with relatively steep gradients. The channel and valley become broader in the downstream direction. Within the Mississippi River floodplain, the bayou flows in a shallow trough between the Mississippi River natural levee and the escarpment bounding the valley. In that region, the stream flows through a small, standing water body known locally as Needle Lake. The lake is about 1700 ft. long and about 40 ft. in average width (about 1.5 ac.). Water depth is normally about 3 ft. A rise in water level caused by local storms floods the surrounding sump area.

Alligator Bayou is subject to short periods of high runoff or storm floods and extended drought periods of zero flow. The USGS has maintained a crest stage gage on Alexander Creek from 1953 to the present (noncontinuous). The drainage area at this point in the creek is 23.9 sq. mi. The estimated flood flow distribution for Alligator Bayou, based on Alexander Creek data, is shown in Figure 2.3-17. This figure also shows the estimated flood flows for the West Fork Thompson Creek flow gage (1950 to 1970). During flood flows, Alligator Bayou carries an increased sediment load and provides an appreciable amount of sediment deposition within the floodplain area. Most sedimentation occurs as Alexander Creek leaves the hills and enters the alluvial valley. Channel length from the headwater to the southern plant property line is about 18 mi. A profile of the channel bed is shown in Figure 2.3-16.

River Access Road, extending from the plant to the Mississippi River, was constructed across Alligator Bayou for the purpose of providing access to the intake structure and barge slip area and as a means of conveyance of heavy construction loads. Culverts were placed in this roadway to allow passage of flow through Alligator Bayou to Thompson Creek and the Mississippi River.

2.3.1.1.3 Local Lakes

There are a number of small farm ponds in the local watershed area, but few natural lakes (Reference 2.3-2). Twenty-four ponds existed within the site boundary prior to construction of Unit 1, with a total surface area of 28.6 ac. (Figure 4.2-1). Five ponds were removed during Unit 1 construction, having a combined total surface area of about 1.7 ac. An additional pond with a surface area of 0.5 ac. would be removed during Unit 3 construction. Following Unit 3 construction, 18 small farm ponds would exist in the local watershed area, with a total surface area of 26.4 ac.

2.3.1.1.4 Physical Properties of Surface Waters

Flow Velocity

Current velocities were obtained as part of a hydrographic survey conducted in 1972 (Reference 2.3-2). The highest current velocities are on the eastern side of the river, where the channel deepens along the bank bounding the site. A river cross section at the intake structure location showing channel current velocities and directions, along with water temperature, is presented in Figure 2.3-18. Channel current velocities are similar to those measured at Tarbert Landing, Mississippi, about 44 river miles upstream of the site. Main channel velocities during the period 1966 to 1970 at that location had a range of 3.0 to 9.5 ft. per second (fps). During the site hydrographic study, the river stage was approximately 8 ft. above average annual stage, and velocities varied from slack bank currents to 8.3 fps in the main channel. The high energy, turbulent character of the flow exerts an erosive force on the river channel and bank.

The natural bank erosion rate (no slope stabilization) is estimated to be 8 ft/year. Channel stabilization and improvement is used to mitigate the natural bank erosion. This consists of stabilizing the banks of the Mississippi River to a desirable alignment and obtaining efficient stream flow characteristics for flood control and navigation. Dikes made of rock confine the river to a single low-water channel, reduce excessive widths, and develop desired river alignments for the benefit of navigation. Revetment, consisting of large concrete blocks joined together with wires, helps stabilize the Mississippi River channel and protect nearby levees by preventing bank caving. Improvement dredging is used to adjust flow patterns, and maintenance dredging deepens shallow channel crossings that tend to form during low water (Reference 2.3-10).

Mississippi River flood characteristics were recently modeled as part of the Bridge Hydraulics Report for the LA-10 Bridge over the Mississippi River, just downstream of the RBS site (Reference 2.3-11). For the 50 Year, 100 Year, and 500 Year recurrence interval flood events, the velocity in the main channel was 8.73, 8.90, and 9.24 fps, respectively. For these events, the east overbank velocities ranged from 1.40 to 1.66 fps. The west overbank velocities ranged from 1.34 to 1.42 fps.

Water Temperature

Water temperatures at the USGS gaging station on the Mississippi River near St. Francisville, Louisiana, are available for the period of August 1954 to September 1972 and October 1974 to September 2005. During this period of record, a minimum daily water temperature of 1.0°C occurred on January 29 and 30, 1961, and December 25, 1989. Ice does not form in the river near the site. The St. Francisville, Louisiana, gaging station is located approximately 4 mi. upstream from the site (Reference 2.3-12).

Temperature data obtained during the 1972 Hydrographic Survey are presented in Figure 2.3-18. The figure shows little variation in temperature with depth, and the river can be considered well-mixed from top to bottom.

Additional water temperature data are presented in Subsection 5.3.2.1.3 and can be summarized as follows.

The ambient river temperature data at St. Francisville are shown in Figure 5.3-11, summarized as water temperature versus day of the year for the 27-year period of record. The seasonal water temperature pattern is clearly illustrated and consistent over the 27 years. Four ambient temperature scenarios were evaluated (Table 5.3-6): summer mean, summer extreme (95th percentile), winter mean, and winter extreme (5th percentile). Ambient winter river water temperatures examined were 46.4°F (8.0°C) as mean temperature and 39.2°F (4.0°C) as the extreme (minimum) (Table 5.3-6). Mean and extreme (maximum) ambient summer river water temperatures were 82.9°F (28.3°C) and 86°F (30.0°C), respectively (Table 5.3-6).

Stream Flow and Flood Characteristics

Stream flow and flood characteristics, along with historic flow and stage data for the Mississippi River and local streams, are described in Subsections 2.3.1.1.1 and 2.3.1.1.2.

Wetlands

On the RBS property, regulated wetlands are found in a narrow corridor along the Grants Bayou east of the existing plant and include the bottomland forest that lies along Wickliffe Creek (Alligator Bayou) adjacent to the Mississippi River. Wetlands are discussed in detail in Section 2.4.

2.3.1.2 Groundwater

This subsection discusses the regional and local groundwater conditions (e.g., aquifers) and their influence on the groundwater characteristics in the vicinity of the RBS site that could affect the RBS site water supply and effluent disposal or that could be affected by plant construction or operation of the proposed project. To acquire the base RBS site-specific information necessary to provide this discussion, a detailed hydrological investigation was conducted on the RBS site between late 2006 through mid-2008. The details from this investigation are presented in FSAR Subsection 2.4.12 (and, in part, FSAR Subsection 2.5.4). The objective of this investigation was to collect groundwater information, including the following:

- The areal extent of aquifers, recharge and discharge areas, elevation and depths of geological formations, and aquifer characteristics (e.g., transmissivity and hydraulic conductivity).
- Piezometric contour maps, historical and current hydraulic gradients, and flow directions.
- Flow travel times.
- Soil properties, including permeability or transmissivity, storage coefficients or specific yields, total and effective porosities, clay content and bulk densities.
- Site surface and groundwater interactions.
- Historical and seasonal trends in groundwater elevation or piezometric levels.
- Hydraulic interactions between different aquifers.
- Recharge rates and soil moisture characteristics.
- Local aquifers designated or proposed to be designated as "sole source aquifers."

2.3.1.2.1 Physiographic Setting

The RBS site covers an area of approximately 3330 ac. and is located on the coastal plain of southeastern Louisiana, along the eastern portion of the Mississippi River. The site lies approximately 3 mi. southeast of St. Francisville, Louisiana, which has a population of approximately 1712, and which is located 24 mi. northwest of the city of Baton Rouge, Louisiana (refer to FSAR Figure 2.4.12-201).

The majority of the site (approximately two-thirds of the site) is located on upland areas east of the Mississippi River (refer to FSAR Figure 2.4.12-202), where the maximum elevation is approximately 120 ft. above msl (refer to FSAR Figure 2.5.1-226). The upland areas of the site are heavily dissected by dry swales and intermittent streams. The remaining one-third of the site stretches approximately north to south across 3000 to 4000 ft. of floodplains of the Mississippi River, where the elevation of land surface is approximately 30 to 40 ft. msl. Major drainage features include the Alligator Bayou to the west and Grants Bayou to the south and east of the site. The western boundary of the RBS site runs along the Mississippi River (refer to FSAR Figure 2.4.12-202).

2.3.1.2.2 Regional Hydrology

Major aquifers in the area are highly variable in composition, consolidation, and hydraulic character and consist of unconsolidated to poorly consolidated Coastal Plain strata of gravel, sand, clay, and minor limestone of Cretaceous to Holocene age.

The USGS Regional Aquifer-System Analysis (RASA) program has identified two regional aquifer systems underlying the RBS site: (1) the shallower coastal lowlands aquifer system (CLAS) consisting of late Oligocene to Holocene age strata and (2) the deeper Mississippi embayment aquifer system (MEAS) consisting of Late Cretaceous to Middle Eocene age strata (FSAR Figure 2.4.12-207). The CLAS extends southward from the Vicksburg-Jackson area in Mississippi to the Gulf of Mexico and includes the RBS site and most of Louisiana (refer to FSAR Figure 2.4.12-207). In accordance with the USGS program, the CLAS includes the Mississippi River alluvial aquifer (MRAA) because the aquifer is lithologically similar and in hydrologic connection with the underlying and adjacent coastal lowlands aquifer sediments.

The aquifers identified at the RBS site include two Quaternary age aquifers (the Upland Terrace Aquifer [UTA] and the MRAA) and the Tertiary age freshwater aquifers referred to as the Tertiary Aquifers (Zones 1, 2, and 3). These aquifers are described in detail below.

<u>Upland Terrace Aquifer</u>

The UTA is the uppermost aquifer within the upland areas and consists primarily of the Quaternary age Citronelle Formation and secondarily of the remnants of later terrace sediments that were deposited on the Citronelle Formation. The RBS site is located within the outcrop area of the Citronelle Formation, which extends from approximately 70 mi. north of the Louisiana-Mississippi state line to approximately 5 mi. south of the RBS site (refer to FSAR Figure 2.4.12-212).

The UTA is a broad, somewhat discontinuous, near-surface aquifer. Sediments range from clay and fine sand to gravel, with the coarsest sediments dominant in the northern portion of the aquifer. Most of the eastern portion of the UTA is blanketed by a layer of loess (eolian silt) that extends 30 to 40 mi. east of the Mississippi River. The loess is thicker near the river and is approximately 6 to 8 ft. thick at the RBS site (refer to FSAR Figure 2.4.12-214). The loess is absent along streams where it has been eroded. Field and empirical hydraulic conductivity of the UTA is shown in FSAR Figure 2.4.12-268.

<u>Mississippi River Alluvial Aquifer</u>

The Quaternary alluvium that occurs in the Mississippi Alluvial Valley (illustrated in FSAR Figure 2.4.12-216) is referred to as the MRAA. The MRAA is largely an uninterrupted deposit that typically grades upward from coarse sand and gravels at the base to fine sand, silt, and clay at the top. The most productive portion of the aquifer is the basal zone, which is composed of sand and gravel deposited during late Pleistocene time by meltwater from retreating glaciers. The upper part of the aquifer consists of point-bar deposits, natural levee deposits, backswamp deposits, and clay plugs of oxbow lakes.

Locally, the MRAA terminates east of the Mississippi River against the natural levee wall of the Mississippi River valley and lies unconformably above older Quaternary and Tertiary deposits. The average thickness of the MRAA is reported to be approximately 200 ft. in West Feliciana Parish. The land surface elevation in the Mississippi Alluvial Valley at the RBS site ranges from approximately 30 to 40 ft. msl. The elevation of the bottom of the Mississippi River near the site is approximately 85 ft. below msl (refer to FSAR Figure 2.4.12-213). Generally, the MRAA is hydraulically connected with the Mississippi River.

An equipotential map of water levels within the MRAA (refer to FSAR Figure 2.4.12-216) shows a hydraulic gradient directed southward. The map shows that the equipotential surface within the MRAA at the RBS site is approximately 10 ft. msl. Reported values of hydraulic conductivity and the storage coefficient for the MRAA are 200 ft/day and 1.0 x 10^{-2} to 9.0 x 10^{-4}, respectively.

Tertiary Aquifers

Tertiary age aquifers containing freshwater in the area include fine- to coarse-grained sand deposits of the Pascagoula and Hattiesburg Formations that crop out approximately 16 mi. north of the RBS site (refer to FSAR Figure 2.4.12-212). The Tertiary Aquifers have been divided into three separate zones designated as 1, 2, and 3. Generally, each of these zones represents a confined flow system comprised of multiple sand units. However, in many areas, the confining clay layers may contain silt and sand and may be leaky, thin, or absent.

Correlations of the three zones with laterally equivalent aquifers in Baton Rouge are presented in FSAR Tables 2.4.12-201 and 2.4.12-202, and in FSAR Figure 2.4.12-211. At the RBS site, Zone 1 consists of the first series of sand units underlying the Quaternary upland deposits (including the UTA) and is overlain by more than 200 ft. of clay belonging to the Pascagoula Formation. At the RBS site, the Zone 1 and Zone 2 sands are separated by approximately 300 ft. of clay. Zone 2 sands include two sand units that extend from 1170 to 1290 ft. below ground surface (bgs). Zone 3 consists of the deepest sand units containing freshwater (less than 250 mg/l chloride) in the region. Zone 3 is separated from the overlying Zone 2 sands by 270 ft. of clay. Near the RBS site, the base of fresh groundwater associated with this zone is approximately 1900 ft. below msl.

Values of the hydraulic conductivity and storage coefficient of Zone 1 sands in the Baton Rouge area range from 70 to 168 ft/day and from 2.0 x 10^{-4} to 8.0 x 10^{-4}, respectively. The following hydrologic parameters were calculated for the Zone 2 sands based on the pumping tests conducted on two wells (Wells 50 and 63) located 3 mi. south of the RBS site: transmissivity (5200 ft^2/day and 6800 ft^2/day), aquifer thickness (120 ft. and 80 ft., respectively), and hydraulic conductivity (43 ft/day and 86 ft/day, respectively). The following hydrologic parameters were calculated for the Zone 3 sands based on one pumping test conducted at Well 215, located 3 mi. south of the RBS site: transmissivity (16,000 ft^2/day), aquifer thickness (80 ft.), and hydraulic conductivity (200 ft/day).

2.3.1.2.3 Piezometric Contour Maps, Hydraulic Gradients, Flow Directions, and Times

A map of the piezometric surface of the UTA was prepared on the basis of hydrograph information for the month of July 2007, as shown in FSAR Figure 2.4.12-256. At the RBS, the July water levels are the highest water levels measured in the UTA during the 1 year. The groundwater table at the site slopes to the south-southwest toward the Mississippi River. The horizontal hydraulic gradient in FSAR Figure 2.4.12-256 within 4000 ft. downgradient of the proposed RBS Unit 3 facility was 0.0029 ft/ft. Farther downgradient, the gradient was less, approximately 0.0009 ft/ft.

A detailed discussion of the historical and current hydraulic gradients and flow directions and times in the UTA is provided in FSAR Subsection 2.4.12. Hydrographs for the MRAA are shown in FSAR Figures 2.4.12-262 through 2.4.12-264. FSAR Subsection 2.4.12 provides a detailed discussion of the historical and current hydraulic gradients and flow directions and times in the MRAA. Hydrographs of the Tertiary Aquifers are provided in FSAR Figures 2.4.12-265, 2.4.12-266, and 2.4.12-267. A detailed discussion of the historical and current hydraulic gradients and flow directions and times in the Tertiary Aquifers is provided in FSAR Subsection 2.4.12.

2.3.1.2.4 Soil Properties

Transmissivities, Storage Coefficients, and Porosities

Analysis of the UTA indicates that the average coefficient of transmissivity, as determined from five sets of time-drawdown data, is 184,400 gpd/ft. The mean effective storage coefficient, as determined from the same five sets of time-drawdown data, is 0.08, with a standard deviation of 0.044. A check on the mean coefficient of transmissivity was done using the distance-drawdown method outlined in Cooper and Jacob. The calculation yielded a coefficient of transmissivity of 194,000 gpd/ft. This compares favorably with the mean value calculated from the time-drawn data. Total and effective porosity data were calculated for the Citronelle Formation, a major stratum of the UTA. The calculated total porosity was 0.36, and effective porosity values ranged between 24 and 32 percent. Assuming an approximate average thickness of 98 ft. for the UTA at the RBS, the hydraulic conductivity of the aquifer is 251 ft/day (0.1 cm/sec). The coefficient of transmissivity for the MRAA, based on pumping tests described in FSAR Subsection 2.4.12.3.2.2, was calculated to be 139,000 gpd/ft, and the coefficient of storage was calculated to be 0.001 (Reference 2.3-1).

For the Tertiary Aquifers, the following hydrologic parameters were calculated for the Zone 1 sands, based on the pumping tests conducted on two wells (Wells 34 and 76) located 22 mi. east-northeast of the RBS site: transmissivity (4,000 ft^2/day and 2,800 ft^2/day, respectively), aquifer thickness (35 and 72 ft., respectively), and hydraulic conductivity (114 ft/day and 39 ft/day, respectively). Values of the hydraulic conductivity and storage coefficient of Zone 1 sands in the Baton Rouge area range from 70 to 168 ft/day and from 2.0×10^{-4} to 8.0×10^{-4}, respectively. The following hydrologic parameters were calculated for the Zone 2 sands, based on the pumping tests conducted on two wells (Wells 50 and 63) located 3 mi. south of the RBS site: transmissivity (5200 ft^2/day and 6800 ft^2/day), aquifer thickness (120 and 80 ft., respectively), and hydraulic conductivity (43 ft/day and 86 ft/day, respectively. The coefficient of transmissivity of the screened area of Zone 3 was determined to be 35,000 gpd/ft, based on the specific capacity data and an assumed (average value for confined aquifers) coefficient of storage of 0.0001. This resulted in a calculated coefficient of storage of 0.000093 at a discharge rate of 40 gpm, and 0.000088 at a discharge rate of 60 gpm. These values compare favorably with the assumed value of 0.0001. Sieve analyses of sediment samples from the exposed interval had a d10 value of 0.125 mm, which yields an effective porosity of 12 percent.

Clay Content and Bulk Densities

As discussed above, major aquifers in the area of the RBS are highly variable in composition, consolidation, and hydraulic character and consist of unconsolidated to poorly consolidated Coastal Plain strata of gravel, sand, clay, and minor limestone of Cretaceous to Holocene age. Rapid, numerous, and complex facies changes have produced sand and gravel aquifers of irregular thickness and extent, interfingering with leaky confining beds of clay and silt. Thick beds of sand or clay of wide areal extent are not common. Widespread marker horizons or continuous clay beds are absent.

The UTA may be overlain by clayey Quaternary deposits and loess that may inhibit recharge from precipitation. Perched groundwater was not observed above discontinuous clay layers that occur above the local water table. The UTA is largely unconfined except beneath discontinuous clay layers at depth or beneath thick surficial deposits of silt and clay close to the boundary with the MRAA (refer to FSAR Figure 2.4.12-213).

The elevation of the top of the clay underlying the UTA may be quite variable in any given location. The Pascagoula Formation consists of approximately 200 ft. of clay that separates the UTA from the Tertiary Aquifers below. At the power plant site, the elevation of the top of the Tertiary deposits (i.e., clay of Pascagoula Formation) ranges from 10 to 50 ft. below msl (refer to FSAR Figure 2.4.12-230). The mantle of silt and clay above the saturated zone of the UTA limits infiltration over most of the site. At lower elevations within the uplands areas of the site, the silt and clay have been eroded away, and groundwater recharge is likely to occur.

The MRAA is largely an uninterrupted deposit that typically grades upward from coarse sand and gravels at the base to fine sand, silt, and clay at the top. However, the MRAA may be confined or semi-confined at the top by clayey backswamp deposits. In some places, clay, up to 50 ft. thick, may separate the MRAA from other aquifers and the Mississippi River. The upper zone is approximately 85 ft. thick and is composed of interbedded clay, silt, and sand, with clay being the dominant sediment type.

The Tertiary Aquifers have been divided into three separate zones. Generally, each of these zones represents a confined flow system that consists of multiple sand units. However, in many areas, the confining clay layers may contain silt and sand and may be leaky, thin, or absent.

At the RBS site, Zone 1 consists of the first series of sand units underlying the Quaternary upland deposits, including the UTA, and is overlain by more than 200 ft. of clay belonging to the Pascagoula Formation. At the RBS site, the Zone 1 and Zone 2 sands are separated by approximately 300 ft. of clay. Zone 3 is separated from the overlying Zone 2 sands by 270 ft. of clay. The Tertiary Aquifers are not hydraulically connected with the UTA. The Zone 1 and Zone 3 sands are separated from the UTA by approximately 200 ft. of Pascagoula clay in the RBS Unit 3 site location. Therefore, the Tertiary Aquifers are not likely to be affected by a release at the plant site.

Soil bulk densities are discussed in detail in FSAR Subsection 2.5.4. The structural backfill to be used beneath and around the Seismic Category I structures will be an inorganic, non-plastic, clean, fine-to-medium grained sand (mostly fine), with similar characteristics to the Class I engineered fill used during the construction of RBS Unit 1. The main soil properties of the engineered fill are presented in FSAR Figure 2.5.4-231. The existing engineered fill is very dense, with a mean relative density of 94 percent and a mean relative compaction of 99 percent.

The structural fill will be compacted to a minimum dry density equal to 95 percent of the maximum density determined by the Modified Proctor (ASTM D1557-02). The material should be moist during placement. These values are consistent with the compaction specification used for the backfilling of RBS Unit 1 and are also consistent with state-of-the-art engineering practice.

2.3.1.2.5 Site Surface and Groundwater Interactions

As described in FSAR Subsection 2.4.12 (refer to FSAR Figure 2.4.12-222), the primary source of recharge to the UTA aquifer system is precipitation falling on upland interstream areas in southwestern Mississippi and southeastern Louisiana where the aquifers crop out and also where overlying shallow clay deposits are not continuous. It is estimated that less than 1 in. per year of recharge in the outcrop area goes into the regional flow system, although local variations may range from 0.04 to 4 in. per year.

Recharge to the UTA via precipitation in the site area can occur anywhere that shallow clay deposits are missing. Recharge to the UTA via channel losses through the West Canal may also occur whenever water flows through that channel (so long as intervening clay deposits are absent). However, most hydrographs of site UTA wells and piezometers, with the exception of Piezometer B69 (refer to FSAR Figures 2.4.12-252 and 2.4.12-255), do not express strong correlations with rainfall events (refer to FSAR Figures 2.4.12-252 and 2.4.12-255).

The water in the UTA discharges to the adjacent MRAA, which itself primarily discharges to the Mississippi River. However, because aquifers in the region are interconnected, some infiltrated precipitation percolates downward through the surficial aquifers to the deeper aquifers (refer to FSAR Figures 2.4.12-209 and 2.4.12-223). Under flooding conditions, limited flow reversals in the MRAA can take place.

For additional information on groundwater rates of flow (velocity) and transport capability, refer to FSAR Subsection 2.4.12.3.

2.3.1.2.6 Historical and Seasonal Trends in Groundwater Elevation or Piezometric Levels

A map of water level elevations from 1960 to 1961 within the UTA shows a hydraulic gradient generally toward the south from the outcrop area (refer to FSAR Figure 2.4.12-215). The average water level elevation at the RBS site is approximately 56 ft. msl. A map of water level elevations measured within the UTA in 1980 shows the same general trends. The elevation of the water surface within the aquifer ranges from more than 280 ft. msl in the northern recharge areas to 100 ft. below msl at the cones of depression located at Baton Rouge. At the RBS site in 1961, the elevation of the water level at the site was approximately 60 ft. msl. There were no significant water level declines in Quaternary aquifers in the Feliciana Parishes from 1958 to 1962. Modeling results of the UTA indicate that heavy pumping of the equivalent aquifers in Baton Rouge (i.e., the "400-foot" and "600-foot" sands) do not affect water levels at the RBS site. The UTA recovers quickly from the effects of pumpage because of the proximity of the outcrop area and the Mississippi River.

Water levels in the MRAA are heavily influenced by the stage of the Mississippi River. Computer simulations indicate that there is now a net recharge from the MRAA to deeper aquifers, whereas prior to development, there was a net discharge from deeper aquifers to the MRAA.

Tertiary Aquifer Zone 1 water levels declined in the Baton Rouge area (approximately 20 mi. southeast of the RBS site) approximately 120 ft. from 1943 to 1961. From 1961 to 2001, water levels fluctuated in the Baton Rouge metropolitan area; they are currently only 28 ft. lower than they were in 1961. From 1990 to 2001, water levels declined approximately 20 ft. in the Baton Rouge metropolitan area. In East Feliciana Parish, at Well EF-27 (located 8 mi. east-northeast of the RBS site) water levels declined from 130 to 110 ft. msl in Zone 1 sands from 1945 to 1962 in response to pumping at Baton Rouge. In 2001, the highest water level in the Zone 1 sands in the Baton Rouge area was about 154 ft. and was located in northeastern West Feliciana Parish (refer to FSAR Figure 2.4.12-217). The lowest water level was 90 ft. below msl in the monitoring wells located in the Baton Rouge industrial district.

At Tertiary Aquifer Zone 2 (in East Feliciana Parish) Well EF-207 (7 mi. east-southeast of the RBS site), water levels dropped from approximately 146 to 65 ft. msl from 1918 to 1962. In St. Francisville, Louisiana, from 1962 to 1975, water levels in Zone 2 declined from 80 to 40 ft. msl (refer to FSAR Figure 2.4.12-246). A map of the 2002 equipotential surface of the Zone 2 "2000-foot sand" was published in 2004 (refer to FSAR Figure 2.4.12-245).

From 1918 to 1962, water levels declined from 145 to 65 ft. msl in Zone 3 in the Feliciana Parishes. Zone 3 water levels at St. Francisville declined 38 ft. during the period from 1941 to 1961. The annual rate of decline in the Feliciana Parishes was 5 ft. from 1958 to 1961. Refer to Subsection 2.3.1.2.3 for a discussion of piezometric levels and contour maps associated with the RBS aquifers.

2.3.1.2.7 Hydraulic Interactions Between Different Aquifers

Because aquifers in the region are interconnected, some infiltrated precipitation percolates downward through the surficial aquifers to the deeper aquifers. Because most recharge to the shallow aquifers is intercepted by intersecting streams (and discharged accordingly), it is estimated that less than 1 in. per year of recharge in the outcrop area goes into the regional flow system, although local variations may range from 0.04 to 4 in. per year.

The RBS site is located in an area that overlaps both a groundwater recharge area and a groundwater discharge area (refer to FSAR Figure 2.4.12-222). Generally, the MRAA is hydraulically connected with the Mississippi River. However, the MRAA may be confined or semi-confined at the top by clayey backswamp deposits. In some places, clay, up to 50 ft. thick, may separate the MRAA from other aquifers and the Mississippi River. Similarly, the MRAA may or may not be in direct hydraulic connection with laterally or vertically adjacent Quaternary and Tertiary Aquifers. Water levels within the MRAA are affected primarily by the stages of the Mississippi River. The upper part of the aquifer consists of point-bar deposits, natural levee deposits, backswamp deposits, and clay plugs of oxbow lakes.

The UTA and the Tertiary Aquifers are in hydraulic connection with the MRAA; recharge to underlying aquifers may occur depending on relative water levels within the aquifers and the stage of the Mississippi River. Flow reversals may occur in local areas depending on the stage of the river. During high river stages, usually from March through May, flow is from the river and into the MRAA. During low stages, usually July through October, flow is out of the MRAA and into the river. However, computer simulations indicate that, prior to development, there was a net discharge from deeper aquifers to the MRAA.

2.3.1.2.8 Recharge Rates and Soil Moisture Characteristics

The primary source of recharge to the aquifer system is precipitation falling on interstream areas in southwestern Mississippi and southeastern Louisiana, where the aquifers crop out (refer to FSAR Figures 2.4.12-209, 2.4.12-221, and 2.4.12-222). Average annual precipitation is approximately 60 in. The amount of precipitation recharging the groundwater system is partially dependent on shallow soil types and topography. In areas of greater topographic relief, much of the precipitation drains to local streams as runoff. The UTA may be overlain by clayey Quaternary deposits and loess that may inhibit recharge from precipitation. Recharge is greater where erosion of clayey surficial deposits has exposed the underlying sands. The greatest recharge potential is in areas of deep, well-drained sands and gravels with low runoff potential (refer to FSAR Figure 2.4.12-221).

Much of the recharge to the surficial aquifers discharges to nearby streams and major rivers. However, because aquifers in the region are interconnected, some infiltrated precipitation percolates downward through the surficial aquifers to the deeper aquifers (refer to FSAR Figures 2.4.12-209 and 2.4.12-223). It is estimated that less than 1 in. per year of recharge in the outcrop area goes into the regional flow system, although local variations may range from 0.04 to 4 in. per year.

Soil moisture content and Atterberg limit results for all the cohesive soils encountered below the Seismic Category I structures and other nonsafety-related structures at the site during the COL site investigation are shown in FSAR Figure 2.5.4-209.

2.3.1.2.9 Local Aquifers Designated or Proposed to be Designated as "Sole Source Aquifers"

The RBS site lies within the western portion of the Southern Hills Aquifer System (refer to FSAR Figure 2.4.12-208). The Southern Hills Aquifer System is a sole source aquifer that was so designated by the U.S. Environmental Protection Agency (EPA) in 1999. The aquifer system is located in portions of southwestern Mississippi and southeastern Louisiana (refer to FSAR Figure 2.4.12-232). It includes all of the regional aquifers that are Oligocene and later in age and includes all of the aquifers discussed herein (refer to FSAR Table 2.4.12-202). A sole source aquifer is an aquifer that is the sole source of at least 50 percent of the drinking water consumed in the area overlying the aquifer. The aquifers in southeast Louisiana that comprise the Southern Hills Regional Aquifer System include the MRAA, UTA, and the Tertiary Aquifers (Zones 1, 2, and 3 sands). At the RBS Unit 3 site location, the UTA is not in direct contact with the Tertiary Aquifers and is separated from the Zone 1 and Zone 3 sands by 200 ft. of Pascagoula clay (refer to FSAR Figure 2.4.12-213). These aquifers are described further in FSAR Subsection 2.4.12.

2.3.2 WATER USE

Water use for RBS Unit 3 is proposed to be very similar to the use of water in the existing RBS Unit 1. The source of cooling and plant water would be the Mississippi River using combined unit intake structures and components. Groundwater/public water would be used as a much smaller inflow for other general plant purposes, including potable and sanitary needs. Planned water use builds upon the systems and programs that have been successfully used in the operation of RBS

Unit 1 since 1986. Land use in the RBS area is described in Section 2.2. Hydrology of the region is provided in Subsection 2.3.1.

2.3.2.1 Surface Water Use

2.3.2.1.1 General Area Surface Water Use

According to information on water use for 2000 (Reference 2.3-13), total surface water withdrawals in West Feliciana Parish (the location of RBS) were 44.29 million gallons per day (Mgd), broken down as follows:

Quantity, Mgd	Usage
29.73	Industrial
14.47	Power Generation
0.06	Livestock
0.03	Public Supply (golf course on Thompson Creek)

According to the USGS, almost all of this water (approximately 44.2 Mgd) was from the Mississippi River.

No surface water usage in West Feliciana Parish was reported for rural domestic, irrigation, or aquaculture.

The same reference notes the following usage for Mississippi River water in the state of Louisiana, with a total withdrawal of approximately 6200 Mgd:

Quantity, Mgd	Usage
1880	Industrial
4025	Power Generation
274	Public Supply

No surface water usage of Mississippi River water was reported in Louisiana by the USGS for rural domestic, livestock, irrigation, or aquaculture. Also notable is the fact that Mississippi River water was not used for public supply purposes in West Feliciana Parish. The values show that the major use of Mississippi River water in Louisiana is for power generation.

Summary data pertaining to water use in West Feliciana Parish and in adjacent Louisiana Parishes are presented in Tables 2.3-5 through 2.3-13 (Reference 2.3-13).

2.3.2.1.2 RBS Vicinity Surface Water Usage

This subsection focuses on water usage from the Mississippi River as the surface water body supplying and receiving water for RBS, and also as the body of water that provides potential liquid pathways for both radiological and non-radiological effluents. RBS's configuration with the Mississippi River is shown in Figures 2.3-21 through 2.3-26.

The neighboring and nearest downstream users of Mississippi River water are power/industrial users, including the Big Cajun Power Plant and the former Tembec Pulp and Paper Mill. According to the USGS (Reference 2.3-13), in 2000, approximately 29.8 Mgd of Mississippi River water was used for paper products in West Feliciana Parish, and a total of 274 Mgd was withdrawn for power generation in the Pointe Coupee Parish where the Big Cajun Plant is located (Reference 2.3-13). Industrial and power generation water usage does not vary significantly seasonally, so daily usage can be used to indicate monthly usage estimates. The continuing use of water by the Tembec facility is uncertain because of the shutdown of that facility as of July 31, 2007.

Summary data in Table 2.3-5 show significantly lower surface water withdrawals in the immediately downstream parishes of East Feliciana and East Baton Rouge.

Water discharges and returns to the Mississippi River downstream of RBS from industrial uses and public treatment plants, along with flow contributions from Mississippi River tributaries, provide minimal changes to the quality of the Mississippi River downstream of RBS, as demonstrated by the Baton Rouge water quality data discussed in Subsection 2.3.3. Water usage opportunities remain similar for the section of the Mississippi River flowing past RBS on to Baton Rouge.

2.3.2.1.3 Downstream Public Water Usage of Mississippi River

According to the Louisiana Department of Health and Hospitals (Reference 2.3-14), the downstream source location nearest to RBS that uses the Mississippi River as a source of public water supply is at RM 175.2, near Donaldsonville. The Peoples Water Service Company of Donaldsonville, Louisiana, approximately 87 river miles downstream of RBS, pumps approximately 200 cfs or 130 Mgd of Mississippi River water into Bayou Lafourche, a water body not connected to the Mississippi River. Bayou Lafourche provides drinking water to approximately 300,000 residents south of the Mississippi River in Assumption Parish, Lafourche Parish, and other locations. A project is being developed by the Louisiana Department of Natural Resources (LDNR) to increase the amount of water pumped from the Mississippi River to Bayou Lafourche to approximately 1000 cfs (References 2.3-15 and 2.3-16). Additional users of Mississippi River water as a public drinking water source (communities in the greater New Orleans area) are located further downstream from the Bayou Lafourche diversion location and, therefore, even more distant from RBS (Reference 2.3-14).

2.3.2.1.4 Transportation Usage

The USACE maintains a 9-ft. depth at low water on the Mississippi River for navigational uses (Reference 2.3-17). The primary navigational use of the river is for freight shipments, with 188 million tons of freight traffic in 2006 for the section of the river between the mouth of the Ohio River to Baton Rouge (Reference 2.3-18). Baton Rouge was ranked as the 12th largest U.S. port in 2006, based upon handling 56.3 million tons of goods.

Additional Mississippi River traffic in the area of RBS is associated with a ferry service that connects West Feliciana Parish near the town of St. Francisville with Pointe Coupee Parish near the town of New Roads. The ferry operates 20 hr. per day, with scheduled crossings every 15 minutes during that period. Approximately 863 vehicles cross the river per day on the ferry, according to a 2003 environmental assessment report (Reference 2.3-19). The LDOTD is replacing the ferry crossing with a highway bridge (John James Audubon Bridge) south of the site. The bridge is under construction and is scheduled for completion in 2010.

2.3.2.1.5 Commercial Fishing and Recreational Areas

There is limited commercial fishing in the area, with 14 resident commercial fisherman licensed in West Feliciana Parish in 2005 (Reference 2.3-20). Commercial fishermen licensed in nearby parishes include 68 in Pointe Coupee, 42 in West Baton Rouge, and 98 in East Baton Rouge. This is a small portion of the 13,179 resident commercial fishermen licensed throughout Louisiana by the LDWF in 2005.

Regional recreational areas closest to the RBS are upstream from the RBS or not connected to the Mississippi River. These include Audubon Lakes, approximately 2 mi. northeast of the site, Cat Island National Wildlife Refuge, approximately 3 mi. north-northwest of the site, and False River, approximately 7 mi. southwest of the site and west of the Mississippi River.

2.3.2.1.6 Plant Use of Surface Water

Makeup to the normal power heat sink (NPHS) cooling towers, balance-of-plant cooling systems (e.g., plant service water), and other raw water makeup needs of the existing facility are supplied by an intake structure located on the east bank of the Mississippi River. Existing water supply structures and components include a pump house and support systems for RBS Unit 1. The existing intake screens located in the embayment would be replaced and would continue to meet the intake velocity requirement (≤0.5 fps at the screen). An existing 36-in. diameter pipeline is used to convey makeup water from the pump house to the Unit 1 clarifiers.

Normal makeup flow rate to the existing facility is approximately 14,120 gpm, and maximum expected makeup flow is approximately 15,403 gpm. Figure 2.3-26 is a water use diagram that illustrates the specific uses of this makeup water and the amounts required. Using the estimated minimum Mississippi River flow value at Tarbert Landing of 100,000 cfs (Subsection 2.3.1.1.1), the facility maximum withdrawal is approximately 0.03 percent of the minimum Mississippi River flow.

The NPHS circulating water system for the facility is a closed-cycle type system that uses MDCTs. Circulating water system flow through the cooling towers is approximately 509,000 gpm, as shown in Figure 2.3-26. Effluent from the facility is discharged into the river downstream of the intake so that recirculation to the intake pipes is precluded.

The design and placement of the intake structure for RBS Unit 1 is in accordance with USACE guidance, Louisiana Department of Environmental Quality (LDEQ), and EPA requirements, and good engineering practice. The state of Louisiana does not currently restrict the quantity of water that can be withdrawn from the Mississippi River.

As described later in Subsection 2.3.3, all effluent discharges and stormwater discharges from the RBS flow directly or indirectly to the Mississippi River. Regulation of potential liquid pathways for effluents includes the monitoring of discharges from the RBS for compliance with the terms of the LDEQ permit and the terms of the NRC license.

2.3.2.2 Groundwater Usage

2.3.2.2.1 Area Groundwater Use

According to information on water use for 2000 (Reference 2.3-13), total groundwater withdrawals in West Feliciana Parish were 6.17 Mgd, broken down as follows:

Quantity, Mgd	Usage
4.52	Public Supply
1.59	Industrial
0.02	Power Generation
0.04	Rural Domestic

No groundwater usage was reported in West Feliciana Parish for livestock, irrigation, or aquaculture.

The focus of this subsection is the aquifers east of the Mississippi River and in a 25-mi. radius of the plant, as shown in the well map in Figure 2.3-27. (This is the area of groundwater usage that would be potentially affected by the usage of groundwater at RBS. However, RBS Units 1 and 3 would use only a maximum of 315 gpm of public water or groundwater, as discussed below.) A geological cross-section diagram is provided in Figure 2.3-28, and an aquifer map is provided in Figure 2.3-29.

Use of the MRAA is limited to household, irrigation, industrial, and commercial use. Use of the Upland Terrace Aquifer (UTA) is more prominent; uses include household, irrigation, industrial, commercial, rural, and institutional/government supply. Use of the Pascagoula Formation Aquifers (Zones 1, 2, and 3) is limited to household, industrial, irrigation, rural, institution, rural, and municipal supply (Reference 2.3-1). The location of wells in use on the east side of the Mississippi River within a 25-mi. radius from RBS is presented in Figure 2.3-27, including wells in Mississippi.

Public and industrial wells in the East Feliciana Parish utilize the UTA, and Zones 1, 2, and 3 Aquifers of the Pascagoula Formation. Public and industrial wells in East Baton Rouge Parish utilize the MRAA; UTA; and Zones 1, 2, and 3 Aquifers of the Pascagoula Formation. Data pertaining to public and industrial supply wells in West Feliciana, East Feliciana, East Baton Rouge, and Livingston parishes in Louisiana are presented in Table 2.3-14. Information on only 10 wells in Livingston Parish (more than 20 mi. from the RBS site) was found for household and irrigation use. Because of the distance and low yield of existing wells, it is not expected that any withdrawal from RBS would affect wells in Livingston Parish (Reference 2.3-1).

Public wells in West Feliciana Parish are supplied by the MRAA, the UTA, and the Zones 1 and 3 Aquifers of the Pascagoula Formation, with well depths ranging from 34 to 2687 ft. (Table 2.3-14). Three active public water supply systems were located in West Feliciana Parish as of 2000, not including RBS (Reference 2.3-13). The closest area of concentrated groundwater withdrawal is the West Feliciana District 13 water system, approximately 5 mi. southeast of the site. Water for West Feliciana is provided by seven wells completed in the Pascagoula Formation Aquifers, with yields rated at 3605 gpm (Table 2.3-14). The greatest area of concentrated groundwater withdrawal occurs at the East Baton Rouge Parish, approximately 20 mi. southeast of the site. Total public supply for the East Baton Rouge Parish is provided by seven public suppliers, totaling 63.8 Mgd, from the UTA and the Zones 1 and 3 Aquifers at the Pascagoula Formation (Reference 2.3-13).

The Applicant notified the EPA and LDEQ about potential plans to utilize Pascagoula Formation water for RBS Units 1 and 3 in February 2008; however, as of 2008, the Applicant has replaced its use of this water based upon agreements with the West Feliciana Water District. The EPA sole source aquifers in the area include the Southern Hills Regional Aquifer, which includes the Pascagoula Formation.

2.3.2.2.2 Plant Groundwater/Public Water Use - Operations

Plant domestic use water for the existing RBS Unit 1 has been supplied from two on-site wells located in the Pascagoula Formation Zone 3 Aquifer. The total use rate for the existing unit and a new RBS Unit 3 is planned at a maximum of 315 gpm, although this use would be replaced by public water as described below. Groundwater usage at RBS has been low compared to the usage of surface water (such as a maximum of 15,403 gpm [refer to Figure 2.3-26] of Mississippi River water used for cooling water makeup).

The Applicant has finalized contractual arrangements to obtain drinking water from the West Feliciana Water District that would displace most or all of the water used from the existing plant well source. Use of the public water supply began in 2008. The water district is capable of providing additional water supplies if needed.

Makeup (cooling tower makeup and other raw water needs) for a new facility would be supplied from the Mississippi River via an intake located on the east bank of the river and on the north side of the existing barge slip. Groundwater or public water may be utilized for other general plant purposes, including potable and sanitary needs. The expected maximum consumption of groundwater/public water for these uses (for a new facility and the existing facility) is approximately 315 gpm.

2.3.2.2.3 Plant Groundwater/Public Water Use - Construction

Construction activities for the RBS Unit 3 would require about 165,000 gallons per day (gpd) (refer to Table 4.2-1), or 114 gpm of water, for concrete batch plant operation, dust suppression, and sanitary needs. Public water use is planned.

The recommended planning number for tap water consumption for workers in hot climates is 3 gpd for each worker. Based on the maximum estimated construction worker population of 3150 people, the tap water consumption is estimated at 9450 gpd (Reference 2.3-17).

2.3.3 WATER QUALITY

This subsection describes the site-specific surface water quality characteristics and groundwater characteristics that could be directly affected by plant construction and operation or that could affect plant water use and effluent disposal within the vicinity of the RBS. This subsection also presents background information on water quality, including data collected prior to RBS Unit 1 operation, more recent data reflecting operation of RBS Unit 1, and discussions of activities associated with a new RBS Unit 3.

Water quality effects for an RBS Unit 3 are projected to be very similar to the effects associated with the existing RBS Unit 1. The new unit would also use Mississippi River water and discharge to the river using combined unit discharge structures and components.

2.3.3.1 Surface Water Quality

RBS Unit 1 water discharge sources usage include cooling tower blowdown, certain low volume wastewaters, clarifier underflow, and treated sanitary wastewater. Similar arrangements are planned for RBS Unit 3. All discharges from Unit 1, including stormwater, are ultimately received by the Mississippi River under a Louisiana Pollutant Discharge Elimination System (LPDES) Permit (Reference 2.3-21).

As noted in Subsection 2.3.2, the predominant use of Mississippi River water in Louisiana is for power generation, with extensive use of river water for cooling. River water is typically withdrawn by power plants in large quantities and then is discharged back to the river after usage with a higher temperature and with a changed composition, depending on evaporative or other losses, the degree of water treatment, and additives used. Mississippi River water has been monitored extensively for such parameters as temperature, solids, inorganic constituents, and related parameters potentially affected by the use of the water by power generation and other industrial users.

2.3.3.1.1 Historic Surface Water Testing

Historic surface water quality data for river water near the RBS site include the following items collected prior to the construction of RBS Unit 1:

- A pre-RBS operations summary of lower Mississippi River data from 1954 to 1977 collected by the USGS about 4 mi. upstream of the RBS at St. Francisville, Louisiana (Table 2.3-15 and Reference 2.3-22).
- Data from the Mississippi River and local streams collected by Louisiana State University (LSU) during a 1972 - 1977 study period (Tables 2.3-16A, 2.3-16B, and 2.3-16C and Reference 2.3-23).

This information provides a background to Mississippi River water quality prior to such developments as the construction of RBS Unit 1 and the effects of various environmental regulatory programs implemented since the period of those studies. The older USGS data, in particular, identify ranges for such parameters as pH, temperature, and dissolved solids similar to the data presented below for recent years.

2.3.3.1.2 Recent Surface Water Testing

Recent Mississippi River water quality data are presented in Tables 2.3-17 and 2.3-18 from USGS monitoring locations upstream (St. Francisville) and downstream (Baton Rouge) of the RBS (Reference 2.3-22). These data from 2004 and 2005 reflect a river with fairly consistent water quality over time from north of the RBS, past the RBS, and south to Baton Rouge. The 2004 and 2005 data also present water quality conditions that include any effects from RBS Unit 1, the operations of the Big Cajun power plants brought on-line in the 1980s, and other changes to Mississippi River quality from current usage and drainage upstream of RBS.

The data tables for the two locations (Tables 2.3-17 and 2.3-18) show a range of data results over 2 years of monitoring, thus demonstrating a spatial and temporal range of data for the river. As noted in Subsection 2.3.1.1, the watershed of the Mississippi River near the RBS includes a drainage area of more than 1.1 million sq. mi., with a river channel width at the station site of about 1700 ft. The water quality reflects a mixing of the drainage impact of large areas of land and a variety of water users. The exceptions are such factors as suspended solids that can vary with localized precipitation cycles.

The data in Table 2.3-17 for the river at St. Francisville, about 4 mi. upriver from the RBS water intake location, include a variety of physical, chemical, and biological parameters of interest to both potential users of the water and for interpretation of environmental conditions in the river. Some key example parameters are summarized below (from Reference 2.3-23):

Example Parameters at St. Francisville	Range
Temperature	4 - 30°C
Suspended Sediment	14.1 - 318 mg/l
Residue (total dissolved solids)	169 - 288 mg/l
Organic Carbon	2.5 - 7.2 mg/l
pH	7.3 - 8.4

The data in Table 2.3-18 for the Mississippi River at Baton Rouge, about 32 mi. downstream from the RBS intake location, cover the same 2-year period as the data for St. Francisville. The data show similar trends for the river at Baton Rouge, which includes any effects from RBS Unit 1 and the Big Cajun plant, in addition to the effects on river water quality from any other users or streams/rivers flowing into the Mississippi in that 36-mi. segment of the river. The data for both locations demonstrate a Mississippi River segment with very similar quality flowing from north of the RBS, past the RBS, and south to Baton Rouge.

Example data from Baton Rouge (Reference 2.3-22) are similar to the St. Francisville average data:

Example Parameters at Baton Rouge	Range
Temperature	6 - 30°C
Suspended Sediment	59 - 384 mg/l
Residue (total dissolved solids)	169 - 282 mg/l
Organic Carbon	2.4 - 4.1 mg/l
pH	7.3 - 8.2

The similarity of data at both locations may be attributed to such factors as the following:

- The large flow rate of the Mississippi River between St. Francisville and Baton Rouge tends to assimilate discharges and drainage to the river over this section that includes the RBS.
- The state of Louisiana discharge permits for the power generation plants and other industrial users appear to have minimized water quality impacts to the Mississippi River by permitted users and dischargers in this section of the river.
- The data tables (Tables 2.3-17 and 2.3-18) tend to indicate that variations in the water quality parameters in the Mississippi River appear to be more obvious for weather-related or seasonally related parameters such as water temperature and suspended sediment related to materials in runoff from precipitation.

2.3.3.1.3 Impacts of Permitted Facilities to Water Quality

RBS

The LDEQ renewed the RBS Unit 1 LPDES permit on June 1, 2006 (Reference 2.3-21). The renewal process included a detailed evaluation of facility operations, facility wastewater discharges, Mississippi River conditions, and Louisiana and federal water quality regulations and guidance. Highlights of permit conditions and requirements for RBS Unit 1 include the following:

- Continuous monitoring of cooling water blowdown discharge temperature and flow rate.
- Periodic monitoring of trace metals in the cooling water combined discharge.
- Monitoring of smaller discharge streams for such parameters as total suspended solids, oil and grease, total organic carbon, and pH.

- Recordkeeping of coagulants (clarifying agents) used in the raw river water treatment system.
- Annual Whole Effluent Toxicity Testing of the cooling water discharge to test for any cumulative toxic effect of the discharge water to EPA- or LDEQ-specified test organisms.

Table 2.3-19 summarizes the numeric discharge permit conditions for the primary discharge of RBS Unit 1. The RBS Unit 1 facility has operated substantially in compliance with its permit limits since operation started in 1986.

Traditional water quality issues associated with power plant withdrawal of surface water for cooling and subsequent discharge of the cooling water include the potential effects of the warmer discharge water and the increased concentration of dissolved solids in the cooling water as a result of evaporative losses from cooling. The LDEQ permitting process addressed such issues as follows:

- The LPDES permit limits discharge water temperature.
- Selected trace metals are monitored periodically in the discharged cooling water representing the total dissolved solids.

The USGS monitoring data for the Mississippi River (as shown in Tables 2.3-17 and 2.3-18 and the above summaries) demonstrate the assimilation capacity of the Mississippi River in the RBS area for such parameters as temperature and residue (total dissolved solids). Additionally, the values for total dissolved solids residue in the Mississippi River are shown in the 169 to 288 mg/l range versus the Louisiana water quality criteria of 400 mg/l for that river segment (Reference 2.3-24).

Other Industrial Users

Although discharges from other industrial users could potentially affect Mississippi River quality, the size of the Mississippi River tends to localize/reduce these effects as noted in the above data. The LDEQ evaluation of appropriate LPDES discharge conditions for Big Cajun Unit 3 across the Mississippi River from RBS Unit 1 included the same process used for development of the RBS Unit 1 LPDES permit.

Radioactive Releases

Potential radioactivity release is monitored at RBS Unit 1 in compliance with the terms of the NRC license and NRC regulations (10 CFR 20) and is reported annually to the NRC. As discussed in Subsection 5.5.3, this monitoring includes the following:

- Sampling of radioactivity in each batch of liquid effluents from low-level radioactive, low volume wastewater.
- Quarterly sampling of radioactivity in upstream and downstream Mississippi River surface water samples.

- Annual sampling of radioactivity in Mississippi River sediment.
- Semiannual sampling of radioactivity in groundwater upgradient and downgradient from the RBS.

To date, the results of the monitoring program have indicated discharges below the limits of 10 CFR 20, and no activity typically seen in background levels has been noted in river or sediment samples. Levels of radionuclides monitored in 2006 continued to remain similar to results obtained in previous operational and preoperational years (Reference 2.3-25). Subsection 5.5.3 and Section 6.2 provide additional information about radioactive waste and ongoing monitoring of radioactivity in Mississippi River water and sediments.

2.3.3.1.4 Existing Thermal Impact to Water Quality

Concerning the effect of thermal plumes on the river, previous modeling studies of the RBS site have concluded that hot water discharge plumes from cooling water discharges to the Mississippi River have minimal effect because of the large size and assimilation capacity of the Mississippi River (Reference 2.3-26). These historical modeling studies have indicated that plumes do not restrict fish passage or significantly raise river temperature. Additional discussion of this topic is provided in Subsection 5.3.2.

2.3.3.1.5 Water Quality Effects on Water Usage

Studies and permitting decisions to date (as described above) have not indicated any discharges to the Mississippi River that may interact with RBS discharges. The size of the Mississippi River flow and its assimilation capacity has tended to minimize the effect of any single activity (except for the variations of weather conditions) to river turbidity and suspended solids as shown in the monitoring data for this river segment (Tables 2.3-17 and 2.3-18).

Likewise, the limited effect of RBS Unit 1 or other power units on Mississippi River water quality has not appeared to modify the usage of the Mississippi River as a water resource for other potential uses, as shown by the comparison of upstream and downstream data earlier in this section. The state of Louisiana does not currently restrict the quantity of water that can be withdrawn from the Mississippi River, as noted in Subsection 2.3.2.

2.3.3.1.6 Treatment of Water Used at the RBS

Water used at the RBS and water discharged from RBS Unit 1 are treated by conventional methods widely used in power generation or other applications. Well water is demineralized as needed. Intake water is filtered with the use of coagulants to remove suspended solids, and additives are used for such needs as controlling macrobiological and microbiological fouling and inhibiting corrosion (refer to Subsection 3.6.1). Sanitary wastewater is treated by an on-site treatment system using physical and biological treatment methods to attain permit limits (refer to Subsection 3.6.2). Stormwater runoff is managed to minimize the discharge of pollutants, in accordance with permit limits. All discharges are under the terms of the LPDES permit.

2.3.3.1.7 Water Quality Categorization

The EPA lists the Mississippi River in the RBS vicinity as being in the 85-mi. long segment "Mississippi River - Old River Control Structure to Monte Sano." This segment is designated (as of 2002) as fully supporting drinking water supply, fish and wildlife propagation, and primary and secondary contact recreation (Reference 2.3-27).

The same source lists Thompson Creek, which receives stormwater runoff and certain low volume wastewaters from the RBS (via Grants Bayou and Alligator Bayou, prior to Thompson Creek and thence to the Mississippi River). Thompson Creek, from the Mississippi state line to the Mississippi River, is listed as impaired for primary contact recreation due to total fecal coliform levels attributed to septic systems in the watershed. The creek is designated as fully supporting fish and wildlife propagation and secondary contact recreation.

The Louisiana portion of the Mississippi River basin is currently scheduled to be investigated by the LDEQ between 2007 and 2011 for the development of any total maximum daily loads (TMDLs) (Reference 2.3-28). Thompson Creek is listed as an impaired waterway on the 2002 Consent Decree Louisiana 303(d) list. Suspected causes of impairment include cadmium, copper, lead, mercury, pathogen indicators, siltation, suspended solids, and turbidity. This information was available for consideration as part of the LDEQ permit renewal process for the RBS in 2006.

2.3.3.2 Groundwater Quality

Groundwater and surface water samples were collected for chemical analysis to evaluate the recent chemical character of local water resources. Groundwater samples were obtained from monitoring wells and RBS Unit 1 pumping wells. A surface water sample was also collected from the Mississippi River for comparison. Results of chemical analyses of samples are presented in Table 2.3-20 for a sampling program conducted by the Applicant for this ER.

Sampling of groundwater from the well screened at the Mississippi River alluvium indicated a dissolved solids and hardness values of 206 mg/l and 150 mg/l calcium carbonate ($CaCO_3$), respectively. Chemical constituents of notable concentrations are lead and zinc. Groundwater samples from wells screened in the Upland Terrace Aquifer indicated a range in dissolved solids and hardness of 80 to 177 mg/l and 26 to 82 mg/l $CaCO_3$, respectively. Water samples of groundwater from the Zone 1 Aquifer at the Pascagoula Clay Formation indicated a dissolved solid concentration of 189 mg/l, with no hardness. Water samples from the Zone 3 Aquifer indicated a dissolved solid concentration of 214 mg/l, with hardness of 10 mg/l $CaCO_3$ (Table 2.3-20).

2.3.4 REFERENCES

2.3-1 Entergy Operations, Inc., "River Bend Station Updated Safety Analysis Report" through Revision 19, July 2006.

2.3-2 Gulf States Utilities Company, "River Bend Station Environmental Report, Operating License Stage," Volumes 1-4, Supplements 1-9, November 1984.

2.3-3 U.S. Army Corps of Engineers, "Mississippi River Hydrographic Survey 1991-1992, Black Hawk, LA to Head of Passes, LA," Mile 0 to Mile 324 (A.H.P.) (New Orleans District), Sheets 18 and 19, Website, http://www.mvn.USACE.army.mil/eng2/edsd/misshyd/misshyd.htm.

2.3-4 U.S. Army Corps of Engineers, "2007 Mississippi River Navigation & Hydrographic Survey Books," Website, http://www.mvn.usace.army.mil/eng/2007MissRiverBooks/2007_Hydro_Book.htm.

2.3-5 U.S. House of Representatives, *Mississippi River and Tributaries Project*, House Document 308, 88th Congress, 2nd Session, Vol. II, U.S. Government Printing Office, Washington D.C., 1964.

2.3-6 U.S. Army Corps of Engineers, Tarbert Landing, Mississippi (RM 306.3) Gauging Station, Verified Flow Data 1930 to Date, 2008.

2.3-7 Gulf States Utilities Company, "River Bend Station Environmental Report, Operating License Stage," Table 2.3-3, Volumes 1-4, Supplements 1-9, November 1984.

2.3-8 U.S. Army Corps of Engineers, Bayou Sara, Louisiana (RM 265.4) Gauging Station, Verified Stage Data 1946 to Date, 2008.

2.3-9 U.S. Army Corps of Engineers, Mississippi River Basin Stage Data, Website, http://www.mvn.USACE.army.mil/eng/edhd/Wcontrol/miss.htm, accessed December 2007.

2.3-10 U.S. Department of the Interior, National Park Service, "The Natural Environment - Volume 2 - Draft Heritage Study and Environmental Assessment," Website, www.nps.gov/history/delta/volume2/natural.htm.

2.3-11 Ocean Engineering Associates, Inc., *Bridge Hydraulics Report for the Route LA-10 Bridge Over the Mississippi River, Pointe Coupee and West Feliciana Parishes, Louisiana*, State Project Nos. 052-02-0024, 499-97-0001, 499-98-0001, and 499-99-0001, submitted to Louisiana Department of Transportation and Development, June 2006.

2.3-12 U.S. Department of the Interior, U.S. Geological Survey, Water Data for the St. Francisville, Louisiana, Gauging Station, Website, http://la.water.usgs.gov, accessed February 2008.

2.3-13 U.S. Geological Survey and Louisiana Department of Transportation and Development, *Water Use in Louisiana, 2000*, Water Resources Special Report No. 15, 2002.

2.3-14 Stout, K., "Mississippi Water Users List Background," Business Communication with J. Causey of Louisiana Department of Health and Hospitals, July 11, 2007.

2.3-15 Louisiana Coastal Wetlands Conservation and Restoration Task Force, Mississippi River Reintroduction into Bayou Lafourche, June 2004, Website, http://www.lacoast.gov/reports/display.asp?projectNumber=BA-25b&reportType=general, accessed July 20, 2007.

2.3-16 Coastal American, A Partnership for Action, Bayou Lafourche Initiative, September 2000, Website, http://www.coastalamerica.gov/text/regions/gm/bayou.html, accessed July 20, 2007.

2.3-17 Mississippi Power and Light, "Grand Gulf Nuclear Station Unit 1, Final Environmental Report," as Amended through Amendment No. 8, 1973.

2.3-18 U.S. Army Corps of Engineers Navigation Data Center, Leading US Ports in 2006 and Domestic Traffic for Selected U.S. Inland Waterways in 2006, The U.S. Waterway System - Transportation Facts, Website, www.iwr.usace.army.mil/ndc/factcard/fc07/factcard.pdf, accessed June 24, 2008.

2.3-19 Louisiana Department of Transportation and Development, Mississippi River Bridge Environmental Assessment, Route LA 10, Final, March 2003.

2.3-20 Louisiana Department of Wildlife & Fisheries, Commercial License Sales by Parish/State, License Year 2005, Website, www.wlf.louisiana.gov, accessed June 28, 2007.

2.3-21 Louisiana Department of Environmental Quality, "Louisiana Water Discharge Permit - River Bend Station, Permit Number LA0042731," June 2006.

2.3-22 U.S. Geological Survey, National Water Information System, available from NWIS Water Quality Data for Louisiana, Field/Lab Samples from the Lower Mississippi River, Website, http://nwis.waterdata.usgs.gov/la/nwis/qwdata?site_no=07374000&agency_cd=USGS&begin_date=1975-03-25&end_date=2005-09-08&format=html_table&inventory_output=0&rdb_inventory_output=file&date_format=YYYY-MM-DD&rdb_compression=file&qw_sample_wide=0&submitted_form=brief_list and from http://nwis.waterdata.usgs.gov/la/nwis/qwdata?site_no=07373420&agency_cd=USGS&begin_date=&end_date=&format=html_table&inventory_output=0&rdb_inventory_output=file&date_format=YYYY-MM-DD&rdb_compression=file&qw_sample_wide=0&submitted_form=brief_list, accessed July 30, 2007.

2.3-23 Bryan, C. F. and J. V. Conner, "LSU Study" as referenced in "Gulf States Utilities Company, River Bend Nuclear Station Units 1 and 2 Final Environmental Report (FER)," as Amended through Amendment No. 9, pp. 2.4-52 and 2.4-53, April 1981.

2.3-24 State of Louisiana Administrative Code, Title 33, Sec. IX 1123, Table 3, May 2007.

2.3-25 Entergy Operations, Inc., *River Bend Station - Annual Radiological Environmental Operating Report for 2006*, April 2007.

2.3-26 Gulf States Utilities Company, "River Bend Nuclear Station Units 1 and 2 Final Environmental Report (FER)," as Amended through Amendment No. 9, April 1991.

2.3-27 U.S. Environmental Protection Agency, National Assessment Database, 305(b) Lists/ Assessment Unit Information Year 2002, Website, http://oaspub.epa.gov/tmdl/enviro_v2.wcontrol?p_id305b=LA070201_00, accessed July 12, 2007.

2.3-28 Louisiana Department of Environmental Quality, 303(d) List and TMDL Program, Website, http://www.deq.louisiana.gov/portal/tabid/130/Default.aspx, accessed May 23, 2007.

Table 2.3-1
Mississippi River Watershed Runoff Characteristics[a]

Area		Annual Runoff (in.)			Monthly Runoff (in.)		
No.	(sq. mi.)	Min.	Ave.	Max.	Min.	Ave.	Max.
1	203,940	7.8	17.6	29.8	0.11	1.47	6.15
2	171,470	3.5	7.7	12.0	0.14	0.65	1.95
3	529,350	0.8	2.0	3.9	0.02	0.17	0.98
4	158,198	1.0	3.8	9.1	0.01	0.32	2.79
5	25,497	6.5	17.2	32.3	0.14	1.43	5.24
6	67,500	2.0	6.7	14.6	0.02	0.56	3.48
7	89,650	--	16.8	--	--	1.40	--
1-7	1,245,605[b]	3.7	7.1	11.9	0.09	0.59	2.04

a) Refer to Figure 2.3-4 for area locations.

b) At latitude of Red River Landing, Louisiana, RM 300.6.

Source: Reference 2.3-5.

Table 2.3-2 (Sheet 1 of 4)
Mississippi River Flow 1900 to 2006[(a)]
(1000 cfs)

Year	Max.	Min.	Mean
1900	796	157	434
1901	822	104	377
1902	861	198	461
1903	1206	116	639
1904	1018	119	465
1905	918	165	576
1906	1116	253	592
1907	1275	198	676
1908	1218	138	667
1909	1163	157	581
1910	853	130	473
1911	1007	174	459
1912	1499	198	646
1913	1272	167	584
1914	903	137	409
1915	934	298	653
1916	1327	157	641
1917	1218	110	510
1918	727	110	400
1919	960	154	602
1920	1223	181	657
1921	992	156	527
1922	1437	133	566
1923	1126	226	590
1924	928	154	549
1925	656	104	368
1926	813	143	477
1927	1779	173	867
1928	1035	236	601
1929	1301	163	643
1930	911	125	419

Table 2.3-2 (Sheet 2 of 4)
Mississippi River Flow 1900 to 2006[a]
(1000 cfs)

Year	Max.	Min.	Mean
1931	672	119	283
1932	1244	158	516
1933	1076	130	522
1934	720	130	292
1935	1087	112	574
1936	973	92	346
1937	1467	128	514
1938	1062	131	511
1939	1124	75	445
1940	872	93	313
1941	749	146	376
1942	973	242	499
1943	1280	133	520
1944	1282	125	475
1945	1520	179	683
1946	1085	145	509
1947	898	114	426
1948	959	126	448
1949	1208	176	555
1950	1458	194	696
1951	986	221	625
1952	1011	107	466
1953	852	100	373
1954	583	121	262
1955	1022	120	363
1956	894	99	332
1957	994	180	548
1958	984	157	482
1959	765	130	382
1960	826	148	409
1961	1107	183	514

Table 2.3-2 (Sheet 3 of 4)
Mississippi River Flow 1900 to 2006[a]
(1000 cfs)

Year	Max.	Min.	Mean
1962	1081	151	475
1963	881	123	268
1964	1018	119	367
1965	942	160	416
1966	1154	155	371
1967	824	180	385
1968	861	158	434
1969	1064	182	457
1970	980	178	437
1971	1036	174	388
1972	938	218	480
1973	1498	204	721
1974	1174	187	586
1975	1216	230	563
1976	721	158	364
1977	746	171	379
1978	977	187	470
1979	1419	187	680
1980	1049	247	494
1981	773	145	354
1982	873	209	492
1983	1470	200	697
1984	1199	172	595
1985	1128	201	564
1986	1023	207	502
1987	974	176	512
1988	1000	111	378
1989	1138	124	561
1990	1230	188	599
1991	1303	208	629
1992	855	181	465

Table 2.3-2 (Sheet 4 of 4)
Mississippi River Flow 1900 to 2006[(a)]
(1000 cfs)

Year	Max.	Min.	Mean
1993	1202	196	729
1994	1164	185	623
1995	1167	186	532
1996	1026	204	492
1997	1480	198	672
1998	1080	185	579
1999	1179	155	540
2000	684	138	321
2001	1120	157	455
2002	1116	181	548
2003	1015	224	495
2004	889	205	522
2005	1229	167	536
2006	735	145	302
Ave.	1053	162	503
Ave. (1900-1955)	1062	151	513
Ave. (1956-2006)	1043	175	492

a) 1900 - 1962 Discharge at Red River Landing, LA (RM 300.6).
1963 - 2006 Discharge at Tarbert Landing, MS (RM 306.3).

Source: References 2.3-2 and 2.3-6.

Table 2.3-3 (Sheet 1 of 4)
Annual Stage Data at Bayou Sara, Louisiana - RM 264.7

Year	Max. (ft. msl)	Min. (ft. msl)	Ave. (ft. NGVD)
1889	31.8	1.7	
1890	45.0	7.8	
1891	42.6	2.0	
1892	46.0	3.0	
1893	45.3	4.0	
1894	36.9	1.1	
1895	28.5	1.0	
1896	34.5	4.0	
1897	47.5	2.4	
1898	41.3	7.8	
1899	40.5	2.4	
1900	32.9	5.2	
1901	34.2	2.4	
1902	35.5	6.4	
1903	47.1	3.0	
1904	40.5	2.6	
1905	37.2	4.6	
1906	41.2	10.1	
1907	44.1	6.7	
1908	46.4	4.2	
1909	42.9	4.6	
1910	35.4	3.2	
1911	38.8	5.6	
1912	51.2	6.8	
1913	48.3	7.1	
1914	38.7	3.8	
1915	40.1	12.7	
1916	49.9	4.5	
1917	44.4	2.6	
1918	32.1	2.0	
1919	40.6	4.2	
1920	48.5	5.5	
1921	41.3	4.8	

Table 2.3-3 (Sheet 2 of 4)
Annual Stage Data at Bayou Sara, Louisiana - RM 264.7

Year	Max. (ft. msl)	Min. (ft. msl)	Ave. (ft. NGVD)
1922	53.2	3.8	
1923	45.4	6.8	
1924	39.8	4.5	
1925	29.4	2.7	
1926	35.6	7.5	
1927	55.5	7.9	
1928	43.0	8.0	
1929	50.5	5.1	
1930	39.4	2.1	
1931	31.7	3.4	
1932	49.7	4.4	
1933	44.8	3.1	
1934	33.9	3.1	
1935	45.2	3.6	
1936	39.8	2.4	
1937	52.6	3.6	
1938	43.4	4.0	
1939	45.0	1.7	
1940	36.8	1.9	
1941	28.4	3.4	
1942	38.4	8.2	
1943	45.5	4.4	
1944	48.2	4.7	
1945	53.7	6.3	
1946	42.9	4.6	
1947	40.1	4.2	
1948	41.8	4.1	
1949	44.6	6.3	
1950	50.7	7.2	
1951	39.4	8.7	
1952	39.9	3.2	
1953	36.8	2.6	
1954	25.0	3.6	

Table 2.3-3 (Sheet 3 of 4)
Annual Stage Data at Bayou Sara, Louisiana - RM 264.7

Year	Max. (ft. msl)	Min. (ft. msl)	Ave. (ft. NGVD)
1955	39.2	4.3	
1956	34.6	2.9	
1957	40.4	7.8	
1958	39.2	6.3	
1959	31.7	4.7	
1960	33.8	5.7	
1961	43.1	7.3	
1962	41.2	6.5	
1963	35.5	4.6	
1964	40.8	3.6	
1965	37.6	7.2	
1966	39.4	6.7	
1967	34.1	8.0	
1968	36.3	7.0	
1969	39.1	8.4	
1970	39.3	8.2	
1971	36.9	8.1	
1972	37.2	10.5	
1973	50.7	12.5	
1974	46.3	10.3	
1975	49.5	12.0	
1976	34.6	7.0	
1977	37.4	7.1	
1978	40.7	9.0	
1979	52.5	9.0	
1980	45.3	11.3	24.6
1981	36.8	6.2	17.3
1982	39.6	9.1	23.9
1983	53.9	9.7	30.1
1984	49.3	8.6	28.0
1985	46.3	9.6	27.4
1986	43.3	11.0	25.0
1987	41.1	9.4	25.8

Table 2.3-3 (Sheet 4 of 4)
Annual Stage Data at Bayou Sara, Louisiana - RM 264.7

Year	Max. (ft. msl)	Min. (ft. msl)	Ave. (ft. NGVD)
1988	40.9	4.8	17.8
1989	44.2	6.0	26.1
1990	46.4	8.1	27.7
1991	48.9	9.0	30.7
1992	39.1	8.0	22.9
1993	45.3	9.2	33.2
1994	48.6	9.5	30.4
1995	48.9	9.9	27.4
1996	44.3	10.8	24.0
1997	53.5	10.7	31.0
1998	44.4	10.7	27.8
1999	45.4	7.2	28.3
2000	31.5	6.7	16.7
2001	43.8	7.1	21.5
2002	46.5	8.6	26.8
2003	43.1	11.9	24.6
2004	38.9	10.4	25.9
2005	46.8	8.0	25.7
2006	34.8	7.4	15.8
Ave. =	41.7	6.1	25.4
Ave. low stage 1889 - 1955 =			4.6
Ave. low stage 1956 - 2006 =			8.2
Ave. peak stage 1889 - 1995 =			41.5
Ave. peak stage 1956 - 2006 =			42.0

Source: References 2.3-2 and 2.3-9.

Table 2.3-4
Local Drainage Area Runoff Variation[a]

	Maximum Recorded (cfs/sq mi)	Minimum Recorded (cfs/sq mi)	Monthly Average (cfs/sq mi)
January	180	0.11	1.65
February	228	0.11	2.75
March	354	0.14	2.26
April	405	0.09	1.83
May	513	0.09	1.39
June	192	0.08	0.69
July	205	0.07	0.65
August	187	0.06	0.44
September	180	0.06	0.41
October	385	0.08	0.50
November	255	0.09	0.63
December	241	0.10	1.32
Annual	513	0.06	1.21

a) Based on USGS data October 1949 to September 1970,
West Fork Thompson Creek, Louisiana. Drainage Area, 35.3 sq. mi.

Source: Reference 2.3-2.

Table 2.3-5
2000 Water Use Totals, Louisiana Parishes Surrounding RBS Site

Parish	Groundwater Withdrawals	Surface Water Withdrawals	Total Withdrawals	Consumptive Use
West Feliciana	6.17	44.29	50.46	18.24
East Feliciana	3.46	0.19	3.65	3.21
East Baton Rouge	135.66	18.50	154.16	100.10

Note: Water quantities expressed in million gallons per day (Mgd).

Source: Reference 2.3-13.

Table 2.3-6
2000 Irrigation Water Use, Louisiana Parishes Surrounding RBS Site

Parish	Groundwater Withdrawals	Surface Water Withdrawals	Total Withdrawals	Consumptive Use
West Feliciana	0	0	0	0
East Feliciana	0.17	0	0.17	0.11
East Baton Rouge	0.26	0	0.26	0.16

Note: Water quantities expressed in Mgd.

Source: Reference 2.3-13.

Table 2.3-7
2000 Livestock Total Water Use, Louisiana Parishes Surrounding RBS Site

Parish	Groundwater Withdrawals	Surface Water Withdrawals	Total Withdrawals	Consumptive Use
West Feliciana	0	0.6	0.6	0.6
East Feliciana	0.02	0.19	0.21	0.21
East Baton Rouge	0.13	0.01	0.14	0.14

Note: Water quantities expressed in Mgd.

Source: Reference 2.3-13.

Table 2.3-8
2000 Mining Water Use, Louisiana Parishes Surrounding RBS Site

Parish	Groundwater Withdrawals	Surface Water Withdrawals	Total Withdrawals	Consumptive Use
West Feliciana	NR	NR	NR	NR
East Feliciana	NR	NR	NR	NR
East Baton Rouge	NR	NR	NR	NR

NR - Not Reported.

Source: Reference 2.3-13.

Table 2.3-9
2000 Power Generation Water Use,
Louisiana Parishes Surrounding RBS Site

Parish	Groundwater Withdrawals	Surface Water Withdrawals	Total Withdrawals	Consumptive Use
West Feliciana	0.02	14.47	14.49	11.39
East Feliciana	0	0	0	0
East Baton Rouge	7.44	0	7.44	6.69

Note: Water quantities expressed in Mgd.

Source: Reference 2.3-13.

Table 2.3-10
2000 Industrial Water Use,
Louisiana Parishes Surrounding RBS Site

Parish	Groundwater Withdrawals	Surface Water Withdrawals	Total Withdrawals	Consumptive Use
West Feliciana	1.59	29.73	31.32	3.53
East Feliciana	0.03	0	0.03	0
East Baton Rouge	63.37	18.49	81.86	42.43

Note: Water quantities expressed in Mgd.

Source: Reference 2.3-13.

Table 2.3-11
2000 Rural Domestic Water Use,
Louisiana Parishes Surrounding RBS Site

Parish	Groundwater Withdrawals	Surface Water Withdrawals	Total Withdrawals	Consumptive Use
West Feliciana	0.04	0	0.04	0.04
East Feliciana	0.27	0	0.27	0.27
East Baton Rouge	0.25	0	0.25	0.25

Note: Water quantities expressed in Mgd.

Source: Reference 2.3-13.

Table 2.3-12
2000 Commercial Water Use,
Louisiana Parishes Surrounding RBS Site

Parish	Groundwater Withdrawals	Surface Water Withdrawals	Total Withdrawals	Consumptive Use
West Feliciana	0	0	0	0
East Feliciana	0	0	0	0
East Baton Rouge	0	0	0	0

Note: Water quantities expressed in Mgd.

Source: Reference 2.3-13.

Table 2.3-13
2000 Public Supply Water Use,
Louisiana Parishes Surrounding RBS Site

Parish	Groundwater Withdrawals	Surface Water Withdrawals	Total Withdrawals
West Feliciana	4.52	0.03	4.55
East Feliciana	2.97	0	2.97
East Baton Rouge	64.14	0	64.14

Note: Water quantities expressed in Mgd.

Source: Reference 2.3-13.

Table 2.3-14 (Sheet 1 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.755	-91.331	West Feliciana	Industrial	1924	94	7/11/1995	Zone 3	160
30.7552	-91.33	West Feliciana	Industrial	220	94	12/28/1994	UTA	929
30.7552	-91.329	West Feliciana	Industrial	1917	94	7/11/1995	Zone 3	150
30.7611	-91.336	West Feliciana	Industrial	500	91	08/22/79	Zone 1	**
30.7438	-91.332	West Feliciana	Industrial	188	34	11/02/94	Zone 1	**
30.7672	-91.321	West Feliciana	Household	510	60	00/00/49	Zone 1	**
30.7705	-91.324	West Feliciana	Industrial	497	63	00/00/60	Zone 1	70
30.7699	-91.342	West Feliciana	Household	180	70	10/01/59	UTA	**
30.7702	-91.343	West Feliciana	Household	161	84.3	04/22/76	UTA	**
30.7716	-91.34	West Feliciana	Household	169	--	--	UTA	**
30.7638	-91.316	West Feliciana	Household	483	--	--	Zone 1	**
30.7719	-91.34	West Feliciana	Household	1647	50	04/18/58	Zone 3	**
30.773	-91.326	West Feliciana	Household	525	37	00/00/50	Zone 1	**
30.7416	-91.328	West Feliciana	Household	410	40	01/04/85	Zone 1	19
30.7688	-91.318	West Feliciana	Household	485	--	--	Zone 1	**
30.7405	-91.33	West Feliciana	Household	115	70	09/00/58	UTA	**
30.7402	-91.329	West Feliciana	Irrigation	115	45	05/31/00	UTA	**
30.7394	-91.329	West Feliciana	Irrigation	520	--	--	Zone 1	**
30.7755	-91.328	West Feliciana	Household	480	50	00/00/57	Zone 1	**
30.7716	-91.346	West Feliciana	Household	114	--	--	UTA	**
30.7763	-91.334	West Feliciana	Household	120	50	07/02/01	--	**
30.7688	-91.314	West Feliciana	Household	502	42	06/00/50	Zone 1	15
30.738	-91.328	West Feliciana	Household	120	60	12/26/00	UTA	**
30.7608	-91.306	West Feliciana	Household	520	40	00/00/53	Zone 1	**
30.7799	-91.34	West Feliciana	Household	1486	44.59	02/25/58	Zone 3	**
30.7855	-91.338	West Feliciana	Household	180	--	--	UTA	**
30.7802	-91.312	West Feliciana	Household	150	62	01/21/00	UTA	**
30.7769	-91.357	West Feliciana	Public-Commercial	120	17.16	04/29/76	UTA	**
30.7772	-91.357	West Feliciana	Public-Commercial	120	27.85	04/26/76	UTA	**
30.7538	-91.299	West Feliciana	Irrigation	140	90	06/06/05	--	**
30.7874	-91.331	West Feliciana	Public-Rural	285	70	10/29/96	Zone 1	151
30.7877	-91.331	West Feliciana	Public-Rural	280	--	--	Zone 1	**
30.7677	-91.297	West Feliciana	Household	138	79.79	07/14/76	UTA	**
30.7469	-91.294	West Feliciana	Household	110	27.38	05/12/76	UTA	**
30.7341	-91.299	West Feliciana	Household	230	90	01/03/01	Zone 1	**
30.7894	-91.306	West Feliciana	Public-Rural	1752	183	06/15/96	Zone 3	800
30.7974	-91.319	West Feliciana	Irrigation	636	--	--	Zone 1	**
30.7977	-91.319	West Feliciana	Irrigation	176	--	--	UTA	**
30.7833	-91.377	West Feliciana	Public-Municipal	1526	59.98	08/02/61	Zone 3	805

Table 2.3-14 (Sheet 2 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.7738	-91.384	West Feliciana	Public-Municipal	1750	37.4	02/00/86	Zone 3	533
30.7088	-91.322	West Feliciana	Industrial	1372	58	04/02/58	Zone 2	1900
30.7088	-91.321	West Feliciana	Industrial	1569	27.2	03/04/58	Zone 3	415
30.7083	-91.325	West Feliciana	Industrial	2068	11.95	02/06/61	Zone 3	915
30.7086	-91.322	West Feliciana	Industrial	2083	39	11/01/57	Zone 3	1025
30.7669	-91.389	West Feliciana	Industrial	145	8	03/29/61	MRAA	**
30.7963	-91.37	West Feliciana	Household	1670	--	--	Zone 3	1000
30.803	-9.1303	West Feliciana	Irrigation	210	--	--	Zone 1	**
30.7661	-91.395	West Feliciana	Household	152	30	00/00/56	UTA	**
30.8075	-9.1361	West Feliciana	Household	190	80	08/22/00	UTA	**
30.808	-9.1361	West Feliciana	Public-Commercial	140	70	09/17/98	UTA	**
30.8055	-9.1368	West Feliciana	Household	140	51	02/13/01	UTA	**
30.7447	-91.266	East Feliciana	Industrial	480	--	--	Zone 1	**
30.7097	-91.293	East Feliciana	Household	190	90	12/21/40	UTA	**
30.7769	-91.268	West Feliciana	Household	120	35	08/12/00	MRAA	**
30.7444	-91.265	East Feliciana	Industrial	1427	89	05/01/84	Zone 3	**
30.6949	-91.341	West Feliciana	Public-Commercial	183	39	10/29/99	MRAA	**
30.8127	-9.1295	West Feliciana	Irrigation	160	75	02/26/02	--	**
30.7966	-91.272	West Feliciana	Household	100	78	00/00/57	UTA	**
30.8047	-9.1385	West Feliciana	Public-Municipal	1675	126.3	09/19/73	Zone 3	825
30.8069	-9.1383	West Feliciana	Industrial	412	60	00/00/38	Zone 1	300
30.7711	-91.256	East Feliciana	Household	38	18	00/00/61	UTA	**
30.7886	-91.262	West Feliciana	Household	110	48	12/15/00	UTA	**
30.8266	-9.1334	West Feliciana	Household	718	168	10/01/59	Zone 1	**
30.8069	-9.1276	West Feliciana	Household	380	78	00/00/47	Zone 1	**
30.8274	-9.1333	West Feliciana	Household	218	125	00/00/59	Zone 1	**
30.8116	-9.1281	West Feliciana	Household	126	100	00/00/56	UTA	**
30.7075	-91.275	East Feliciana	Public-Commercial	210	--	--	UTA	**
30.8111	-9.1386	West Feliciana	Household	135	69	11/23/99	UTA	**
30.8113	-9.1279	West Feliciana	Irrigation	50	15	10/08/04	--	**
30.7972	-91.403	West Feliciana	Household	137	113	00/00/59	UTA	**
30.8136	-9.1388	West Feliciana	Household	589	96	01/06/54	Zone 1	**
30.815	-9.1386	West Feliciana	Household	135	64	03/29/00	UTA	**
30.8327	-9.1321	West Feliciana	Public-Rural	1630	202.05	09/13/82	Zone 3	276
30.8333	-9.1327	West Feliciana	Household	200	120	07/27/00	UTA	**
30.8327	-9.1312	West Feliciana	Household	120	70	06/27/84	UTA	19
30.833	-9.1351	West Feliciana	Irrigation	135	70	09/23/03	--	**
30.6988	-91.274	East Feliciana	Irrigation	170	50	05/30/95	UTA	**
30.7986	-91.408	West Feliciana	Household	175	90	07/27/98	UTA	**

Table 2.3-14 (Sheet 3 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.7161	-91.256	East Feliciana	Household	34	24	00/00/53	UTA	**
30.8338	-9.1352	West Feliciana	Irrigation	387	77	07/29/96	Zone 1	100
30.8258	-9.1378	West Feliciana	Public-Institution	674	--	--	Zone 1	**
30.8258	-9.1378	West Feliciana	Public-Institution	793	--	--	Zone 1	**
30.8369	-9.1327	West Feliciana	Household	150	100	12/13/91	UTA	**
30.7933	-91.417	West Feliciana	Household	210	120	12/27/01	--	**
30.8377	-9.1316	West Feliciana	Household	275	120	08/01/59	Zone 1	**
30.8361	-9.1305	West Feliciana	Irrigation	407	2.18	12/30/52	Zone 1	**
30.8361	-9.1305	West Feliciana	Irrigation	426	120	10/09/50	Zone 1	**
30.7022	-91.261	East Feliciana	Household	150	60	00/00/50	UTA	**
30.7019	-91.259	East Feliciana	Household	117	58	00/00/58	UTA	**
30.8213	-9.1268	West Feliciana	Irrigation	140	75	12/07/00	UTA	**
30.7936	-91.422	West Feliciana	Household	155	80	09/04/03	--	**
30.6811	-91.286	East Feliciana	Household	78	35	00/00/56	UTA	**
30.8372	-9.1372	West Feliciana	Public-Institution	650	95	00/00/52	Zone 1	**
30.8033	-9.1247	West Feliciana	Irrigation	140	75	12/07/00	--	**
30.6969	-91.26	E. Baton Rouge	Household	280	60	10/08/83	UTA	20
30.7941	-91.424	West Feliciana	Irrigation	175	110	00/00/60	UTA	**
30.7108	-91.246	East Feliciana	Irrigation	168	53.59	04/14/60	UTA	**
30.838	-9.1374	West Feliciana	Industrial	618	180	04/20/89	Zone 3	**
30.8438	-9.1308	West Feliciana	Household	150	90	03/28/00	UTA	**
30.8461	-9.1344	West Feliciana	Household	145	90	12/04/03	--	**
30.8322	-9.1389	West Feliciana	Household	650	80	00/00/58	Zone 1	**
30.7969	-91.426	West Feliciana	Irrigation	154	105	00/00/60	UTA	**
30.8497	-9.1346	West Feliciana	Irrigation	130	70	03/31/00	UTA	**
30.8469	-9.1301	West Feliciana	Household	387	--	--	Zone 1	**
30.7363	-91.225	East Feliciana	Public-Rural	2008	132.88	06/23/80	Zone 3	439
30.8172	-9.1419	West Feliciana	Household	120	60	00/00/52	UTA	**
30.8011	-91.432	West Feliciana	Irrigation	67	16	00/00/60	UTA	**
30.8141	-9.1424	West Feliciana	Household	210	60	00/00/55	Zone 1	**
30.843	-9.1278	West Feliciana	Household	210	110	08/22/89	Zone 1	**
30.7219	-91.227	East Feliciana	Irrigation	150	--	--	UTA	**
30.8216	-9.1419	West Feliciana	Household	89	60	00/00/52	UTA	**
30.7666	-91.218	East Feliciana	Household	120	60	06/30/99	UTA	**
30.8511	-9.1375	West Feliciana	Household	333	98	06/18/60	Zone 1	**
30.7633	-91.216	East Feliciana	Industrial	168	66	05/04/76	UTA	**
30.8541	-9.1365	West Feliciana	Household	322	65	05/24/51	Zone 1	**
30.7338	-91.218	East Feliciana	Household	165	50	00/00/56	UTA	**
30.85	-9.138	West Feliciana	Household	330	95	00/00/55	Zone 1	**

Table 2.3-14 (Sheet 4 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.8399	-9.1262	West Feliciana	Household	1529	86	04/17/53	Zone 3	**
30.6622	-91.289	E. Baton Rouge	Household	200	80	00/00/40	UTA	4
30.8538	-9.1373	West Feliciana	Household	343	106.84	06/17/60	Zone 1	**
30.7261	-91.219	East Feliciana	Household	180	65	01/00/53	UTA	**
30.8594	-9.1349	West Feliciana	Irrigation	340	80	07/02/01	--	**
30.8488	-9.1388	West Feliciana	Household	1224	75	00/00/45	Zone 3	**
30.7866	-91.217	East Feliciana	Household	200	--	--	Zone 1	**
30.8427	-9.1401	West Feliciana	Public-Institution	100	--	--	UTA	**
30.6802	-91.252	E. Baton Rouge	Household	1239	11	01/01/55	Zone 1	**
30.8452	-9.14	West Feliciana	Irrigation	260	--	00/00/46	Zone 1	**
30.6913	-91.238	E. Baton Rouge	Irrigation	195	50	08/03/01	UTA	**
30.8561	-9.1375	West Feliciana	Irrigation	300	135	09/21/98	Zone 1	**
30.8274	-9.1424	West Feliciana	Public-Institution	230	79	08/27/59	Zone 1	**
30.6619	-91.28	E. Baton Rouge	Public-Commercial	204	120	12/18/03	--	50
30.6616	-91.28	E. Baton Rouge	Industrial	204	120	12/09/03	--	500
30.7927	-91.216	East Feliciana	Household	400	70	07/07/03	--	**
30.7941	-91.216	East Feliciana	Household	140	80	06/02/03	UTA	**
30.7933	-91.215	East Feliciana	Household	270	45	08/00/96	Zone 1	**
30.66	-91.28	E. Baton Rouge	Industrial	1282	60	03/14/67	Zone 1	1500
30.7927	-91.214	East Feliciana	Household	190	72	07/24/96	UTA	**
30.8452	-9.1406	West Feliciana	Irrigation	245	16	00/00/53	Zone 1	**
30.803	-9.1218	East Feliciana	Household	160	96	10/15/99	UTA	**
30.66	-91.277	E. Baton Rouge	Industrial	2436	118.4	06/29/88	Zone 3	1976
30.66	-91.277	E. Baton Rouge	Industrial	392	84	10/27/93	UTA	**
30.6602	-91.275	E. Baton Rouge	Public-Institution	1277	69	09/01/68	Zone 1	**
30.7502	-91.205	East Feliciana	Household	250	80	00/00/60	UTA	**
30.7144	-91.215	East Feliciana	Household	1090	--	--	Zone 1	**
30.6575	-91.274	E. Baton Rouge	Industrial	1300	61.3	04/24/67	Zone 1	1500
30.6572	-91.275	E. Baton Rouge	Industrial	2475	50.06	01/30/69	Zone 3	**
30.6855	-91.233	E. Baton Rouge	Household	1900	--	--	Zone 3	22
30.8044	-9.1212	East Feliciana	Household	270	20	08/09/00	UTA	**
30.7072	-91.214	East Feliciana	Household	1122	45	11/13/55	Zone 1	**
30.6527	-91.279	E. Baton Rouge	Industrial	2376	128	11/15/91	Zone 3	2000
30.6527	-91.279	E. Baton Rouge	Industrial	397	88	10/15/93	UTA	**
30.653	-91.277	E. Baton Rouge	Industrial	770	82	08/20/98	Zone 1	1551
30.653	-91.277	E. Baton Rouge	Industrial	1287	172	05/19/98	Zone 1	**
30.6527	-91.277	E. Baton Rouge	Industrial	2485	21.65	08/09/67	Zone 3	2000
30.6819	-91.231	E. Baton Rouge	Irrigation	195	61	08/10/03	UTA	506
30.6611	-91.258	E. Baton Rouge	Household	200	58.58	08/26/74	UTA	**

Table 2.3-14 (Sheet 5 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.6508	-91.28	E. Baton Rouge	Industrial	785	68	12/06/67	Zone 1	1500
30.6541	-91.271	E. Baton Rouge	Industrial	2460	108	06/22/88	Zone 3	2066
30.8383	-9.1234	West Feliciana	Irrigation	240	80	02/12/00	Zone 1	**
30.6544	-91.268	E. Baton Rouge	Industrial	265	--	--	UTA	**
30.8411	-9.1237	West Feliciana	Irrigation	152	0.9	00/00/40	Zone 1	**
30.648	-91.283	E. Baton Rouge	Industrial	2362	134	02/09/92	Zone 3	2255
30.648	-91.282	E. Baton Rouge	Industrial	1302	172	03/23/93	Zone 1	2429
30.855	-9.1409	West Feliciana	Industrial	180	--	--	Zone 1	**
30.7563	-91.196	East Feliciana	Household	235	60	08/27/99	UTA	**
30.6486	-91.277	E. Baton Rouge	Industrial	2478	23.34	10/02/67	Zone 3	2000
30.6483	-91.277	E. Baton Rouge	Industrial	1328	63	11/20/67	Zone 1	1500
30.7844	-91.198	East Feliciana	Household	130	60	06/27/00	UTA	**
30.6477	-91.276	E. Baton Rouge	Industrial	390	81	07/02/91	UTA	**
30.6536	-91.26	E. Baton Rouge	Industrial	390	55	08/12/75	UTA	1000
30.6419	-91.29	E. Baton Rouge	Household	1193	12.5	09/27/55	Zone 2	**
30.6924	-91.213	E. Baton Rouge	Household	1907	40	04/01/46	Zone 3	**
30.7097	-91.202	East Feliciana	Household	93	51	12/02/88	UTA	**
30.7033	-91.206	E. Baton Rouge	Irrigation	190	60	04/28/88	UTA	175
30.8158	-9.1208	East Feliciana	Public-Institution	1525	195	04/08/80	Zone 3	834
30.8763	-9.1367	West Feliciana	Household	335	140	00/00/54	Zone 1	**
30.6474	-91.27	E. Baton Rouge	Industrial	1054	106	11/05/75	Zone 1	1000
30.6469	-91.27	E. Baton Rouge	Industrial	280	83.1	12/13/90	UTA	2334
30.8605	-9.1411	West Feliciana	Household	167	40	00/00/59	UTA	**
30.8802	-9.1358	West Feliciana	Industrial	866	163	04/29/76	Zone 2	245
30.8502	-9.1234	West Feliciana	Household	450	--	--	Zone 1	**
30.6477	-91.256	E. Baton Rouge	Household	200	--	--	UTA	**
30.6897	-91.206	E. Baton Rouge	Household	1135	25	05/10/50	Zone 1	45
30.8297	-9.1207	East Feliciana	Public-Institution	1276	125.91	08/10/72	Zone 3	708
30.6358	-91.277	E. Baton Rouge	Public-Commercial	200	--	--	UTA	**
30.888	-9.135	West Feliciana	Household	837	135	00/00/46	Zone 2	**
30.7311	-91.179	East Feliciana	Irrigation	230	40	04/01/61	UTA	**
30.893	-9.1339	West Feliciana	Irrigation	185	90	07/11/85	UTA	100
30.893	-9.1339	West Feliciana	Household	787	120	00/00/56	Zone 2	**
30.8938	-9.1326	West Feliciana	Household	320	120	04/02/52	Zone 1	**
30.8372	-9.1204	East Feliciana	Irrigation	265	124	05/30/00	Zone 1	**
30.8061	-9.1184	East Feliciana	Household	120	90	06/24/03	UTA	**
30.8372	-9.1203	East Feliciana	Industrial	365	--	--	Zone 1	**
30.8955	-9.1346	West Feliciana	Household	576	--	--	Zone 1	**
30.8444	-9.1207	East Feliciana	Household	135	80	08/30/99	UTA	**

Table 2.3-14 (Sheet 6 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.8463	-9.1209	East Feliciana	Public-Municipal	1256	189	03/30/79	Zone 2	205
30.8369	-9.12	East Feliciana	Public-Municipal	1292	172.83	10/10/83	Zone 3	357
30.8388	-9.1201	East Feliciana	Public-Municipal	1270	185	12/01/01	Zone 3	1507
30.7563	-91.17	East Feliciana	Household	38	31.74	04/25/61	UTA	**
30.8111	-9.118	East Feliciana	Household	140	85	10/17/95	UTA	**
30.75	-91.168	East Feliciana	Household	195	38	03/08/88	UTA	**
30.8091	-9.1179	East Feliciana	Household	240	90	03/28/90	Zone 1	**
30.8811	-9.1416	West Feliciana	Household	72	35	00/00/60	UTA	**
30.8888	-9.1265	West Feliciana	Household	340	120	00/00/55	Zone 1	**
30.7658	-91.165	East Feliciana	Irrigation	185	20	03/25/87	UTA	**
30.9011	-9.1312	West Feliciana	Industrial	540	140	00/00/58	Zone 1	**
30.8788	-9.1241	West Feliciana	Irrigation	234	27	00/00/55	Zone 1	**
30.8955	-9.1281	West Feliciana	Public-Rural	1072	206	09/30/96	Zone 3	876
30.8961	-9.1279	West Feliciana	Public-Institution	466	150	08/24/59	Zone 1	**
30.7533	-91.163	East Feliciana	Household	210	30	01/23/98	UTA	**
30.9041	-9.1342	West Feliciana	Household	175	--	--	UTA	**
30.8355	-9.1188	East Feliciana	Household	296	122	05/03/51	Zone 1	**
30.6383	-91.231	E. Baton Rouge	Irrigation	320	--	--	UTA	**
30.8322	-9.1184	East Feliciana	Irrigation	120	70	12/03/04	UTA	**
30.6383	-91.23	E. Baton Rouge	Irrigation	200	45	05/14/02	UTA	**
30.8286	-9.1181	East Feliciana	Public-Institution	1325	--	--	Zone 3	**
30.8286	-9.1181	East Feliciana	Public-Institution	1325	196	10/21/81	Zone 3	557
30.7527	-91.16	East Feliciana	Household	197	20	10/28/97	UTA	**
30.6283	-91.244	E. Baton Rouge	Industrial	240	40	01/06/03	--	**
30.663	-91.196	E. Baton Rouge	Household	385	50.88	10/25/73	UTA	**
30.8736	-9.1444	West Feliciana	Household	145	50	05/26/98	Zone 1	**
30.7608	-91.156	East Feliciana	Household	170	35	06/30/97	UTA	**
30.8847	-9.1429	West Feliciana	Household	465	20	00/00/51	Zone 1	**
30.6641	-91.192	E. Baton Rouge	Public-Municipal	2096	96.8	11/15/88	Zone 3	1016
30.7836	-91.157	East Feliciana	Household	185	80	12/17/97	UTA	**
30.8216	-9.1494	West Feliciana	Irrigation	216	20	12/23/78	MRAA	3250
30.8283	-9.1172	East Feliciana	Household	364	139	05/07/56	Zone 1	25
30.8841	-9.1228	West Feliciana	Irrigation	157	40	09/08/51	UTA	**
30.7583	-91.151	East Feliciana	Household	230	42	09/18/05	--	**
30.8538	-9.1188	East Feliciana	Household	113	72	00/00/53	UTA	**
30.6538	-91.195	E. Baton Rouge	Public-Municipal	2120	104.9	05/09/00	Zone 3	**
30.7038	-91.161	E. Baton Rouge	Public-Municipal	2201	9	01/31/56	Zone 3	70
30.8688	-9.1203	East Feliciana	Household	680	120	00/00/59	Zone 1	70
30.6355	-91.216	E. Baton Rouge	Household	230	65	10/22/98	UTA	**

Table 2.3-14 (Sheet 7 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.6661	-91.183	E. Baton Rouge	Irrigation	330	60	04/01/02	UTA	**
30.6977	-91.163	E. Baton Rouge	Irrigation	200	25	09/09/98	UTA	**
30.665	-91.182	E. Baton Rouge	Public-Municipal	2090	--	--	Zone 3	**
30.7094	-91.156	East Feliciana	Household	155	45	08/12/99	UTA	**
30.6897	-91.164	E. Baton Rouge	Household	70	20	05/27/99	UTA	**
30.8102	-9.1509	West Feliciana	Irrigation	408	4	06/21/60	Zone 1	10
30.6547	-91.186	E. Baton Rouge	Household	1405	--	--	Zone 2	**
30.6055	-91.262	E. Baton Rouge	Public-Institution	315	71	09/22/00	UTA	33
30.9197	-9.1298	West Feliciana	Household	220	50	00/00/54	Zone 1	**
30.7199	-91.146	East Feliciana	Household	160	80	10/12/95	UTA	**
30.8713	-9.1194	East Feliciana	Household	136	36	03/01/56	UTA	**
30.7016	-91.152	E. Baton Rouge	Household	168	25	02/09/99	UTA	**
30.8702	-9.119	East Feliciana	Public-Rural	1728	187.2	12/16/77	Zone 3	205
30.6411	-91.193	E. Baton Rouge	Household	1876	46	10/21/41	Zone 3	**
30.9194	-9.1281	West Feliciana	Household	220	110	00/00/42	Zone 1	**
30.833	-9.1158	East Feliciana	Public-Institution	1514	125.3	01/16/61	Zone 3	1000
30.6341	-91.199	E. Baton Rouge	Irrigation	2250	25.5	10/29/57	Zone 3	5
30.6127	-91.232	E. Baton Rouge	Industrial	1132	--	--	Zone 1	300
30.7191	-91.142	East Feliciana	Public-Municipal	2000	46.19	08/06/64	Zone 3	**
30.6125	-91.231	E. Baton Rouge	Industrial	1130	--	--	Zone 1	200
30.8788	-9.1471	West Feliciana	Irrigation	270	100	07/31/00	Zone 1	**
30.6247	-91.209	E. Baton Rouge	Household	2590	41	08/04/52	Zone 3	450
30.928	-9.1338	West Feliciana	Public-Rural	1005	--	--	Zone 3	**
30.8347	-9.1156	East Feliciana	Public-Institution	1503	95.43	07/03/56	Zone 2	785
30.9255	-9.1292	West Feliciana	Irrigation	185	40	06/23/87	Zone 1	56
30.6125	-91.225	E. Baton Rouge	Household	265	--	--	UTA	**
30.9055	-9.1434	West Feliciana	Household	130	20	09/10/85	Zone 1	12
30.8761	-9.1188	East Feliciana	Household	250	120	12/08/98	Zone 1	**
30.9297	-9.1339	West Feliciana	Public-Rural	982	234	09/26/87	Zone 3	402
30.5977	-91.257	E. Baton Rouge	Public-Institution	2003	78	06/19/02	Zone 3	**
30.6838	-91.152	E. Baton Rouge	Household	240	--	--	UTA	**
30.8405	-9.1509	West Feliciana	Irrigation	120	24	10/17/96	MRAA	**
30.8502	-9.1502	West Feliciana	Irrigation	134	21	10/30/96	MRAA	**
30.9086	-9.1233	West Feliciana	Household	260	75	00/00/48	Zone 1	**
30.7711	-91.131	East Feliciana	Household	151	18	00/00/56	UTA	**
30.6924	-91.145	E. Baton Rouge	Household	160	60	06/02/99	UTA	**
30.6202	-91.206	E. Baton Rouge	Household	1460	46	06/17/37	Zone 2	**
30.7847	-91.132	East Feliciana	Household	100	50	00/00/56	UTA	**
30.8502	-9.1506	West Feliciana	Irrigation	420	25	00/00/59	Zone 1	20

Table 2.3-14 (Sheet 8 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.7069	-91.137	E. Baton Rouge	Household	110	30	10/06/99	UTA	**
30.6394	-91.18	E. Baton Rouge	Irrigation	280	55	01/10/02	UTA	350
30.8727	-9.1176	East Feliciana	Household	120	90	07/08/03	UTA	**
30.6844	-91.145	E. Baton Rouge	Household	1300	22	11/22/36	Zone 3	**
30.9299	-9.1282	West Feliciana	Household	225	--	--	Zone 1	**
30.8586	-9.1163	East Feliciana	Household	120	60	05/08/02	UTA	**
30.8969	-9.1467	West Feliciana	Household	142	70	00/00/36	UTA	**
30.9027	-9.1458	West Feliciana	Household	1209	153	04/21/60	Zone 3	**
30.9386	-9.1349	West Feliciana	Household	40	36	00/00/60	UTA	**
30.7072	-91.13	E. Baton Rouge	Household	90	15	10/10/89	UTA	**
30.8805	-9.1488	West Feliciana	Irrigation	225	--	--	Zone 1	**
30.8786	-9.1491	West Feliciana	Irrigation	164	1	08/07/01	UTA	294
30.7374	-91.122	East Feliciana	Household	205	30	05/30/95	UTA	**
30.7238	-91.124	East Feliciana	Household	186	65	00/00/60	UTA	**
30.6783	-91.14	E. Baton Rouge	Household	1035	13.5	11/29/30	Zone 1	150
30.9363	-9.1281	West Feliciana	Household	218	--	--	Zone 1	**
30.7394	-91.12	East Feliciana	Household	210	100	10/27/03	--	**
30.7297	-91.121	East Feliciana	Household	245	20	06/28/90	UTA	**
30.7519	-91.117	East Feliciana	Household	225	40	00/00/60	UTA	**
30.5974	-91.223	E. Baton Rouge	Household	230	40	09/26/86	UTA	**
30.9138	-9.1214	West Feliciana	Household	90	70	00/00/50	Zone 1	**
30.8749	-9.1164	East Feliciana	Household	140	70	02/18/85	Zone 1	19
30.9141	-9.1451	West Feliciana	Household	111	96	00/00/50	UTA	5
30.9141	-9.1451	West Feliciana	Household	558	--	--	Zone 2	**
30.8927	-9.1182	East Feliciana	Household	225	75	00/00/57	Zone 1	**
30.8994	-9.1474	West Feliciana	Household	125	--	--	UTA	**
30.8736	-9.1161	East Feliciana	Household	120	70	06/03/85	UTA	19
30.5841	-91.247	E. Baton Rouge	Industrial	1252	94	02/09/94	Zone 1	524
30.5852	-91.242	E. Baton Rouge	Industrial	1277	41	03/10/60	Zone 1	**
30.8766	-9.1162	East Feliciana	Household	280	150	07/13/90	Zone 1	**
30.9252	-9.123	West Feliciana	Household	593	104	02/09/59	Zone 3	**
30.8761	-9.116	East Feliciana	Household	65	32	11/08/93	UTA	**
30.5838	-91.242	E. Baton Rouge	Industrial	2441	94	06/15/79	Zone 3	650
30.9394	-9.1265	West Feliciana	Household	240	70	00/00/54	Zone 1	**
30.5838	-91.239	E. Baton Rouge	Industrial	1296	120.5	08/19/87	Zone 1	**
30.8755	-9.1157	East Feliciana	Household	86	49	12/21/92	UTA	**
30.8755	-9.1157	East Feliciana	Household	140	45	10/22/99	UTA	**
30.8763	-9.1158	East Feliciana	Household	87	40	03/20/96	UTA	**
30.623	-91.174	E. Baton Rouge	Household	260	60	08/11/99	UTA	**

Table 2.3-14 (Sheet 9 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.8772	-9.1158	East Feliciana	Household	90	53	03/29/93	UTA	**
30.9172	-9.1456	West Feliciana	Household	293	129	00/00/57	Zone 1	**
30.9247	-9.1442	West Feliciana	Household	90	46.03	05/07/75	UTA	**
30.5822	-91.241	E. Baton Rouge	Industrial	1288	126	01/31/83	Zone 1	704
30.6016	-91.202	E. Baton Rouge	Household	1916	27	02/27/45	Zone 3	135
30.708	-91.117	E. Baton Rouge	Household	270	18	12/19/02	--	**
30.8744	-9.1155	East Feliciana	Household	160	58	05/29/00	UTA	**
30.9202	-9.1452	West Feliciana	Household	242	35	01/22/54	Zone 1	3
30.5922	-91.217	E. Baton Rouge	Household	270	53	05/28/92	UTA	**
30.7655	-91.109	East Feliciana	Household	120	48	01/10/03	UTA	**
30.8763	-9.1156	East Feliciana	Household	93	50	07/17/97	UTA	**
30.5836	-91.234	E. Baton Rouge	Industrial	2608	70	12/11/81	Zone 3	**
30.8747	-9.1154	East Feliciana	Household	102	60	01/03/02	UTA	**
30.8772	-9.1156	East Feliciana	Household	90	45	04/02/92	UTA	**
30.8774	-9.1156	East Feliciana	Household	83	54	11/07/94	UTA	**
30.5833	-91.234	E. Baton Rouge	Industrial	2579	35	12/05/57	Zone 3	750
30.5819	-91.238	E. Baton Rouge	Industrial	1231	122	05/26/87	Zone 1	100
30.8805	-9.1159	East Feliciana	Household	68	40	05/02/97	UTA	**
30.7083	-91.115	E. Baton Rouge	Household	252	10	05/09/03	--	**
30.8786	-9.1156	East Feliciana	Household	63	33	04/01/94	UTA	**
30.9077	-9.1189	East Feliciana	Household	230	140	06/16/95	Zone 1	**
30.6899	-91.121	E. Baton Rouge	Household	265	45	00/00/40	UTA	**
30.8744	-9.1151	East Feliciana	Household	290	160	06/21/95	Zone 1	**
30.8388	-9.1127	East Feliciana	Household	90	10	06/18/99	UTA	**
30.5977	-91.203	E. Baton Rouge	Household	1122	23	06/14/37	Zone 1	**
30.9486	-9.1381	West Feliciana	Household	258	151	10/27/88	Zone 1	**
30.7597	-91.106	East Feliciana	Irrigation	150	60	05/09/00	UTA	**
30.5891	-91.216	E. Baton Rouge	Household	250	40	09/17/86	UTA	**
30.8749	-9.115	East Feliciana	Household	185	70	06/05/85	UTA	10
30.8844	-9.1159	East Feliciana	Household	265	140	08/10/01	Zone 1	**
30.7072	-91.112	E. Baton Rouge	Household	240	30	08/26/99	UTA	**
30.8855	-9.1159	East Feliciana	Household	155	49	08/14/90	UTA	**
30.5794	-91.234	E. Baton Rouge	Public-Commercial	300	65	04/21/03	--	**
30.6469	-91.142	E. Baton Rouge	Public-Municipal	2080	11.27	07/31/63	Zone 3	1100
30.5941	-91.203	E. Baton Rouge	Household	280	62	07/23/92	UTA	**
30.8874	-9.1159	East Feliciana	Household	95	70	04/13/89	UTA	**
30.8772	-9.1149	East Feliciana	Household	150	60	03/22/94	UTA	**
30.8744	-9.1146	East Feliciana	Household	110	65	06/12/96	UTA	**
30.9216	-9.1463	West Feliciana	Household	294	135	00/00/55	Zone 1	**

Table 2.3-14 (Sheet 10 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.843	-9.1124	East Feliciana	Household	115	35	07/29/00	Zone 1	**
30.8783	-9.1149	East Feliciana	Household	80	37	07/09/96	UTA	**
30.8686	-9.1141	East Feliciana	Household	210	60	04/20/87	Zone 1	**
30.8761	-9.1147	East Feliciana	Household	70	15	02/15/01	UTA	**
30.8272	-9.1116	East Feliciana	Irrigation	115	50	08/05/98	UTA	18
30.8791	-9.1149	East Feliciana	Household	140	55	10/09/97	UTA	**
30.5941	-91.199	E. Baton Rouge	Household	1604	93	02/20/64	Zone 2	**
30.5883	-91.209	E. Baton Rouge	Household	913	80	00/00/58	Zone 1	**
30.8558	-9.113	East Feliciana	Household	120	60	07/26/99	Zone 1	**
30.7219	-91.103	East Feliciana	Household	120	20	10/09/96	UTA	**
30.8677	-9.1136	East Feliciana	Household	100	50	03/16/88	Zone 1	**
30.8694	-9.1137	East Feliciana	Household	140	40	00/00/48	UTA	**
30.8694	-9.1137	East Feliciana	Household	162	45	00/00/48	UTA	**
30.6674	-91.123	E. Baton Rouge	Household	210	--	--	UTA	**
30.8761	-9.1143	East Feliciana	Public-Commercial	120	60	10/19/93	UTA	**
30.8697	-9.1137	East Feliciana	Irrigation	125	65	05/02/87	UTA	**
30.8699	-9.1137	East Feliciana	Public-Commercial	100	50	08/18/93	Zone 1	**
30.8788	-9.1144	East Feliciana	Household	160	50	08/06/98	UTA	**
30.9455	-9.1245	West Feliciana	Household	143	100	00/00/59	Zone 1	**
30.5822	-91.215	E. Baton Rouge	Public-Commercial	190	46	01/14/94	UTA	20
30.95	-9.1409	West Feliciana	Household	387	63	11/01/54	Zone 1	**
30.9613	-9.1325	West Feliciana	Household	443	--	--	Zone 1	**
30.5808	-91.214	E. Baton Rouge	Industrial	195	35	06/01/88	UTA	**
30.9105	-9.1175	East Feliciana	Household	110	85	09/19/97	UTA	**
30.6869	-91.11	E. Baton Rouge	Household	225	22	01/22/03	--	**
30.6938	-91.107	E. Baton Rouge	Household	215	24	01/14/92	UTA	**
30.7136	-91.101	East Feliciana	Irrigation	120	20	03/26/87	UTA	**
30.8691	-9.1133	East Feliciana	Irrigation	130	--	--	UTA	**
30.7877	-91.098	East Feliciana	Public-Institution	78	49.85	06/03/60	UTA	**
30.893	-9.1154	East Feliciana	Household	265	140	09/27/01	Zone 1	**
30.9608	-9.1367	West Feliciana	Irrigation	145	45	00/00/56	Zone 1	**
30.5849	-91.203	E. Baton Rouge	Public-Institution	1942	48.5	03/28/46	Zone 3	440
30.7141	-91.1	East Feliciana	Household	186	17.74	08/14/73	UTA	**
30.6919	-91.107	E. Baton Rouge	Household	200	15	06/27/89	UTA	**
30.6922	-91.106	E. Baton Rouge	Household	200	25	09/02/97	UTA	**
30.7077	-91.101	E. Baton Rouge	Household	160	26	01/21/05	UTA	**
30.6899	-91.107	E. Baton Rouge	Household	220	60	09/14/98	UTA	543
30.8705	-9.1133	East Feliciana	Household	120	60	05/19/86	Zone 1	**
30.9322	-9.146	West Feliciana	Irrigation	190	18	12/08/99	Zone 1	40

Table 2.3-14 (Sheet 11 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.6888	-91.107	E. Baton Rouge	Household	200	35	12/07/98	UTA	**
30.6886	-91.107	E. Baton Rouge	Household	200	80	11/25/98	UTA	**
30.5813	-91.207	E. Baton Rouge	Public-Institution	1926	65	05/13/77	Zone 3	300
30.7077	-91.1	E. Baton Rouge	Household	120	20	08/29/97	UTA	**
30.6858	-91.108	E. Baton Rouge	Household	200	20	01/06/87	UTA	**
30.9466	-9.1235	West Feliciana	Household	230	--	--	Zone 1	**
30.8944	-9.1152	East Feliciana	Household	320	155	08/13/91	Zone 1	**
30.6869	-91.107	E. Baton Rouge	Household	220	30	10/18/98	UTA	**
30.6849	-91.107	E. Baton Rouge	Household	210	15	06/00/98	UTA	**
30.6858	-91.106	E. Baton Rouge	Household	195	25	04/19/99	UTA	**
30.6844	-91.107	E. Baton Rouge	Household	260	19	10/20/95	UTA	**
30.7408	-91.092	East Feliciana	Household	135	80	08/24/98	UTA	**
30.6874	-91.105	E. Baton Rouge	Household	225	23	06/14/03	--	**
30.7372	-91.092	East Feliciana	Household	189	--	--	UTA	**
30.9091	-9.1165	East Feliciana	Household	310	150	05/16/91	Zone 1	**
30.9613	-9.1277	West Feliciana	Household	130	100	05/08/95	Zone 1	**
30.7324	-91.092	East Feliciana	Household	178	38	09/06/94	UTA	**
30.6824	-91.106	E. Baton Rouge	Household	200	19	11/14/95	UTA	**
30.6872	-91.104	E. Baton Rouge	Household	200	25	09/12/00	UTA	**
30.6824	-91.106	E. Baton Rouge	Household	200	19	11/02/95	UTA	**
30.9086	-9.1163	East Feliciana	Household	300	140	09/21/90	Zone 1	**
30.7927	-91.093	East Feliciana	Household	114	56	00/00/58	UTA	**
30.8986	-9.1152	East Feliciana	Household	100	65	08/05/03	UTA	**
30.783	-91.091	East Feliciana	Public-Rural	2197	131	12/01/74	Zone 3	**
30.8969	-9.115	East Feliciana	Irrigation	122	75	03/03/03	UTA	**
30.7041	-91.097	E. Baton Rouge	Household	200	23	01/04/90	UTA	**
30.9644	-9.1288	West Feliciana	Irrigation	195	90	11/10/94	Zone 1	**
30.783	-91.09	East Feliciana	Household	140	65.88	01/29/74	UTA	**
30.9033	-9.1511	West Feliciana	Household	200	40	09/02/83	Zone 1	10
30.9111	-9.1163	East Feliciana	Household	300	150	10/06/92	Zone 1	**
30.8977	-9.1148	East Feliciana	Irrigation	170	55	07/19/01	UTA	**
30.898	-9.1148	East Feliciana	Household	170	55	07/18/01	UTA	**
30.913	-9.1165	East Feliciana	Household	310	150	10/20/92	Zone 1	**
30.9347	-9.1196	West Feliciana	Public-Institution	160	--	--	Zone 1	**
30.7588	-91.086	East Feliciana	Household	108	40	00/00/59	UTA	**
30.5733	-91.208	E. Baton Rouge	Public-Municipal	1926	70	09/05/78	Zone 3	394
30.9705	-9.135	West Feliciana	Household	360	147	00/00/56	Zone 1	**
30.703	-91.093	E. Baton Rouge	Household	210	--	--	UTA	**
30.5716	-91.21	E. Baton Rouge	Industrial	977	104	09/23/87	Zone 1	3000

Table 2.3-14 (Sheet 12 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location		Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
Latitude	Longitude							
30.8994	-9.1146	East Feliciana	Household	300	100	10/03/86	Zone 1	**
30.6883	-91.097	E. Baton Rouge	Household	210	35	10/11/91	UTA	**
30.7344	-91.084	East Feliciana	Household	240	55	10/06/88	UTA	**
30.9186	-9.1166	East Feliciana	Household	275	150	08/23/88	Zone 1	**
30.6883	-91.095	E. Baton Rouge	Household	250	27	05/06/99	UTA	**
30.9055	-9.115	East Feliciana	Household	260	90	06/05/02	--	**
30.9736	-9.1348	West Feliciana	Household	100	75	05/16/00	UTA	**
30.9736	-9.1348	West Feliciana	Household	100	75	05/30/00	UTA	**
30.7197	-91.085	East Feliciana	Household	310	20	02/05/97	Zone 1	**
30.5677	-91.211	E. Baton Rouge	Industrial	384	51.3	05/26/72	UTA	333
30.9669	-9.1399	West Feliciana	Household	240	10	08/20/99	Zone 1	**
30.9747	-9.134	West Feliciana	Household	480	80	00/00/56	Zone 1	**
30.9727	-9.1368	West Feliciana	Irrigation	162	--	--	Zone 1	**
30.9749	-9.1336	West Feliciana	Irrigation	562	192	03/23/67	Zone 2	25
30.9011	-9.1143	East Feliciana	Household	105	48	08/09/00	UTA	**
30.8955	-9.1137	East Feliciana	Irrigation	172	80	09/20/84	UTA	50
30.9199	-9.1162	East Feliciana	Public-Commercial	250	138	10/04/96	Zone 1	**
30.9763	-9.1341	West Feliciana	Household	130	20	02/01/01	Zone 1	**
30.8163	-9.1088	East Feliciana	Household	120	55	06/07/85	UTA	8
30.5922	-91.166	E. Baton Rouge	Public-Municipal	2395	18	07/12/59	Zone 3	1000
30.9102	-9.1149	East Feliciana	Household	260	140	10/15/03	--	**
30.6861	-91.092	E. Baton Rouge	Public-Municipal	1972	--	--	Zone 3	**
30.9416	-9.1472	West Feliciana	Irrigation	250	110	06/28/00	Zone 1	**
30.9769	-9.1352	West Feliciana	Household	169	100	10/25/51	Zone 1	**
30.8477	-9.11	East Feliciana	Household	96	73.24	01/31/74	UTA	**
30.9477	-9.1461	West Feliciana	Household	30	25	00/00/60	UTA	**
30.7569	-91.077	East Feliciana	Irrigation	92	20	09/15/00	UTA	**
30.7633	-91.077	East Feliciana	Household	75	20	09/06/01	UTA	**
30.5994	-91.154	E. Baton Rouge	Public-Municipal	2368	12	04/01/63	Zone 3	1500
30.8974	-9.1134	East Feliciana	Household	200	90	04/18/85	Zone 1	35
30.7605	-91.076	East Feliciana	Household	90	35	12/15/97	UTA	**
30.6872	-91.09	E. Baton Rouge	Household	210	--	--	UTA	**
30.6363	-91.118	E. Baton Rouge	Household	366	60	04/01/40	UTA	**
30.8838	-9.1122	East Feliciana	Irrigation	307	120	08/04/93	Zone 1	75
30.9349	-9.1178	East Feliciana	Household	220	130	06/07/95	Zone 1	**
30.9036	-9.1139	East Feliciana	Household	125	70	09/30/87	UTA	**
30.9133	-9.1149	East Feliciana	Household	97	50	01/24/96	UTA	**
30.9036	-9.1138	East Feliciana	Household	253	125	03/20/89	Zone 1	**
30.9774	-9.1294	West Feliciana	Irrigation	65	30	11/10/94	UTA	**

Table 2.3-14 (Sheet 13 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.5588	-91.217	E. Baton Rouge	Public-Commercial	1341	13.94	08/28/58	Zone 1	**
30.9186	-9.1155	East Feliciana	Household	220	150	09/24/84	Zone 1	15
30.6525	-91.105	E. Baton Rouge	Household	1170	25	01/25/44	Zone 1	**
30.9177	-9.1153	East Feliciana	Household	220	150	09/24/84	Zone 1	15
30.6916	-91.086	E. Baton Rouge	Household	228	35	08/07/87	UTA	**
30.978	-9.1296	West Feliciana	Irrigation	198	100	11/10/94	Zone 1	**
30.9188	-9.1154	East Feliciana	Household	85	50	03/02/94	UTA	**
30.9802	-9.1346	West Feliciana	Household	100	75	05/15/00	UTA	**
30.8994	-9.1133	East Feliciana	Household	161	68	07/20/92	UTA	**
30.9102	-9.1144	East Feliciana	Household	310	200	03/19/93	Zone 1	**
30.9047	-9.1138	East Feliciana	Household	120	60	08/09/84	UTA	19
30.905	-9.1138	East Feliciana	Household	115	70	03/25/85	UTA	19
30.9152	-9.1148	East Feliciana	Household	270	150	03/04/94	Zone 1	**
30.9133	-9.1146	East Feliciana	Household	318	140	04/22/94	Zone 1	**
30.5619	-91.206	E. Baton Rouge	Industrial	1025	86	06/20/62	Zone 1	955
30.9361	-9.1176	East Feliciana	Household	260	80	01/12/99	Zone 1	**
30.9072	-9.1526	West Feliciana	Household	170	50	08/30/83	Zone 1	27
30.9458	-9.1473	West Feliciana	Household	180	80	04/28/03	UTA	**
30.9452	-9.1474	West Feliciana	Irrigation	290	150	01/11/00	Zone 1	**
30.5613	-91.206	E. Baton Rouge	Industrial	2540	68	05/01/76	Zone 3	800
30.6911	-91.084	E. Baton Rouge	Household	230	20	11/26/85	UTA	30
30.5597	-91.21	E. Baton Rouge	Industrial	2504	71	11/01/95	Zone 3	1507
30.5688	-91.192	E. Baton Rouge	Public-Municipal	1295	38.99	01/07/59	Zone 1	350
30.9113	-9.1143	East Feliciana	Household	280	150	02/19/02	Zone 1	**
30.6602	-91.098	E. Baton Rouge	Household	1670	--	--	Zone 3	**
30.9072	-9.1138	East Feliciana	Household	180	70	04/29/87	UTA	**
30.9111	-9.1142	East Feliciana	Household	260	150	03/07/94	Zone 1	**
30.9122	-9.1143	East Feliciana	Household	110	60	04/05/99	UTA	**
30.9166	-9.1148	East Feliciana	Household	260	150	12/26/02	--	**
30.6919	-91.083	E. Baton Rouge	Household	222	38	08/08/87	UTA	**
30.9063	-9.1136	East Feliciana	Household	120	70	05/20/03	UTA	**
30.7224	-91.074	East Feliciana	Household	240	75	00/00/59	UTA	**
30.5597	-91.206	E. Baton Rouge	Industrial	1340	88	04/01/69	Zone 1	420
30.9169	-9.1146	East Feliciana	Household	114	75	10/23/98	UTA	543
30.9474	-9.1476	West Feliciana	Household	330	200	08/23/99	Zone 1	**
30.8722	-9.1106	East Feliciana	Household	320	150	05/25/95	Zone 1	**
30.9144	-9.1142	East Feliciana	Household	280	145	02/01/84	Zone 1	10
30.8988	-9.1126	East Feliciana	Household	290	140	08/12/02	--	**
30.6597	-91.095	E. Baton Rouge	Household	240	23	05/04/05	--	**

Table 2.3-14 (Sheet 14 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.9122	-9.1139	East Feliciana	Household	100	70	08/06/93	UTA	**
30.7724	-91.069	East Feliciana	Household	830	45	00/00/45	Zone 1	**
30.9858	-9.1346	West Feliciana	Public-Commercial	150	--	--	Zone 1	**
30.5594	-91.2	E. Baton Rouge	Household	1349	--	--	Zone 1	**
30.8697	-9.1101	East Feliciana	Household	140	80	04/29/02	UTA	**
30.9849	-9.1363	West Feliciana	Irrigation	480	109.5	10/01/61	Zone 2	130
30.8686	-9.11	East Feliciana	Household	140	70	07/12/99	Zone 1	**
30.873	-9.1102	East Feliciana	Household	150	60	03/23/94	Zone 1	**
30.9183	-9.1142	East Feliciana	Household	365	180	11/15/84	Zone 1	35
30.9252	-9.115	East Feliciana	Household	220	145	09/14/83	Zone 1	12
30.7888	-91.068	East Feliciana	Household	80	30	05/11/88	UTA	**
30.8699	-9.1099	East Feliciana	Household	140	80	08/15/96	Zone 1	**
30.8688	-9.1098	East Feliciana	Household	130	70	04/02/99	Zone 1	**
30.8752	-9.1102	East Feliciana	Household	158	--	--	Zone 1	19
30.5561	-91.2	E. Baton Rouge	Industrial	2547	61.5	05/01/75	Zone 3	1000
30.9611	-9.1205	West Feliciana	Household	590	40	00/00/49	Zone 2	**
30.873	-9.11	East Feliciana	Household	120	50	05/10/01	Zone 1	**
30.553	-91.206	E. Baton Rouge	Industrial	2570	65	12/16/77	Zone 3	1750
30.8697	-9.1097	East Feliciana	Household	135	60	12/23/96	Zone 1	**
30.5575	-91.196	E. Baton Rouge	Industrial	445	49.6	03/25/85	UTA	309
30.5572	-91.196	E. Baton Rouge	Industrial	1365	90	12/04/70	Zone 1	200
30.9525	-9.1479	West Feliciana	Household	185	135	10/25/01	UTA	**
30.5575	-91.195	E. Baton Rouge	Industrial	2420	80	09/04/98	Zone 3	543
30.5888	-91.147	E. Baton Rouge	Public-Municipal	2300	46	04/13/59	Zone 3	525
30.8741	-9.1099	East Feliciana	Household	125	60	08/18/97	Zone 1	**
30.9586	-9.1468	West Feliciana	Household	175	70	00/00/58	UTA	**
30.8638	-9.1093	East Feliciana	Household	130	60	03/05/96	Zone 1	**
30.553	-91.203	E. Baton Rouge	Industrial	1361	19	09/23/53	Zone 1	626
30.8647	-9.1092	East Feliciana	Household	120	40	01/29/04	UTA	**
30.8238	-9.1073	East Feliciana	Irrigation	120	60	11/19/98	UTA	**
30.9855	-9.1273	West Feliciana	Household	110	70	00/00/57	Zone 1	**
30.9469	-9.1174	East Feliciana	Household	135	50	10/20/89	Zone 1	**
30.8736	-9.1097	East Feliciana	Household	120	70	06/04/93	Zone 1	**
30.5536	-91.2	E. Baton Rouge	Industrial	2512	22.9	07/01/60	Zone 3	1012
30.8763	-9.1099	East Feliciana	Public-Institution	110	55	09/04/92	Zone 1	**
30.5527	-91.201	E. Baton Rouge	Industrial	2511	46.7	02/04/55	Zone 3	1470
30.9916	-9.1347	West Feliciana	Household	104	72	10/01/57	UTA	**
30.8719	-9.1095	East Feliciana	Household	135	70	11/14/04	UTA	**
30.8747	-9.1096	East Feliciana	Household	115	60	03/03/94	Zone 1	**

Table 2.3-14 (Sheet 15 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.5655	-91.175	E. Baton Rouge	Industrial	170	26.38	03/20/80	UTA	260
30.9866	-9.1271	West Feliciana	Household	402	80	00/00/58	Zone 1	**
30.8772	-9.1098	East Feliciana	Household	130	75	11/19/96	UTA	**
30.893	-9.1109	East Feliciana	Public-Commercial	100	45	09/02/98	Zone 1	**
30.8733	-9.1095	East Feliciana	Household	130	95	08/10/98	Zone 1	**
30.9663	-9.1459	West Feliciana	Public-Rural	960	197	05/10/77	Zone 3	200
30.8333	-9.1074	East Feliciana	Household	100	30	12/14/00	Zone 1	**
30.8769	-9.1097	East Feliciana	Household	120	80	05/09/00	Zone 1	**
30.6472	-91.091	E. Baton Rouge	Household	1380	52	03/14/39	Zone 2	**
30.8763	-9.1095	East Feliciana	Household	135	75	09/16/93	Zone 1	**
30.7469	-91.058	East Feliciana	Household	31	28	02/08/58	UTA	**
30.9202	-9.1132	East Feliciana	Household	147	65	05/01/95	Zone 1	**
30.8394	-9.1074	East Feliciana	Household	84	18	03/23/85	UTA	**
30.9241	-9.1136	East Feliciana	Household	160	55	09/29/87	Zone 1	**
30.9291	-9.1141	East Feliciana	Household	100	60	12/09/85	UTA	19
30.9197	-9.113	East Feliciana	Household	140	60	04/03/97	Zone 1	**
30.9288	-9.114	East Feliciana	Household	95	60	01/14/00	UTA	**
30.9774	-9.144	West Feliciana	Household	343	--	--	Zone 1	12
30.9713	-9.1208	West Feliciana	Household	140	50	02/14/00	MRAA	**
30.9244	-9.1134	East Feliciana	Household	170	60	06/21/90	Zone 1	**
30.9738	-9.1451	West Feliciana	Household	178	60	07/22/98	UTA	**
30.9969	-9.1347	West Feliciana	Irrigation	150	100	00/00/60	Zone 1	**
30.9969	-9.1347	West Feliciana	Irrigation	150	100	00/00/58	Zone 1	**
30.7938	-91.058	East Feliciana	Household	636	--	--	Zone 1	**
30.9733	-9.1454	West Feliciana	Household	173	55	07/23/98	UTA	**
30.9947	-9.1289	West Feliciana	Household	140	--	--	UTA	**
30.5627	-91.169	E. Baton Rouge	Irrigation	265	48	08/11/03	--	250
30.7466	-91.054	East Feliciana	Household	78	16	08/18/93	UTA	**
30.998	-9.1347	West Feliciana	Household	150	100	00/00/57	Zone 1	**
30.9716	-9.1203	West Feliciana	Household	199	112	05/11/56	Zone 1	**
30.6355	-91.091	E. Baton Rouge	Household	380	25	04/17/02	UTA	**
30.853	-9.1075	East Feliciana	Household	107	55	02/10/97	Zone 1	**
30.805	-9.1058	East Feliciana	Household	80	20	04/17/91	UTA	**
30.8558	-9.1076	East Feliciana	Household	126	--	--	UTA	**
30.9824	-9.1226	West Feliciana	Household	215	150	12/13/00	Zone 1	**
30.8591	-9.1077	East Feliciana	Household	80	62	00/00/55	UTA	**
30.9655	-9.1478	West Feliciana	Household	85	50	00/00/60	UTA	**
30.553	-91.18	E. Baton Rouge	Industrial	2435	5.4	04/11/68	Zone 3	1600
30.8791	-9.1088	East Feliciana	Household	130	85	04/24/98	UTA	**

Table 2.3-14 (Sheet 16 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.9552	-9.1168	East Feliciana	Household	415	180	01/08/99	Zone 1	**
30.553	-91.179	E. Baton Rouge	Industrial	2440	4	04/10/68	Zone 3	1000
30.5452	-91.194	E. Baton Rouge	Public-Commercial	220	35	04/14/89	UTA	**
30.9655	-9.1185	East Feliciana	Household	120	30	11/08/01	UTA	**
30.9674	-9.1189	East Feliciana	Household	325	18	10/17/88	Zone 1	**
30.8836	-9.1089	East Feliciana	Household	100	50	09/16/87	UTA	**
30.9563	-9.1167	East Feliciana	Household	425	150	00/00/50	Zone 1	**
30.9199	-9.112	East Feliciana	Household	125	75	00/00/56	UTA	**
30.9166	-9.1116	East Feliciana	Household	250	70	00/00/58	Zone 1	**
30.9186	-9.1118	East Feliciana	Household	30	25.58	05/27/60	UTA	**
30.8147	-9.1056	East Feliciana	Public-Rural	2101	--	--	Zone 3	**
30.9563	-9.1166	East Feliciana	Household	435	200	05/17/90	Zone 1	**
30.6466	-91.079	E. Baton Rouge	Household	290	30	02/15/98	UTA	**
30.6086	-91.106	E. Baton Rouge	Household	180	35	05/03/05	UTA	**
30.9208	-9.1119	East Feliciana	Public-Rural	506	143	11/22/65	Zone 1	287
30.9711	-9.1191	East Feliciana	Household	450	95	05/31/95	Zone 1	**
30.8105	-9.1054	East Feliciana	Irrigation	175	80	11/12/99	UTA	**
30.9386	-9.1139	East Feliciana	Household	88	60	04/07/98	UTA	**
30.9166	-9.1114	East Feliciana	Public-Municipal	585	175.8	08/10/98	Zone 1	302
30.9633	-9.1174	East Feliciana	Household	135	90	12/08/87	Zone 1	**
30.9727	-9.1192	West Feliciana	Public-Commercial	130	60	08/22/91	Zone 1	**
30.8077	-9.1052	East Feliciana	Irrigation	440	70	07/24/00	Zone 1	**
30.9205	-9.1117	East Feliciana	Household	100	70	06/27/84	UTA	10
30.808	-9.1052	East Feliciana	Household	427	87	00/00/43	Zone 1	**
30.9486	-9.115	East Feliciana	Household	230	135	04/19/85	Zone 1	15
30.9655	-9.1176	East Feliciana	Household	140	60	04/20/89	Zone 1	**
30.5466	-91.181	E. Baton Rouge	Industrial	1320	--	--	Zone 1	200
30.5991	-91.111	E. Baton Rouge	Household	1206	15.8	04/08/44	Zone 1	**
30.7991	-9.1049	East Feliciana	Household	320	60	08/30/01	Zone 1	**
30.5755	-91.135	E. Baton Rouge	Public-Municipal	2446	35.8	11/28/72	Zone 3	1500
30.8002	-9.1047	East Feliciana	Household	150	40	06/20/02	UTA	**
30.9333	-9.1538	West Feliciana	Household	549	13.5	07/07/55	Zone 2	**
30.943	-9.1138	East Feliciana	Household	455	175	12/03/93	Zone 1	**
30.943	-9.1138	East Feliciana	Household	110	85	09/23/88	UTA	**
30.9036	-9.1096	East Feliciana	Household	80	35	09/03/98	UTA	**
30.9722	-9.1483	West Feliciana	Household	14	12	00/00/60	UTA	**
30.9722	-9.1483	West Feliciana	Household	204	--	--	Zone 1	**
30.9683	-9.1175	East Feliciana	Household	120	45	02/20/03	UTA	**
30.868	-9.1071	East Feliciana	Household	80	12	03/24/85	UTA	**

Table 2.3-14 (Sheet 17 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.9355	-9.1538	West Feliciana	Public-Rural	822	20.1	11/10/76	Zone 3	200
30.7977	-9.1045	East Feliciana	Household	120	20	09/16/99	UTA	**
30.9597	-9.1158	East Feliciana	Household	410	150	05/26/94	Zone 1	**
30.9038	-9.1094	East Feliciana	Household	123	47	00/00/59	UTA	**
30.9691	-9.1173	East Feliciana	Household	505	78	04/27/61	Zone 1	**
30.9316	-9.1544	West Feliciana	Public-Commercial	679	1	10/14/60	Zone 2	**
30.5538	-91.159	E. Baton Rouge	Public-Municipal	2405	57	02/20/89	Zone 3	751
30.9688	-9.1171	East Feliciana	Household	140	55	11/04/96	Zone 1	**
30.9274	-9.155	West Feliciana	Household	800	12	00/00/38	Zone 3	**
30.933	-9.1546	West Feliciana	Household	650	--	00/00/53	Zone 2	**
30.9274	-9.1553	West Feliciana	Household	346	8	05/07/60	Zone 1	7
30.7455	-91.036	East Feliciana	Household	80	--	--	UTA	**
30.8608	-9.106	East Feliciana	Household	120	70	02/18/00	Zone 1	**
30.7638	-91.034	East Feliciana	Household	39	21	00/00/49	UTA	5
30.9299	-9.1554	West Feliciana	Household	624	31	00/00/54	Zone 2	**
30.6372	-91.069	E. Baton Rouge	Public-Municipal	2190	--	--	Zone 3	**
30.9247	-9.1105	East Feliciana	Household	283	60	02/01/60	Zone 1	**
30.528	-91.196	E. Baton Rouge	Public-Municipal	2643	--	--	Zone 3	**
30.9491	-9.1132	East Feliciana	Household	165	63	05/25/85	Zone 1	40
30.6919	-91.043	E. Baton Rouge	Industrial	140	20	09/17/86	UTA	40
30.7419	-91.033	East Feliciana	Household	108	25	08/27/93	UTA	**
30.9505	-9.1533	West Feliciana	Household	705	50	00/00/47	Zone 2	**
30.6597	-91.055	E. Baton Rouge	Household	107	40	10/23/02	UTA	**
30.7519	-91.032	East Feliciana	Household	504	25	03/01/49	Zone 1	**
30.8588	-9.1056	East Feliciana	Public-Rural	1500	95	00/00/60	Zone 3	**
30.8588	-9.1056	East Feliciana	Public-Rural	550	134.2	07/13/77	Zone 1	**
30.9	-9.1081	East Feliciana	Public-Institution	120	80	10/16/00	UTA	**
30.8611	-9.1057	East Feliciana	Household	140	70	03/10/03	UTA	**
30.7391	-91.032	East Feliciana	Household	220	30	06/09/92	UTA	**
30.8724	-9.1061	East Feliciana	Household	180	70	12/02/93	UTA	**
30.9644	-9.1148	East Feliciana	Household	235	50	06/11/86	Zone 1	**
30.9583	-9.1527	West Feliciana	Public-Rural	802	61	10/09/96	Zone 2	851
30.6005	-91.089	E. Baton Rouge	Household	165	12	09/24/36	UTA	**
30.9602	-9.1526	West Feliciana	Public-Institution	600	24	11/15/52	Zone 2	**
30.8724	-9.1058	East Feliciana	Household	115	70	06/12/00	Zone 1	**
30.9627	-9.1141	East Feliciana	Household	428	140	00/00/59	Zone 1	**
30.7397	-91.028	East Feliciana	Household	100	35	12/20/96	UTA	**
30.5588	-91.132	E. Baton Rouge	Public-Municipal	2457	51	11/22/54	Zone 3	500
30.5311	-91.175	E. Baton Rouge	Irrigation	280	36.3	05/10/91	UTA	602

Table 2.3-14 (Sheet 18 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.8583	-9.1049	East Feliciana	Household	120	70	05/05/94	UTA	**
30.6219	-91.069	E. Baton Rouge	Irrigation	70	18	08/17/04	UTA	**
30.9647	-9.1524	West Feliciana	Household	314	24	00/00/46	Zone 1	**
30.7758	-91.026	East Feliciana	Household	150	30	07/01/57	UTA	**
30.8911	-9.1066	East Feliciana	Household	105	50	03/17/87	UTA	**
30.7769	-91.026	East Feliciana	Household	220	35	00/00/45	Zone 1	**
30.7883	-91.027	East Feliciana	Household	140	60	09/20/83	UTA	10
30.9352	-9.1562	West Feliciana	Household	250	10	00/00/52	Zone 1	5
30.9824	-9.1165	East Feliciana	Household	75	--	--	UTA	**
30.9127	-9.108	East Feliciana	Public-Commercial	250	80	09/13/01	Zone 1	**
30.6858	-91.034	E. Baton Rouge	Public-Municipal	1920	36.83	09/11/67	Zone 3	**
30.9133	-9.1079	East Feliciana	Household	260	75	09/24/91	Zone 1	**
30.9677	-9.1139	East Feliciana	Household	415	180	06/23/86	Zone 1	**
30.5258	-91.175	E. Baton Rouge	Public-Municipal	2647	11	12/12/67	Zone 3	1300
30.5513	-91.133	E. Baton Rouge	Public-Municipal	2461	37	03/14/61	Zone 3	435
30.5255	-91.175	E. Baton Rouge	Public-Municipal	1395	64	08/11/64	Zone 1	850
30.8719	-9.105	East Feliciana	Household	90	50	01/30/87	UTA	**
30.5869	-91.091	E. Baton Rouge	Irrigation	178	38	10/10/90	UTA	**
30.5252	-91.174	E. Baton Rouge	Public-Municipal	1934	169	02/08/67	Zone 2	1140
30.6344	-91.054	E. Baton Rouge	Irrigation	197	41	06/09/96	UTA	**
30.9016	-9.1066	East Feliciana	Irrigation	87	30	08/02/95	UTA	**
30.5302	-91.159	E. Baton Rouge	Public-Institution	1374	80	12/07/68	Zone 1	**
30.5966	-91.078	E. Baton Rouge	Household	175	28	06/19/40	UTA	**
30.5588	-91.116	E. Baton Rouge	Household	997	23	08/15/40	Zone 1	**
30.7069	-91.02	E. Baton Rouge	Public-Rural	1870	106	01/03/02	Zone 3	1507
30.6283	-91.052	E. Baton Rouge	Household	140	20	09/09/04	UTA	**
30.6036	-91.069	E. Baton Rouge	Household	2490	30	05/15/57	Zone 3	**
30.9538	-9.1109	East Feliciana	Household	105	75	00/00/59	UTA	**
30.5983	-91.072	E. Baton Rouge	Public-Commercial	1251	--	10/08/36	Zone 1	**
30.9424	-9.1571	West Feliciana	Public-Institution	632	19.68	12/05/56	Zone 2	800
30.9444	-9.1569	West Feliciana	Public-Institution	649	2.81	08/06/65	Zone 2	1710
30.7077	-91.017	E. Baton Rouge	Household	100	40	12/16/99	UTA	**
30.9455	-9.1569	West Feliciana	Public-Institution	595	11.44	12/05/56	Zone 2	540
30.7816	-91.012	East Feliciana	Irrigation	235	65	08/31/89	UTA	120
30.5108	-91.184	E. Baton Rouge	Industrial	585	190.4	11/03/53	UTA	1000
30.9861	-9.1149	East Feliciana	Irrigation	100	60	08/08/03	UTA	**
30.7077	-91.016	E. Baton Rouge	Household	110	40	06/14/00	UTA	**
30.5102	-91.184	E. Baton Rouge	Industrial	2301	32.06	06/13/47	Zone 3	600
30.9863	-9.1148	East Feliciana	Household	75	50	04/17/89	UTA	**

Table 2.3-14 (Sheet 19 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.5083	-91.188	E. Baton Rouge	Industrial	600	185	01/15/56	UTA	1000
30.793	-91.012	East Feliciana	Household	545	24.56	05/26/61	Zone 1	**
30.7586	-91.009	East Feliciana	Household	85	50	00/00/45	UTA	**
30.7591	-91.009	East Feliciana	Household	85	50.09	06/02/60	UTA	**
30.5091	-91.185	E. Baton Rouge	Industrial	2278	58	09/15/42	Zone 3	400
30.5097	-91.182	E. Baton Rouge	Industrial	2331	226	12/19/69	Zone 3	1500
30.5497	-91.116	E. Baton Rouge	Public-Municipal	2600	--	--	Zone 3	**
30.5063	-91.189	E. Baton Rouge	Industrial	1952	35	01/30/53	Zone 2	1209
30.9936	-9.1509	West Feliciana	Household	210	100	10/16/02	--	**
30.953	-9.1566	West Feliciana	Public-Institution	596	12.8	07/25/55	Zone 2	**
30.9497	-9.1094	East Feliciana	Household	218	100	01/03/03	--	**
30.5055	-91.185	E. Baton Rouge	Industrial	2308	131.65	02/15/65	Zone 3	1000
30.8777	-9.1036	East Feliciana	Household	101	55	05/29/85	UTA	15
30.5038	-91.187	E. Baton Rouge	Industrial	1980	173	03/31/64	Zone 2	1000
30.9786	-9.1127	East Feliciana	Household	110	70	00/00/56	UTA	**
30.8899	-9.1042	East Feliciana	Household	110	36	08/13/96	UTA	**
30.8672	-9.1029	East Feliciana	Household	335	60	09/08/59	Zone 1	**
30.8791	-9.1035	East Feliciana	Household	110	60	03/20/98	UTA	**
30.5922	-91.065	E. Baton Rouge	Irrigation	220	45	03/26/84	UTA	150
30.8388	-9.1017	East Feliciana	Household	40	20	11/04/87	UTA	**
30.8863	-9.1038	East Feliciana	Household	95	45	06/09/03	UTA	**
30.8872	-9.1039	East Feliciana	Household	120	65	12/05/00	UTA	**
30.8722	-9.103	East Feliciana	Household	110	45	10/14/99	UTA	**
30.8694	-9.1029	East Feliciana	Household	120	50	09/02/86	UTA	**
30.8755	-9.1032	East Feliciana	Household	100	60	08/05/03	UTA	**
30.8763	-9.1031	East Feliciana	Household	90	45	05/11/00	UTA	**
30.9863	-9.1531	West Feliciana	Household	425	159.5	04/26/60	Zone 1	**
30.8913	-9.1039	East Feliciana	Irrigation	110	50	04/04/00	UTA	**
30.5591	-91.094	E. Baton Rouge	Household	242	60	00/00/59	UTA	**
30.5269	-91.136	E. Baton Rouge	Household	294	84	00/00/56	UTA	**
30.8791	-9.1032	East Feliciana	Household	100	60	07/14/86	Zone 1	**
30.8727	-9.1028	East Feliciana	Household	105	50	09/12/86	UTA	**
30.4974	-91.191	E. Baton Rouge	Industrial	648	--	--	UTA	1300
30.8738	-9.1028	East Feliciana	Household	120	50	09/02/86	UTA	**
30.4988	-91.185	E. Baton Rouge	Industrial	1212	100	12/22/96	Zone 1	**
30.5027	-91.176	E. Baton Rouge	Industrial	2032	--	--	Zone 2	995
30.5044	-91.172	E. Baton Rouge	Industrial	1204	120	07/10/91	Zone 1	1000
30.9683	-9.1103	East Feliciana	Public-Municipal	450	172.62	01/05/99	Zone 1	224
30.56	-91.088	E. Baton Rouge	Irrigation	189	40	05/29/84	UTA	**

Table 2.3-14 (Sheet 20 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.4966	-91.188	E. Baton Rouge	Industrial	646	95.3	12/06/84	UTA	1200
30.4983	-91.183	E. Baton Rouge	Industrial	2104	315	04/01/71	Zone 2	**
30.8075	-9.1002	East Feliciana	Public-Rural	1720	199	04/18/88	Zone 3	400
30.8075	-9.1002	East Feliciana	Public-Rural	2176	165.48	03/10/78	Zone 3	150
30.5013	-91.175	E. Baton Rouge	Industrial	2029	155.4	07/06/61	Zone 2	1085
30.8255	-9.1006	East Feliciana	Household	160	80	03/30/00	UTA	**
30.9622	-9.1094	East Feliciana	Household	70	60	04/01/58	UTA	**
30.4983	-91.179	E. Baton Rouge	Industrial	405	65.3	12/15/88	UTA	528
30.5313	-91.12	E. Baton Rouge	Household	100	28	08/31/99	UTA	**
30.5013	-91.172	E. Baton Rouge	Industrial	2040	276	03/00/81	Zone 2	**
30.56	-91.084	E. Baton Rouge	Household	275	14.84	07/10/40	UTA	**
30.4991	-91.176	E. Baton Rouge	Industrial	1250	59	11/13/53	Zone 1	1400
30.8072	-9.0999	East Feliciana	Household	155	60	06/30/00	UTA	**
30.4972	-91.179	E. Baton Rouge	Industrial	425	214.32	10/20/44	UTA	790
30.8644	-9.1017	East Feliciana	Public-Municipal	1966	91.46	02/02/59	Zone 3	560
30.5269	-91.124	E. Baton Rouge	Household	292	65	00/00/51	UTA	**
30.5	-91.171	E. Baton Rouge	Industrial	2040	236	08/25/67	Zone 2	1900
30.8333	-9.1005	East Feliciana	Household	120	60	11/03/97	UTA	**
30.9738	-9.1103	East Feliciana	Industrial	121	65	04/01/57	UTA	**
30.5691	-91.072	E. Baton Rouge	Household	2020	41.6	01/03/55	Zone 3	**
30.7102	-90.997	E. Baton Rouge	Household	95	25	08/01/45	UTA	**
30.5719	-91.069	E. Baton Rouge	Household	1310	21.4	02/25/43	Zone 1	**
30.5249	-91.125	E. Baton Rouge	Public-Municipal	2557	13	04/22/70	Zone 3	900
30.9744	-9.1103	East Feliciana	Irrigation	298	--	--	Zone 1	**
30.4966	-91.176	E. Baton Rouge	Industrial	2395	25	05/20/43	Zone 3	1000
30.4961	-91.176	E. Baton Rouge	Industrial	2059	150.7	08/18/60	Zone 2	1715
30.4908	-91.188	E. Baton Rouge	Industrial	2062	278	09/28/90	Zone 2	1000
30.5252	-91.123	E. Baton Rouge	Household	1140	27.7	07/15/37	Zone 1	**
30.8197	-9.0999	East Feliciana	Household	220	50	00/00/45	Zone 1	**
30.8511	-9.1008	East Feliciana	Household	80	50	00/00/57	UTA	**
30.9874	-9.1117	East Feliciana	Household	88	30	10/07/86	UTA	**
30.4963	-91.173	E. Baton Rouge	Industrial	1250	146	10/16/57	Zone 1	1722
30.8341	-9.1001	East Feliciana	Irrigation	160	90	05/03/99	UTA	**
30.5536	-91.084	E. Baton Rouge	Household	1287	41.6	00/00/37	Zone 1	**
30.5566	-91.081	E. Baton Rouge	Household	220	--	--	UTA	**
30.7327	-90.99	East Feliciana	Household	84	--	--	UTA	**
30.4952	-91.173	E. Baton Rouge	Industrial	2066	279	06/16/69	Zone 2	1940
30.5263	-91.118	E. Baton Rouge	Irrigation	2604	--	--	Zone 3	**
30.5263	-91.118	E. Baton Rouge	Household	304	62	02/04/65	UTA	**

Table 2.3-14 (Sheet 21 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.9572	-9.1588	West Feliciana	Public-Institution	531	30.8	01/09/03	--	1200
30.9638	-9.1084	East Feliciana	Household	58	50.97	07/17/58	UTA	**
30.4936	-91.173	E. Baton Rouge	Industrial	2434	40.5	09/03/42	Zone 3	800
30.4908	-91.179	E. Baton Rouge	Industrial	690	--	--	UTA	1180
30.4933	-91.172	E. Baton Rouge	Industrial	1270	28	01/15/53	Zone 1	1350
30.9586	-9.1588	West Feliciana	Public-Institution	531	22	02/18/93	Zone 2	1500
30.558	-91.076	E. Baton Rouge	Household	1115	37	10/05/35	Zone 1	**
30.4911	-91.176	E. Baton Rouge	Industrial	692	155.87	05/26/72	UTA	1258
30.4869	-91.185	E. Baton Rouge	Industrial	441	226	09/22/43	UTA	1520
30.493	-91.171	E. Baton Rouge	Industrial	1245	86	12/15/54	Zone 1	1125
30.8363	-9.0998	East Feliciana	Household	134	--	--	UTA	**
30.8183	-9.0993	East Feliciana	Irrigation	150	70	12/15/99	UTA	70
30.9586	-9.159	West Feliciana	Public-Institution	545	21	03/07/01	Zone 2	1012
30.85	-9.1001	East Feliciana	Household	135	50	08/26/85	Zone 1	19
30.8433	-9.0999	East Feliciana	Household	420	90	00/00/48	Zone 1	**
30.8438	-9.0999	East Feliciana	Household	175	--	--	UTA	3
30.8638	-9.1006	East Feliciana	Public-Municipal	2014	188.3	06/20/77	Zone 3	1500
30.8202	-9.0991	East Feliciana	Household	120	55	05/31/00	Zone 1	**
30.8377	-9.0996	East Feliciana	Household	140	--	--	UTA	**
30.4838	-91.187	E. Baton Rouge	Industrial	1285	--	--	Zone 1	1400
30.8441	-9.0998	East Feliciana	Household	170	75	08/02/02	UTA	**
30.9555	-9.1596	West Feliciana	Industrial	650	--	--	Zone 2	**
30.4836	-91.186	E. Baton Rouge	Industrial	2119	267	09/23/68	Zone 2	2068
30.8677	-9.1007	East Feliciana	Household	100	56	07/05/96	UTA	**
30.488	-91.175	E. Baton Rouge	Industrial	1270	73.75	10/25/54	Zone 1	1050
30.9841	-9.1564	West Feliciana	Public-Institution	672	18	06/18/47	Zone 2	**
30.8527	-9.1	East Feliciana	Irrigation	120	60	09/19/96	UTA	**
30.8813	-9.1012	East Feliciana	Public-Institution	130	--	--	UTA	**
30.9858	-9.1563	West Feliciana	Public-Institution	660	5.9	06/09/67	Zone 2	810
30.8525	-9.0999	East Feliciana	Household	1564	--	--	Zone 3	**
30.4852	-91.178	E. Baton Rouge	Industrial	459	141	06/03/38	UTA	1000
30.8505	-9.0998	East Feliciana	Household	130	75	07/31/96	UTA	**
30.4833	-91.182	E. Baton Rouge	Industrial	2110	121	09/17/56	Zone 2	1268
30.4872	-91.173	E. Baton Rouge	Industrial	430	--	--	UTA	822
30.4822	-91.181	E. Baton Rouge	Industrial	607	95	10/01/03	--	1270
30.5058	-91.133	E. Baton Rouge	Public-Municipal	1206	105.61	03/10/59	Zone 1	890
30.5777	-91.047	E. Baton Rouge	Public-Municipal	2025	69	12/10/93	Zone 3	1261
30.505	-91.132	E. Baton Rouge	Public-Municipal	2375	204	02/20/74	Zone 3	1100
30.4844	-91.171	E. Baton Rouge	Industrial	2120	299	04/22/70	Zone 2	1982

Table 2.3-14 (Sheet 22 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.8219	-9.0985	East Feliciana	Irrigation	140	70	12/02/04	UTA	**
30.4797	-91.182	E. Baton Rouge	Industrial	2208	274	04/29/69	Zone 2	2010
30.5058	-91.129	E. Baton Rouge	Public-Municipal	2382	44.58	09/30/58	Zone 3	915
30.9358	-9.1043	East Feliciana	Irrigation	280	60	01/20/94	Zone 1	**
30.4841	-91.171	E. Baton Rouge	Industrial	1242	115	12/09/55	Zone 1	1200
30.4816	-91.176	E. Baton Rouge	Industrial	2130	223.1	10/19/66	Zone 2	1658
30.5361	-91.086	E. Baton Rouge	Public-Commercial	1393	21.9	02/25/43	Zone 1	**
30.5052	-91.129	E. Baton Rouge	Public-Municipal	1153	119	02/22/63	Zone 1	1050
30.8544	-9.0994	East Feliciana	Irrigation	150	45	08/21/00	UTA	**
30.5058	-91.126	E. Baton Rouge	Public-Municipal	2362	94	05/20/63	Zone 3	1150
30.5052	-91.126	E. Baton Rouge	Public-Municipal	1168	105.86	06/29/62	Zone 1	975
30.9644	-9.1599	West Feliciana	Irrigation	117	25	05/02/00	MRAA	**
30.5147	-91.111	E. Baton Rouge	Household	360	19	06/00/96	UTA	**
30.5158	-91.109	E. Baton Rouge	Household	330	20	06/05/01	UTA	**
30.8588	-9.0993	East Feliciana	Irrigation	320	110	06/05/00	UTA	**
30.5672	-91.05	E. Baton Rouge	Public-Rural	1690	137	10/31/97	Zone 2	1001
30.5155	-91.108	E. Baton Rouge	Household	328	53	04/04/02	UTA	**
30.8566	-9.0992	East Feliciana	Irrigation	320	90	06/05/00	UTA	350
30.4749	-91.184	E. Baton Rouge	Industrial	1260	135	04/27/00	Zone 1	**
30.858	-9.0992	East Feliciana	Household	200	85	09/16/99	Zone 1	**
30.5647	-91.05	E. Baton Rouge	Household	265	30	11/21/93	UTA	**
30.4738	-91.185	E. Baton Rouge	Industrial	1021	101.98	03/02/48	Zone 1	413
30.5288	-91.088	E. Baton Rouge	Household	280	49	08/28/95	UTA	**
30.7461	-90.972	East Feliciana	Household	122	--	--	UTA	**
30.473	-91.185	E. Baton Rouge	Industrial	1282	--	--	Zone 1	830
30.8227	-9.0979	East Feliciana	Irrigation	210	90	06/25/03	--	**
30.8291	-9.098	East Feliciana	Household	195	--	--	Zone 1	**
30.8638	-9.0992	East Feliciana	Household	120	60	03/24/95	Zone 1	**
30.9308	-9.1031	East Feliciana	Irrigation	200	60	07/12/95	Zone 1	**
30.9949	-9.1096	East Feliciana	Household	210	82	01/09/85	Zone 1	**
30.9936	-9.1094	East Feliciana	Household	185	45	12/06/95	Zone 1	**
30.9672	-9.1602	West Feliciana	Irrigation	126	25	05/01/00	MRAA	**
30.9747	-9.107	East Feliciana	Public-Institution	450	--	--	Zone 1	**
30.9672	-9.1062	East Feliciana	Household	270	40	05/09/95	Zone 1	**
30.7433	-90.969	East Feliciana	Household	110	43	05/30/60	UTA	**
30.8311	-9.0978	East Feliciana	Household	175	70	12/23/87	Zone 1	**
30.9963	-9.1094	East Feliciana	Household	70	40	06/17/93	UTA	**
30.9424	-9.1037	East Feliciana	Household	300	76	09/26/91	Zone 1	**
30.9683	-9.1061	East Feliciana	Household	225	35	04/19/00	Zone 1	**

Table 2.3-14 (Sheet 23 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.6666	-90.983	E. Baton Rouge	Household	120	20	09/14/99	UTA	**
30.9411	-9.1035	East Feliciana	Household	180	65.11	03/14/61	Zone 1	**
30.8552	-9.0985	East Feliciana	Household	170	55	09/18/95	UTA	**
30.708	-90.971	E. Baton Rouge	Household	126	--	--	UTA	6
30.8177	-9.0973	East Feliciana	Irrigation	482	--	--	Zone 1	**
30.9722	-9.1064	East Feliciana	Household	230	100	11/11/02	--	**
30.7222	-90.968	East Feliciana	Household	105	30	09/26/00	UTA	**
30.7219	-90.968	East Feliciana	Household	115	--	--	UTA	**
30.9966	-9.1092	East Feliciana	Household	80	45	12/05/00	UTA	**
30.5424	-91.063	E. Baton Rouge	Public-Municipal	2652	53	01/24/57	Zone 3	**
30.9177	-9.1015	East Feliciana	Public-Commercial	105	60	10/18/93	UTA	**
30.4702	-91.176	E. Baton Rouge	Industrial	585	85	07/06/00	UTA	300
30.8783	-9.0992	East Feliciana	Household	145	85	11/19/84	Zone 1	19
30.5102	-91.102	E. Baton Rouge	Irrigation	350	--	--	UTA	**
30.7474	-90.965	East Feliciana	Household	120	70	06/15/85	UTA	10
30.8174	-9.097	East Feliciana	Household	189	45	07/01/57	UTA	8
30.9724	-9.1059	East Feliciana	Household	260	45	07/14/97	Zone 1	**
30.5505	-91.051	E. Baton Rouge	Irrigation	1176	39	00/00/35	Zone 1	**
30.9516	-9.1627	West Feliciana	Public-Institution	907	13.7	05/08/58	Zone 3	**
30.4638	-91.186	E. Baton Rouge	Public-Municipal	2250	--	--	Zone 2	**
30.6794	-90.973	E. Baton Rouge	Household	200	19	08/03/93	UTA	**
30.4636	-91.186	E. Baton Rouge	Public-Municipal	2536	162	08/24/67	Zone 3	1050
30.8777	-9.0989	East Feliciana	Household	130	85	03/27/97	Zone 1	**
30.593	-91.014	E. Baton Rouge	Public-Municipal	1976	--	--	Zone 3	**
30.5622	-91.038	E. Baton Rouge	Household	1130	--	04/08/44	Zone 1	**
30.5399	-91.06	E. Baton Rouge	Irrigation	255	47	03/06/87	UTA	15
30.8747	-9.0986	East Feliciana	Household	130	60	06/13/98	Zone 1	**
30.753	-90.961	East Feliciana	Household	67	--	--	UTA	**
30.9761	-9.106	East Feliciana	Household	80	30	09/23/98	UTA	**
30.8161	-9.0966	East Feliciana	Irrigation	178	58	03/10/59	UTA	**
30.753	-90.96	East Feliciana	Household	63	46.3	04/29/58	UTA	**
30.9672	-9.1616	West Feliciana	Public-Institution	484	17.5	09/05/56	Zone 2	100
30.7058	-90.964	E. Baton Rouge	Irrigation	130	20	03/24/99	UTA	**
30.8161	-9.0965	East Feliciana	Irrigation	184	45.95	10/20/77	UTA	**
30.9141	-9.1006	East Feliciana	Household	85	55	03/12/92	UTA	**
30.5072	-91.096	E. Baton Rouge	Household	363	46	04/29/93	UTA	**
30.9216	-9.101	East Feliciana	Household	100	40	07/22/88	UTA	**
30.9138	-9.1004	East Feliciana	Household	230	40	04/09/01	Zone 1	**
30.7249	-90.96	East Feliciana	Household	154	16	08/16/01	UTA	**

Table 2.3-14 (Sheet 24 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.9019	-9.0996	East Feliciana	Household	280	70	04/10/98	Zone 1	**
30.6219	-90.992	E. Baton Rouge	Household	2510	32	01/23/64	Zone 3	**
30.5691	-91.026	E. Baton Rouge	Household	250	33	03/07/94	UTA	**
30.8772	-9.0983	East Feliciana	Household	150	70	02/09/94	Zone 1	**
30.8749	-9.0981	East Feliciana	Household	135	55	09/16/83	Zone 1	10
30.5013	-91.101	E. Baton Rouge	Household	380	51	08/29/92	UTA	**
30.5327	-91.06	E. Baton Rouge	Public-Municipal	2520	--	--	Zone 3	**
30.9774	-9.1053	East Feliciana	Household	93	18	07/20/01	UTA	**
30.8558	-9.0972	East Feliciana	Public-Institution	1078	--	--	Zone 2	**
30.6255	-90.987	E. Baton Rouge	Public-Commercial	196	--	--	UTA	**
30.5991	-91.001	E. Baton Rouge	Household	180	28	04/21/92	UTA	**
30.9208	-9.1004	East Feliciana	Household	115	70	01/23/86	UTA	10
30.6547	-90.973	E. Baton Rouge	Public-Municipal	2048	6.22	09/12/68	Zone 3	**
30.9811	-9.1055	East Feliciana	Household	240	40	08/15/89	Zone 1	**
30.7647	-90.953	East Feliciana	Household	130	65	09/17/86	UTA	**
30.5374	-91.052	E. Baton Rouge	Household	1140	39	01/09/39	Zone 1	**
30.9811	-9.1055	East Feliciana	Household	100	30	12/04/01	UTA	**
30.9038	-9.0991	East Feliciana	Household	105	70	01/07/87	Zone 1	**
30.883	-9.0979	East Feliciana	Household	100	70	03/25/93	UTA	**
30.5002	-91.094	E. Baton Rouge	Household	450	35	07/25/86	UTA	**
30.453	-91.187	E. Baton Rouge	Public-Institution	845	94.09	08/03/78	Zone 1	565
30.4641	-91.158	E. Baton Rouge	Public-Municipal	1618	72.02	09/04/58	Zone 1	1000
30.4641	-91.156	E. Baton Rouge	Public-Municipal	1605	77.65	09/04/58	Zone 1	1000
30.4636	-91.157	E. Baton Rouge	Public-Municipal	1599	151	02/01/74	Zone 1	1300
30.4638	-91.155	E. Baton Rouge	Public-Municipal	1592	165	02/23/77	Zone 1	1200
30.5122	-91.075	E. Baton Rouge	Public-Commercial	380	24	05/17/02	--	**
30.515	-91.071	E. Baton Rouge	Household	1266	39	03/16/39	Zone 1	**
30.4636	-91.154	E. Baton Rouge	Public-Municipal	2168	180.6	11/14/66	Zone 2	980
30.4625	-91.156	E. Baton Rouge	Public-Municipal	1604	75.39	09/04/58	Zone 1	1000
30.4627	-91.154	E. Baton Rouge	Public-Municipal	1601	89.4	10/10/60	Zone 1	735
30.5836	-91.004	E. Baton Rouge	Household	220	30	07/12/93	UTA	**
30.5877	-91.001	E. Baton Rouge	Household	265	30	07/03/92	UTA	**
30.9883	-9.1054	East Feliciana	Household	58	30	12/03/01	UTA	**
30.6061	-90.989	E. Baton Rouge	Household	1966	2	05/18/66	Zone 3	**
30.4477	-91.189	E. Baton Rouge	Public-Municipal	2687	165	08/31/93	Zone 3	1261
30.8899	-9.0978	East Feliciana	Household	360	125	11/15/84	Zone 1	19
30.5858	-91.001	E. Baton Rouge	Household	240	18	07/24/96	UTA	**
30.9808	-9.1045	East Feliciana	Household	250	40	01/28/01	Zone 1	**
30.4474	-91.189	E. Baton Rouge	Public-Municipal	2253	138.66	02/08/61	Zone 2	1135

Table 2.3-14 (Sheet 25 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.8447	-9.0959	East Feliciana	Household	140	60	06/01/84	Zone 1	19
30.5477	-91.031	E. Baton Rouge	Household	330	52	01/01/56	UTA	**
30.9297	-9.1	East Feliciana	Household	185	--	--	Zone 1	**
30.7405	-90.945	East Feliciana	Household	100	40	10/22/91	UTA	**
30.5819	-91.002	E. Baton Rouge	Household	265	30	06/29/92	UTA	**
30.8747	-9.0969	East Feliciana	Household	120	70	10/22/85	Zone 1	**
30.5336	-91.044	E. Baton Rouge	Household	210	15	04/05/00	UTA	**
30.8705	-9.0967	East Feliciana	Household	140	80	04/06/84	Zone 1	19
30.6036	-90.988	E. Baton Rouge	Irrigation	180	30	04/06/01	UTA	**
30.9794	-9.104	East Feliciana	Household	250	60	03/22/91	Zone 1	**
30.5852	-90.998	E. Baton Rouge	Household	240	22	05/15/03	--	**
30.9291	-9.0997	East Feliciana	Household	232	70	09/27/57	Zone 1	**
30.4786	-91.115	E. Baton Rouge	Public-Commercial	730	80	11/01/53	UTA	160
30.5774	-91.003	E. Baton Rouge	Household	170	40	03/21/03	UTA	**
30.4952	-91.087	E. Baton Rouge	Irrigation	460	55	05/24/88	UTA	**
30.448	-91.176	E. Baton Rouge	Public-Municipal	2242	207	04/21/87	Zone 2	**
30.448	-91.176	E. Baton Rouge	Public-Municipal	2694	147	05/13/87	Zone 3	**
30.883	-9.0969	East Feliciana	Household	160	70	12/01/01	UTA	**
30.8708	-9.0963	East Feliciana	Public-Institution	1051	92	05/11/71	Zone 2	**
30.8663	-9.0961	East Feliciana	Public-Institution	21	9.5	03/19/58	UTA	**
30.5783	-91	E. Baton Rouge	Household	280	20	02/19/04	--	**
30.543	-91.029	E. Baton Rouge	Household	2573	46.2	08/16/60	Zone 3	35
30.4488	-91.17	E. Baton Rouge	Industrial	2250	--	--	Zone 2	**
30.8774	-9.0964	East Feliciana	Household	385	64	09/24/57	Zone 1	8
30.5783	-90.998	E. Baton Rouge	Household	180	25	11/29/04	--	**
30.8794	-9.0964	East Feliciana	Household	146	76	03/05/86	Zone 1	20
30.5783	-90.997	E. Baton Rouge	Household	250	35	09/30/02	--	**
30.5802	-90.995	E. Baton Rouge	Household	160	40	09/06/00	UTA	**
30.5783	-90.996	E. Baton Rouge	Household	180	40	10/22/01	UTA	**
30.4813	-91.1	E. Baton Rouge	Irrigation	696	73.5	09/07/56	UTA	**
30.6141	-90.973	E. Baton Rouge	Irrigation	120	30	08/06/01	UTA	**
30.578	-90.995	E. Baton Rouge	Household	225	22	08/30/95	UTA	**
30.5761	-90.996	E. Baton Rouge	Household	240	35	04/17/03	--	**
30.5147	-91.053	E. Baton Rouge	Household	570	40	04/14/91	UTA	**
30.5794	-90.993	E. Baton Rouge	Household	260	30	04/16/87	UTA	30
30.4552	-91.144	E. Baton Rouge	Public-Municipal	1070	98	09/16/01	Zone 1	1251
30.5758	-90.995	E. Baton Rouge	Irrigation	260	35	05/22/03	--	**
30.455	-91.144	E. Baton Rouge	Public-Municipal	2143	126	04/02/64	Zone 2	1000
30.4547	-91.144	E. Baton Rouge	Public-Municipal	1075	93	02/27/97	Zone 1	1001

Table 2.3-14 (Sheet 26 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.4547	-91.144	E. Baton Rouge	Public-Municipal	1511	135	02/19/74	Zone 1	1120
30.4544	-91.143	E. Baton Rouge	Public-Municipal	2595	82	08/27/62	Zone 3	1000
30.5427	-91.02	E. Baton Rouge	Public-Rural	1763	111	05/02/01	Zone 2	1050
30.5424	-91.02	E. Baton Rouge	Public-Municipal	1876	74.5	04/08/87	Zone 2	1000
30.5424	-91.02	E. Baton Rouge	Public-Municipal	2682	--	--	Zone 3	**
30.578	-90.99	E. Baton Rouge	Public-Institution	2580	38	01/06/78	Zone 3	**
30.5777	-90.99	E. Baton Rouge	Public-Institution	1725	81	12/19/41	Zone 2	**
30.5777	-90.99	E. Baton Rouge	Public-Institution	2590	54.4	05/25/56	Zone 3	760
30.9891	-9.1034	East Feliciana	Household	290	85	11/30/00	Zone 1	**
30.4463	-91.153	E. Baton Rouge	Household	116	4	00/00/46	UTA	**
30.6127	-90.966	E. Baton Rouge	Irrigation	180	15	06/26/03	UTA	**
30.8252	-9.0937	East Feliciana	Household	120	70	04/10/85	Zone 1	10
30.4908	-91.074	E. Baton Rouge	Irrigation	363	40	02/10/87	UTA	**
30.8922	-9.096	East Feliciana	Household	115	50	12/05/01	UTA	**
30.755	-90.929	East Feliciana	Public-Institution	333	60	03/11/59	Zone 1	20
30.8936	-9.096	East Feliciana	Household	138	50	09/27/92	Zone 1	**
30.9897	-9.103	East Feliciana	Household	317	80	07/01/56	Zone 1	**
30.8905	-9.0958	East Feliciana	Household	120	50	03/20/87	Zone 1	**
30.8311	-9.0937	East Feliciana	Household	130	82	07/18/85	UTA	10
30.7491	-90.928	East Feliciana	Household	136	--	--	UTA	15
30.4308	-91.188	E. Baton Rouge	Household	280	12	06/04/64	UTA	**
30.8922	-9.0958	East Feliciana	Household	135	60	02/01/84	Zone 1	10
30.5277	-91.027	E. Baton Rouge	Irrigation	300	35	01/05/88	UTA	30
30.6116	-90.964	E. Baton Rouge	Household	160	40	08/31/01	UTA	**
30.4944	-91.064	E. Baton Rouge	Irrigation	360	50	07/21/03	--	200
30.4447	-91.149	E. Baton Rouge	Public-Municipal	2658	5.6	08/29/44	Zone 3	1090
30.9916	-9.1029	East Feliciana	Irrigation	425	102	05/01/57	Zone 1	**
30.4736	-91.094	E. Baton Rouge	Public-Municipal	880	113	05/25/06	Zone 1	2524
30.4733	-91.094	E. Baton Rouge	Public-Municipal	1707	135	07/14/00	Zone 1	1906
30.803	-9.0929	East Feliciana	Household	120	80	05/01/02	UTA	**
30.4461	-91.143	E. Baton Rouge	Public-Municipal	1739	72	08/15/63	Zone 1	1087
30.4736	-91.092	E. Baton Rouge	Irrigation	515	56	12/16/03	--	**
30.4727	-91.093	E. Baton Rouge	Public-Municipal	2480	165	05/11/06	Zone 3	2093
30.4463	-91.142	E. Baton Rouge	Public-Municipal	2637	86.03	07/25/61	Zone 3	1440
30.7477	-90.925	East Feliciana	Household	120	50	10/13/98	UTA	**
30.4724	-91.093	E. Baton Rouge	Public-Municipal	870	92	04/04/06	Zone 1	2476
30.8305	-9.0933	East Feliciana	Household	125	80	05/01/87	Zone 1	**
30.4463	-91.141	E. Baton Rouge	Public-Municipal	2633	153	05/06/93	Zone 3	1251
30.8291	-9.0933	East Feliciana	Household	290	80	09/19/92	Zone 1	**

Table 2.3-14 (Sheet 27 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.493	-91.063	E. Baton Rouge	Household	400	40	07/13/49	UTA	**
30.8297	-9.0933	East Feliciana	Household	240	80	04/13/93	Zone 1	**
30.8286	-9.0932	East Feliciana	Household	135	80	09/30/94	Zone 1	**
30.8894	-9.0953	East Feliciana	Household	115	50	10/02/87	UTA	**
30.5244	-91.026	E. Baton Rouge	Household	1101	46	08/29/36	Zone 1	**
30.565	-90.99	E. Baton Rouge	Household	250	35	07/24/03	--	**
30.7494	-90.924	East Feliciana	Household	150	70	10/23/03	UTA	**
30.8113	-9.0928	East Feliciana	Household	140	70	08/12/83	UTA	19
30.8474	-9.0937	East Feliciana	Household	100	60	06/28/90	Zone 1	**
30.4991	-91.054	E. Baton Rouge	Irrigation	160	10	07/20/93	UTA	**
30.9033	-9.096	East Feliciana	Household	95	60	06/04/86	UTA	**
30.8288	-9.0931	East Feliciana	Household	110	60	12/08/97	Zone 1	**
30.4449	-91.142	E. Baton Rouge	Public-Municipal	1745	55.43	09/04/58	Zone 1	810
30.7513	-90.923	East Feliciana	Household	120	70	11/26/01	UTA	**
30.8986	-9.0956	East Feliciana	Public-Rural	2200	230	07/02/87	Zone 3	800
30.8277	-9.0931	East Feliciana	Household	115	70	12/26/97	Zone 1	**
30.4938	-91.059	E. Baton Rouge	Public-Municipal	973	--	--	Zone 1	**
30.7874	-90.924	East Feliciana	Household	300	--	--	Zone 1	**
30.7858	-90.923	East Feliciana	Household	98	76.6	05/07/75	UTA	**
30.6636	-90.936	E. Baton Rouge	Household	165	25	07/18/90	UTA	**
30.7572	-90.921	East Feliciana	Household	127	60	00/00/46	UTA	**
30.5861	-90.972	Livingston	Household	238	20	02/26/46	UTA	**
30.7841	-90.921	East Feliciana	Household	135	70	07/10/86	UTA	**
30.9055	-9.0957	East Feliciana	Household	110	60	12/20/96	UTA	**
30.6575	-90.937	E. Baton Rouge	Household	148	20	10/17/98	UTA	**
30.6402	-90.943	E. Baton Rouge	Household	160	20	06/30/83	UTA	**
30.81	-9.0924	East Feliciana	Household	126	--	--	UTA	**
30.5652	-90.986	E. Baton Rouge	Household	2088	65	07/03/51	Zone 3	60
30.7894	-90.921	East Feliciana	Irrigation	130	--	--	UTA	**
30.5855	-90.971	Livingston	Public-Rural	225	25	08/02/85	UTA	150
30.8224	-9.0926	East Feliciana	Household	130	--	--	UTA	**
30.8791	-9.0944	East Feliciana	Household	125	40	10/10/86	UTA	**
30.9563	-9.0989	East Feliciana	Household	110	70	03/26/85	UTA	10
30.9455	-9.098	East Feliciana	Household	80	45	06/02/98	UTA	**
30.6605	-90.934	E. Baton Rouge	Irrigation	170	60	08/09/95	UTA	**
30.8224	-9.0925	East Feliciana	Household	130	50	08/07/98	UTA	**
30.9322	-9.0971	East Feliciana	Household	55	28	02/04/87	UTA	**
30.4861	-91.063	E. Baton Rouge	Public-Municipal	982	76	10/07/85	Zone 1	**
30.5819	-90.972	Livingston	Household	165	18	02/22/65	UTA	**

Table 2.3-14 (Sheet 28 of 28)
Domestic, Public, and Industrial Wells Within 25 Mi. from RBS Unit 1 Site

Location								
Latitude	Longitude	Parish	Use	Well Depth, ft.	Water Level, ft.	Date Meas.	Aquifer	Yield, gpm
30.5897	-90.967	Livingston	Household	250	25	06/21/91	UTA	**
30.5805	-90.973	Livingston	Irrigation	269	28	06/03/86	UTA	60
30.823	-9.0925	East Feliciana	Household	120	50	07/30/98	UTA	**
30.5894	-90.967	Livingston	Household	225	26	07/15/92	UTA	**
30.4394	-91.143	E. Baton Rouge	Household	481	70.42	10/23/61	UTA	**
30.5805	-90.972	Livingston	Household	245	22	08/10/93	UTA	**
30.9058	-9.0955	East Feliciana	Household	105	75	02/26/92	UTA	**
30.5749	-90.976	Livingston	Household	266	--	--	UTA	**
30.5283	-91.014	E. Baton Rouge	Household	330	27	03/12/99	UTA	**
30.5902	-90.966	Livingston	Household	2002	48	04/29/54	Zone 3	**
30.9611	-9.099	East Feliciana	Household	160	82	08/16/83	Zone 1	**
30.4861	-91.06	E. Baton Rouge	Public-Municipal	980	53.5	04/01/73	Zone 1	1000
30.6397	-90.939	E. Baton Rouge	Household	205	24	10/14/88	UTA	**
30.6394	-90.939	E. Baton Rouge	Household	155	13	02/28/85	UTA	19
30.9577	-9.0986	East Feliciana	Household	105	--	--	UTA	10
30.5163	-91.024	E. Baton Rouge	Household	1118	38	00/00/41	Zone 1	30
30.6608	-90.931	E. Baton Rouge	Household	140	40	01/11/84	UTA	10
30.6205	-90.947	E. Baton Rouge	Household	200	20	05/29/93	UTA	**
30.5861	-90.966	Livingston	Household	236	20	02/26/46	UTA	**
30.5583	-90.985	E. Baton Rouge	Household	210	20	00/00/57	UTA	**
30.658	-90.931	E. Baton Rouge	Public-Commercial	220	--	--	UTA	**
30.6247	-90.944	E. Baton Rouge	Household	200	21	09/29/92	UTA	**
30.9058	-9.0951	East Feliciana	Household	105	50	12/08/86	UTA	**
30.6616	-90.93	E. Baton Rouge	Household	70	25	12/06/90	UTA	**
30.9061	-9.0951	East Feliciana	Household	105	45	11/23/84	UTA	10
30.5058	-91.033	E. Baton Rouge	Household	1140	48.5	08/13/36	Zone 1	**
30.618	-90.947	E. Baton Rouge	Household	230	26	01/06/01	UTA	**
30.5111	-91.027	E. Baton Rouge	Household	365	34	02/08/92	UTA	**
30.638	-90.938	E. Baton Rouge	Household	160	20	10/15/83	UTA	10
30.6302	-90.94	E. Baton Rouge	Household	165	24	09/09/87	UTA	**
30.9652	-9.0988	East Feliciana	Household	110	60	12/09/87	UTA	**
30.6311	-90.939	E. Baton Rouge	Household	220	24	02/08/93	UTA	**
30.6311	-90.939	E. Baton Rouge	Household	225	24	06/13/88	UTA	**
30.643	-90.934	E. Baton Rouge	Household	120	20	03/08/99	UTA	**
30.6352	-90.937	E. Baton Rouge	Household	140	23	05/30/88	UTA	**
30.6477	-90.932	E. Baton Rouge	Household	300	22	09/15/04	--	**

** No yield information available.

-- No water level or aquifer information available.

Table 2.3-15
Variation in Chemical and Physical Characteristics of the Mississippi River near St. Francisville, Louisiana (USGS Data)

Characteristics[a]	Range in Concentration (1954 - 1968)	Range in Concentration[b] (1968 - 1977)	Percent of Time Vaues Were Equal to or Less Than Those Shown (1954 - 1968)										
			95	90	80	70	60	50	40	30	20	10	5
Silica	2.6 - 15	0.7 - 9.0	-	-	-	-	-	-	-	-	-	-	-
Calcium	25 - 61	26 - 53	50	48	46	44	42	40	38	36	34	32	31
Sodium	7.1 - 50	10 - 43	33	29	26	23	21	19	17	15	13	11	10
Magnesium	2.7 - 24	5.7 - 18.0	15	14	13	12	11	10	10	9	8	7	6
Bicarbonate	69 - 174	81 - 173	164	156	146	138	131	125	118	111	103	93	86
Sulfate	28 - 89	29 - 90	73	67	61	56	52	48	45	42	39	35	33
Chloride	11 - 44	12 - 63	35	31	28	26	23	21	20	18	16	14	13
Flouride	0.1 - 1.0	0.0 - 0.6	-	-	-	-	-	-	-	-	-	-	-
Nitrate	0.2 - 7.9	0 - 7	-	-	-	-	-	-	-	-	-	-	-
Hardness	75 - 204	94 - 200	185	176	165	156	149	142	136	129	122	112	105
Dissolved solids	111 - 342	152 - 336	300	283	264	250	240	230	220	210	200	185	174
Specific conductance[c]	173 - 683	198 - 567	535	490	450	425	400	380	360	335	310	280	260
Color[d]	5 - 100	0 - 200	50	-	-	15	-	10	-	-	-	-	-
Temperature[e]	1 - 31	2 - 31	28	27	26	23	21	18	14	11	9	7	5
Discharge[f]			1000	900	710	570	450	360	290	240	195	150	130
pH	6.7 - 8.2	6.6 - 8.2											

a) Chemical constituents in mg/l.
b) Does not include 1971, 1973.
c) Micromhos per cm at 25°C.
d) Units of the Platinum-Cobalt Scale.
e) °C.
f) Discharge in thousand cfs.

Source: Reference 2.3-22.

Table 2.3-16A (Sheet 1 of 2)
Monthly Variation in Selected Physicochemical Characteristics of the Missississippi River near RBS Site (LSU Data)

Parameter	1972										1973						
	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July
Discharge (cfs x 1000)	465-694	451-683	533-858	249-323	315-429	285-335	220-247	275-335	302-747	683-877	888-938	839-881	565-105	1112-1433	1207-1498	744-1216	309-643
Sample depth (m)	-	0-25	0-25	0-25	0-17	0.0-14.5	0-16	0-16	0-25	0-25	0-22	0-25	0-26	0-32	0-25	0-26	0-16
Temperature (°C)	-	16.3-17.3	22-24	27.5-29	26.2-29.5	28-31	27.5-29	21-23	8.2-17.8	4.6-7.1	3.1-6.0	4.9-7.0	9.8-12.9	9.8-16.2	15.5-18.0	23.0-27.8	27.8-29.1
Conductivity (μmhos/cm)	-	220-320	300-360	410-495	360-395	320-400	400-435	230-380	210-380	155-220	164-185	175-190	200-230	195-250	210-240	265-310	290-360
DO (mg/l)	-	7.0-8.6	5.1-6.6	5.3-7.0	5.8-6.4	5.2-6.4	5.1-6.9	6.6-8.6	7.5-10.1	8.9-12.0	9.9-13.0	10.0-11.7	8.0-11.2	5.0-10.3	6.4-7.6	3.3-6.8	5.8-7.2
pH	7.3-7.8	7.6-7.9	7.4-7.9	7.7-8.2	7.7-8.1	7.8-8.0	7.9-8.1	8.0-8.1	7.8-8.2	7.8-8.3	7.8-8.2	7.8-8.0	7.8-8.0	7.7-7.9	7.7-7.9	7.7-7.8	7.6-8.0
Turbidity (JTU)	-	30-99	65-233	49-258	90-245	123-273	51-125	150-188	125-290	131-360	157-222	28-273	144-350	137-211	130-188	128-153	101-320
Alkalinity (mg/l) (as $CaCO_3$)	68-74	64-100	80-100	50-190	80-110	100-140	130-160	100-132	100-164	80-132	24-110	23-110	90-150	96-150	80-114	100-154	110-150
Hardness (mg/l) (as $CaCO_3$)	110-144	130-194	138-168	140-220	110-190	132-180	160-190	154-160	150-190	108-320	130-200	110-180	120-160	70-114	140-180	134-182	150-200
Total iron (mg/l)	0.60-3.65	0.10-0.82	0.31-2.26	0.08-1.55	0.33-2.88	0.27-1.08	0.12-0.52	0.20-0.58	0.22-1.15	0.55-1.95	0.68-1.34	1.26-3.18	0.67-2.26	0.20-0.85	0.08-0.16	0.12-0.42	0.00-0.55
Silica (mg/l)	0.2-5.0	0.9-6.5	1.0-7.6	1.3-9.7	2.4-7.4	2.9-9.9	0.1-7.0	1.7-8.8	0.0-8.2	1.0-7.9	0-7	0.4-6.7	0.8-7.0	0.0-8.3	1.3-9.0	0.8-1.4	0.0-8.3
Sulfate (mg/l)	40-86	36-83	45-83	61-77	54-77	45-75	62-73	49-73	33-79	27-52	35-52	34-49	29-50	24/5/50	25-40	32-40	29/5/40
Total phosphate (mg/l)	0.0-4.7	0.0-3.1	0.0-1.5	0.1-1.4	0.1-1.4	0.0-1.3	0.4-4.1	0.0-0.9	0.0-1.6	0.0-0.9	0-2.4	0.0-1.3	0.0-1.0	0.0-0.5	0.0-0.4	0.0-1.1	0.0-2.3
Nitrate nitrogen (mg/l)	0.26-1.32	0.09-1.70	0.30-1.28	0.39-0.89	0.39-0.73	0.314-0.73	0.17-0.65	0.48-0.88	0.43-0.79	0.0-0.4	0.16-0.62	0.0-0.6	0.44-0.68	0.49-0.84	0.43-0.63	0.37-0.77	0.24-0.68

Table 2.3-16A (Sheet 2 of 2)
Monthly Variation in Selected Physicochemical Characteristics of the Missississippi River near RBS Site (LSU Data)

	1974				1975				1976				1977			
Parameter	**Jan-Mar**	**Apr-Jun**	**Jul-Sep**	**Oct-Dec**	**Jan-Mar**	**Apr-Jun**	**Jul-Sep**	**Oct-Dec**	**Jan-Mar**	**Apr-Jun**	**Jul-Sep**	**Oct-Dec**	**Jan-Mar**	**Apr-Jun**	**Jul-Sep**	**Oct-Dec**
Discharge (cfs x 1000)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sample depth (m)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Temperature (°C)	8.8-9.8	15-18	27.7-28.0	11.3-11.9	8.1-8.2	18.3-18.5	30.5-31.5	17.8-18.5	5.0-5.0	19.0-20.0	29-29.5	9.5-9.5	7.2-8.5	24-25	26.7-27.2	15.0-15.0
Conductivity (µmhos/cm)	225-231	296-314	350-357	345-371	335-335	320-325	389-394	370-422	277-277	334-344	372-374	341-348	394-410	307-322	421-428	344-344
DO (mg/l)	9.8-10.1	5.5-7.4	6.9-7.7	8.5-9.2	10.4-11.8	6.4-7.1	6.9-8.3	6.9-7.2	11.8-12.6	6.4-7.1	7.6-9.0	9.6-10.0	10.6-11.2	6.0-7.1	5.6-6.0	7.8-8.1
pH	7.7-8.2	7.3-7.5	7.7-7.8	8.1-8.2	7.9-8.0	7.8-7.9	7.5-8.4	7.6-7.6	7.9-8.4	8.0-8.1	7.8-8.3	7.7-8.0	7.8-8.1	7.6-8.1	7.8-8.1	7.8-8.1
Turbidity (JTU)	112-137	-	32-86	168-228	104-172	197-258	39-123	80-134	157-168	86-128	30-61	73-106	65-88	134-217	71-157	194-273
Alkalinity (mg/l) (as $CaCO_3$)	70-76	104-120	128-144	110-136	90-96	90-96	154-174	126-134	113-132	138-149	150-168	106-112	151-163	116-120	152-158	101-106
Hardness (mg/l) (as $CaCO_3$)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total iron (mg/l)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silica (mg/l)	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Sulfate (mg/l)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total phosphate (mg/l)	0.09-0.90	0.0-0.9	0.0-0.9	0.1-0.9	0.1-0.9	0.0-0.9	0.0-0.6	0.2-0.7	0.1-0.5	0.2-0.8	0.1-0.8	0.2-0.8	0.2-0.5	0.1-1.1	0.3-0.9	0.4-1.3
Nitrate nitrogen (mg/l)	0.4-0.6	0.3-0.7	0.1-0.1	0.2-0.5	0.8-1.0	0.9-1.0	0.4-0.6	0.3-0.6	2.2-5.6	0.4-3.1	0.0-1.9	0.2-2.8	0.0-2.2	0.0-4.9	0.7-7.2	0.4-3.7

Note: Values given are recorded ranges.

Source: Reference 2.3-23.

Table 2.3-16B
Alligator Bayou Water Quality Characteristics
(LSU Data)

Parameter	1972-1973	1974				1975				1976				1977			
	May 1972-July 1973	Jan-Mar[a]	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
Temperature (°C)	9.5-27.5	12.2	19.8-21.2	23.5-26.0	10.5-12.8	12.5-21.0	18.5-19.0	25.0-29.0	19.0-22.0	11.3-16.0	19.0-19.7	25.5-28.0	13.5-20.0	10-14.5	18.5-21.5	26.3-29.0	15.5-17.8
Conductivity (μmhos/cm)	5-300	144	150-160	105-195	90-130	110-205	40-295	87-159	89-165	144-208	56-83	96-106	97-178	70-124	90-124	107-123	92-107
DO (mg/l)	0.4-10.3	5.8	2.0-3.0	1.9-6.2	5.9-10.3	0.2-8.3	7.5-8.3	1.2-5.9	2.7-7.7	7.5-10.4	2.3-5.8	0.4-8.2	1.4-8.3	5.4-11.0	2.3-7.8	1.6-6.0	1.0-6.7
pH	6.8-7.9	7.5	6.9-7.1	6.6-6.8	6.5-7.1	6.6-7.0	6.7-7.6	6.5-7.1	6.9-7.2	6.8-7.0	6.9-7.3	6.5-7.4	6.6-7.3	6.5-6.8	6.8-7.0	7.2-7.8	6.9-7.5
Turbidity (JTU)	44-700	92	-	106-140	54-157	80-104	164-490	38-172	99-125	84-184	84-233	22-90	68-200	44-80	86-134	131-395	90-250
Alkalinity (mg/l) (as $CaCO_3$)	10-330	56	10-20	-	42-52	36-80	9-82	52-106	42-96	50-77	44 -64	38-53	36-48	22-36	42-78	45-49	28-45
Hardness (mg/l) (as $CaCO_3$)	0.0-3.6	0.9	0.1-0.5	0.5-0.9	0.1-0.1	0.2-0.6	0.0-0.3	0.1-0.7	0.1-0.2	-	0.2-0.4	0.0-0.4	0.1-0.2	0.2-0.4	0.3-0.6	0.5-0.9	0.4-0.9
Total phosphate (mg/l)	0.00-0.42	0.1	0.1-0.2	0.00-0.05	0.1-0.2	0.1-0.1	0.2-1.2	0.1-0.3	0.1-0.2	0.4-1.6	0.0-1.6	0.4-1.6	0.0-0.7	0.2-1.0	0.2-1.3	0.0-0.6	0.0-0.4
Nitrate nitrogen (mg/l)	9.5-27.5	12.2	19.8-21.2	23.5-26.0	10.5-12.8	12.5-21.0	18.5-19.0	25.0-29.0	19.0-22.0	11.3-16.0	19.0-19.7	25.5-28.0	13.5-20.0	10-14.5	18.5-21.5	26.3-29.0	15.5-17.8

a) Ranges not tabulated; one sampling day only.

Note: Values given are recorded ranges for all data stations.

Source: Reference 2.3-23.

Table 2.3-16C
Grants Bayou Water Quality Characteristics
(LSU Data)

Parameter	1972		1973		1974		1975				1976				1977			
	Oct	Dec	Jun	Aug[a]	Sep	Oct-Dec (Range)	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep[b]	Oct-Dec[b]	Jan-Mar	Apr-Jun	Jul-Sep[b]	Oct-Dec
Temperature (°C)	19.0	12.3	25.0	24.2	27.4	16.5-18.7	13.1-16.8	22.1-24.5	27.0-27.5	22.5-23.0	16.0-17.0	17.5-18.0	21.5	19.8	12.0-18.7	23.5-24.0	29.0	18.9-19.0
Conductivity (μmhos/cm)	60	65	90	238	70	70-100	95-100	43-75	65-70	160-175	105-120	98-105	120	114	79-123	90-104	116	83-111
DO (mg/l)	7.5	8.9	4.2	3.2	0.6	4.2-8.4	7.0-12.6	6.4-7.9	5.5-6.9	3.6-4.8	8.5-9.5	6.7-8.9	8.6	8.8	8.8-11.8	8.5-9.1	6.6	7.9-8.5
pH	7.2	7.9	7.5	7.1	7.2	7.4-7.4	6.6-7.0	6.4-6.6	6.2-6.5	6.4-6.7	7.0-7.4	6.8-7.3	6.5	6.6	6.2-7.2	6.9-7.2	8.4	7.6-7.8
Turbidity (JTU)	-	44	-	79	-	112-123	49-56	49-56	168-172	81-86	75-106	0-42	0	56	77-84	30-47	188	56-68
Alkalinity (mg/l) (as $CaCO_3$)	-	52	-	18	-	25-26	37-38	28-30	28-29	54-92	24-33	32-54	37	47	16-28	24-38	41	20-36
Hardness (mg/l) (as $CaCO_3$)	-	42	-	70	-	-	-	-	-		-	-	-	-	-	-	-	-
Total phosphate (mg/l)	-	1.04	-	3.36	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate nitrogen (mg/l)	-	8.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

a) Values are from periodic sampling, unless otherwise noted.

b) One sampling period only.

Note: Values given are recorded ranges.

Source: Reference 2.3-23.

Table 2.3-17 (Sheet 1 of 6)
Water Quality Samples for Louisiana
USGS - Mississippi River near St. Francisville, Louisiana

Code		10	95	300	310	400	608	613	623	631	666	671	681	915	925	930
														Hardness Components		
Date	Time	Water Temper-ature	Specific Conduct-ance	Dissolved Oxygen	Biochemical Oxygen Demand (BOD)	pH, Field	Ammonia	Nitrite	Ammonia + Organic Nitrogen	Nitrite + Nitrate	Phos-phorus	Ortho-phosphate	Organic Carbon	Calcium	Magnesium	Sodium
1/13/2004	10:30	6.6	367	11.3		7.7	< .04	0.011	0.23	1.45	0.063	0.050	3.1	40.1	12.2	15.8
1/29/2004	10:30	5.7	328	11.6	2.7	7.8	< .04	0.008	0.28	1.35	0.054	0.045	3.4	37.3	10.8	14
2/17/2004	10:30	4.3	289	12.3	3.0	7.6	E .03	E .005	0.23	0.92	0.045	0.034	2.8	30.3	8.1	12.1
3/2/2004	10:30	8.2	307	11.5		7.5	E .04	0.014	0.31	0.96	0.043	0.036	7.2	33.3	9.5	15.1
3/16/2004	10:30	10.6		10.8	2.0	7.3	< .04	0.035	0.30	1.65	0.075	0.060	3.7	41.7	12.6	29.7
3/30/2004	10:30	13.7	350	8.2		7.3	< .04	0.025	0.30	1.54	0.061	0.048	3.8	37.7	10.6	17.9
5/6/2004	10:00	18.6	297	7.4	0.3	7.8	E .03	< .008	0.25	1.03	0.055	0.041	3.4	30.4	8.3	14.1
5/18/2004	10:30	21.4	307	7.3	1.1	7.6	< .04	< .008	0.24	1.09	0.057	0.044	4	33.9	10.1	12.8
6/8/2004	9:00	24.6	385	6.2	1.1	7.3	< .04	< .008	0.27	2.40	0.088	0.069	3.3	38.5	12.2	17.1
6/22/2004	9:00	26.7	360	6.1	0.6	7.4	< .04	< .008	0.27	2.48	0.094	0.081	4	39.0	11.3	13.7
7/20/2004	10:00	29.3	399	7.2	0.5	7.3	< .04	< .008	0.30	1.80	0.106	0.093	4.1	39.6	12.2	17.1
8/17/2004	9:30	26.7	400	9.6	0.9	7.8	< .04	< .008	0.21	1.20	0.087	0.071	2.9	40.6	13.1	16.7
9/14/2004	10:00	26.7	340	6.7	1.5	7.3	< .04	< .008	0.26	0.87	0.104	0.094	3.5	35.3	10.8	15.9
10/26/2004	10:30	20.5	383	9.5		8.4	< .04	< .008	0.24	1.07	0.086	0.075	3.4	41.9	13.9	17.5
11/16/2004	9:30	15.5	325	10.1	1.7		< .04	< .008	0.29	1.08	0.103	0.084	4	31.8	10.2	13.9
12/21/2004	9:00	8.5	279	10.4	3.0		< .04	0.009	0.25	1.15	0.068	0.053	3.7	29.4	8.3	10.7

Table 2.3-17 (Sheet 2 of 6) Water Quality Samples for Louisiana USGS - Mississippi River near St. Francisville, Louisiana

Code		10	95	300	310	400	608	613	623	631	666	671	681	915	925	930
														Hardness Components		
Date	Time	Water Temper-ature	Specific Conduct-ance	Dissolved Oxygen	Biochemical Oxygen Demand (BOD)	pH, Field	Ammonia	Nitrite	Ammonia + Organic Nitrogen	Nitrite + Nitrate	Phos-phorus	Ortho-phosphate	Organic Carbon	Calcium	Magnesium	Sodium
2/2/2005	10:30	5.4	279	11.3	3.1	7.6	E .03	0.011	0.28	1.31	0.052	0.041	3.3	32.2	8.2	10.4
3/22/2005	11:00	9.3	391	11.5	4.0	7.7	< .04	0.010	0.25	1.58	0.061	0.046	2.5	42.9	13.0	15.4
4/13/2005	9:30	14.4	371	9.2		7.7	< .04	0.025	0.24	1.27	E .059	0.046	2.9	38.4	11.2	19.2
4/27/2005	9:30	18.6	342	8.0	1.6	7.7	< .04	< .008	0.41	1.16	0.063	0.044	3.5	33.8	11.0	13.9
5/10/2005	10:30	17.8	380	8.9	0.7	7.5	< .04	< .008	0.25	1.62	0.068	0.055	2.9	40.3	13.6	15.6
5/24/2005	9:30	23.5	414	8.4	1.6	7.9	< .04	< .008	0.24	1.67	0.060	0.046	3	43.8	15.2	16.5
6/14/2005	10:00	26.9	459	7.3	1.1	7.6	< .04	< .008	0.46	2.57	0.088	0.065	3.3	50.2	16.5	18.1
6/28/2005	10:00		462	6.5	0.9	7.8	< .04	< .008		1.91			2.9	44.1	14.2	24.7
7/12/2005	10:00	29.3	489	7.6	1.5	8.0	< .04	< .008	0.51	1.93	0.125	0.079	3.7	47.8	15.6	23.8
8/10/2005	10:30	30.2	452	7.6	2.3	8.2	< .04	< .008	0.56	0.78	0.070	0.040	3.3	45.0	15.1	21.8
9/7/2005	10:30	28.0	435		1.7	8.0	< .04	< .008	0.56	0.61	0.109	0.072	4.5	38.9	13.3	26.3
Average		18.1	369	8.9	1.7	7.7		0.016	0.31	1.42	0.075	0.058	3.6	38.5	11.9	17.0

Table 2.3-17 (Sheet 3 of 6)
Water Quality Samples for Louisiana
USGS - Mississippi River near St. Francisville, Louisiana

Code		935	940	945	1000	29836	29841	31625	31673	39086	50624	61028	61726	70300	70953	80154
Date	Time	Potassium	Chloride	Sulfate	Arsenic	Lead	Mercury	Fecal Coliform	Fecal Streptococci	Alka-linity	Absorbance, UV, 254 nm	Turbidity	Absorbance, UV, 280 nm	Residue	Chloro-phyll a	Suspended Sediment
1/13/2004	10:30	2.85	20.1	40.5	0.8			150	56		0.080	59.0	0.059	211	1.8	122
1/29/2004	10:30	3.03	17.9	34.2	0.8			500	260	97	0.097	90.0	0.072	199	E 2.6	214
2/17/2004	10:30	2.24	15.6	31.4	0.7			92	137	84	0.092	4.3	0.073	176	1.8	205
3/2/2004	10:30	2.72	17.0	31.2	0.7			67	60	86	0.086	74.0	0.064	185	3.4	163
3/16/2004	10:30	3.29	39.5	44.4	0.9			83	56	104	0.102	140.0	0.076	257	6.4	316
3/30/2004	10:30	3.19	24.2	33.5	0.9			93	21	96	0.108	78.0	0.081	205	4.8	162
5/6/2004	10:00	2.56	18.1	32.9	0.9	50	0.04		17	79	0.114	65.0	0.085	182	4.5	147
5/18/2004	10:30	2.91	15.7	29.5	1.1			110	160	95	0.126	99.0	0.093	182	4.3	191
6/8/2004	9:00	3.41	21.1	44.4	1.2			320	56	101	0.111	340.0	0.082	226	3.5	318
6/22/2004	9:00	3.66	17.9	28.1	1.5	86	0.08	40	38	106	0.126	96.0	0.093	209	2.3	152
7/20/2004	10:00	3.30	22.4	37.4	1.8	29	0.07	30	21	115	0.122	67.0	0.089	237	5.7	128
8/17/2004	9:30	3.31	20.6	45.1	1.6			16	6	105	0.089		0.064	232		77
9/14/2004	10:00	3.74	15.9	38.4	1.6	33	< .01	58	32	96	0.113		0.084	199	5.1	175
10/26/2004	10:30	3.67	17.6	41.0	1.6			210	82	121	0.090		0.065	219		70
11/16/2004	9:30	4.08	17.0	33.7	1.3			180	E 40	96	0.129		0.097	198		201
12/21/2004	9:00	2.93	13.1	26.9	0.9	28	0.05	96	E 78	87	0.114		0.086	170	1.6	172

Table 2.3-17 (Sheet 4 of 6)
Water Quality Samples for Louisiana
USGS - Mississippi River near St. Francisville, Louisiana

Code		935	940	945	1000	29836	29841	31625	31673	39086	50624	61028	61726	70300	70953	80154
Date	**Time**	**Potassium**	**Chloride**	**Sulfate**	**Arsenic**	**Lead**	**Mercury**	**Fecal Coliform**	**Fecal Streptococci**	**Alka-linity**	**Absorbance, UV, 254 nm**	**Turbidity**	**Absorbance, UV, 280 nm**	**Residue**	**Chloro-phyll a**	**Suspended Sediment**
2/2/2005	10:30	3.09	14.1	28.7	0.7	30	0.07	140	104	81	0.108		0.081	169	3.09	14.1
3/22/2005	11:00	2.65	22.2	38.8	0.8			160	84	115	0.076		0.056	222	2.65	22.2
4/13/2005	9:30	2.85	26.0	39.6	0.8			95	E 29	96	0.095		0.072	210	2.85	26.0
4/27/2005	9:30	2.75	18.0	34.8	0.9	26	0.07	E 11	E 17	103	0.109		0.081	203	2.75	18.0
5/10/2005	10:30	3.03	20.0	43.8	1.0			42	E 6	108	0.098		0.072	230	3.03	20.0
5/24/2005	9:30	3.06	18.2	43.4	1.1			E 8	E 3	126	0.091		0.066	244	3.06	18.2
6/14/2005	10:00	3.17	24.4	46.2	1.5	12	0.04	E 5	E 3	138	0.089		0.064	267	3.17	24.4
6/28/2005	10:00	3.60	31.7	51.3	1.7			E 46	E 9	118	0.102		0.075	268	3.60	31.7
7/12/2005	10:00	3.78	30.0	51.4	2.1	13	0.06	E 21	E 5	139	0.121		0.089	288	3.78	30.0
8/10/2005	10:30	3.19	23.5	52.1	2.0			E 34	E 2	135	0.087		0.063	264	3.19	23.5
9/7/2005	10:30	3.72	34.2	49.4	2.0	30	0.03	E 33	E 7	107	0.102		0.075	252	3.72	34.2
Average		3.18	21.3	39.0	1.2	34	0.06	131	74	105	0.103	101.1	0.076	219	3.18	21.3

Legend

< Actual value is known to be less than the value shown.
> Actual value is known to be greater than the value shown.
A Average value.
E Estimated value.
M Presence of material verified but not quantified.
N Presumptive evidence of presence of material.
S Most probable value.
U Material specifically analyzed for but not detected.
V Value affected by contamination.

Table 2.3-17 (Sheet 5 of 6)
Water Quality Samples for Louisiana
USGS - Mississippi River near St. Francisville, Louisiana
Code Legend

Code	Description
00010	Temperature, water, degrees Celsius
00095	Specific conductance, water, unfiltered, microsiemens per centimeter at 25 degrees Celsius
00300	Dissolved oxygen, water, unfiltered, milligrams per liter
00310	Biochemical oxygen demand, water, unfiltered, 5 days at 20 degrees Celsius, milligrams per liter
00400	pH, water, unfiltered, field, standard units
00608	Ammonia, water, filtered, milligrams per liter as nitrogen
00613	Nitrite, water, filtered, milligrams per liter as nitrogen
00623	Ammonia plus organic nitrogen, water, filtered, milligrams per liter as nitrogen
00631	Nitrite plus nitrate, water, filtered, milligrams per liter as nitrogen
00666	Phosphorus, water, filtered, milligrams per liter
00671	Orthophosphate, water, filtered, milligrams per liter as phosphorus
00681	Organic carbon, water, filtered, milligrams per liter
00915	Calcium, water, filtered, milligrams per liter
00925	Magnesium, water, filtered, milligrams per liter
00930	Sodium, water, filtered, milligrams per liter
00935	Potassium, water, filtered, milligrams per liter

Table 2.3-17 (Sheet 6 of 6)
Water Quality Samples for Louisiana
USGS - Mississippi River near St. Francisville, Louisiana
Code Legend

Code	Description
00940	Chloride, water, filtered, milligrams per liter
00945	Sulfate, water, filtered, milligrams per liter
01000	Arsenic, water, filtered, micrograms per liter
29836	Lead, suspended sediment, total digestion, dry weight, micrograms per gram
29841	Mercury, suspended sediment, total digestion, dry weight, micrograms per gram
31625	Fecal coliform, M-FC MF (0.7 micron) method, water, colonies per 100 milliliters
31673	Fecal streptococci, KF streptococcus MF method, water, colonies per 100 milliliters
39086	Alkalinity, water, filtered, incremental titration, field, milligrams per liter as calcium carbonate
50624	Absorbance, UV, 254 nm, 1 cm pathlength, water, filtered, units per centimeter
61028	Turbidity, water, unfiltered, field, nephelometric turbidity units
61726	Absorbance, UV, organic constituents, 280 nm, 1 cm pathlength, water, filtered, units per centimeter
70300	Residue on evaporation, dried at 180 degrees Celsius, water, filtered, milligrams per liter
70953	Chlorophyll a, phytoplankton, chromatographic-fluorometric method, micrograms per liter
80154	Suspended sediment concentration, milligrams per liter

Source: Reference 2.3-22.

Table 2.3-18 (Sheet 1 of 6)
Water Quality Samples for Louisiana
USGS - Mississippi River at Baton Rouge, Louisiana

Code		10	95	300	310	400	608	613	623	631	666	671	681	915	925	930
														Hardness Components		
Date	Time	Water Temper-ature	Specific Conduct-ance	Dissolved Oxygen	Biochemical Oxygen Demand (BOD)	pH, Field	Ammonia	Nitrite	Ammonia + Organic Nitrogen	Nitrite + Nitrate	Phos-phorus	Ortho-phosphate	Organic Carbon	Calcium	Magnesium	Sodium
1/14/2004	12:45		402			7.8	< .04	0.013		1.50		0.050				
1/26/2004	7:30		324			7.6	< .04	0.009		1.34		0.040				
2/9/2004	11:30		339			7.5	0.06	0.010		1.02		E .01				
3/3/2004	10:30		330			7.6	0.04	0.016		0.99		0.040				
3/17/2004	12:00		441			7.8	< .04	0.027		1.63		0.060				
4/8/2004	12:00		419			7.6	< .04	0.023		1.93		0.050				
5/11/2004	7:30		341			7.7	< .04	E .006		1.21		0.050				
5/18/2004	13:30	21.4	301	7.2	1.3	7.6	< .04	< .008	0.24	1.07	0.055	0.044	3.9	32.0	8.56	12.2
6/9/2004	8:30	25.5	385	5.7	3.0	7.5	< .04	< .008	0.29	2.34	0.085	0.066	4.0	38.0	12.00	17.0
6/23/2004	8:00	26.8	364	6.4	0.7	7.4	< .04	< .008	0.20	2.47	0.098	0.082	4.1	39.0	11.60	13.8
7/7/2004	8:00		324			7.7	0.27	< .008		2.42		0.510				
7/21/2004	9:30	29.4	402	7.0		7.4	< .04	< .008	0.29	1.81	0.106	0.094	4.0	41.1	12.80	18.2
8/5/2004	6:30		427			7.7	E .03	< .008		2.09		0.160				
8/9/2004	0:01									0.99						
8/16/2004	0:01									0.99						
8/16/2004	11:30									1.15						
8/18/2004	10:30	26.9	406	9.6		8.1	< .04	< .008	0.24	1.21	0.087	0.072	3.0	40.5	13.30	17.1
9/15/2004	10:00	26.7	334	6.8	0.1	7.8	< .04	< .008	0.24	0.88	0.106	0.096	3.2	32.9	10.80	15.9
10/27/2004	9:30	20.8	393	8.6	1.9	7.9	< .04	< .008	0.23	1.07	0.088	0.077	3.2	40.0	13.20	16.9
11/17/2004	8:30	15.5	320	8.7	1.6	8.0	< .04	< .008	0.31	1.04	0.105	0.084	4.0	30.8	9.60	13.6
12/21/2004	13:15	8.8	282	10.4	2.3		< .04	0.008	0.28	1.16	0.070	0.050	3.8	29.4	8.38	10.8

Table 2.3-18 (Sheet 2 of 6) Water Quality Samples for Louisiana USGS - Mississippi River at Baton Rouge, Louisiana

Code		10	95	300	310	400	608	613	623	631	666	671	681	915	925	930
														Hardness Components		
Date	Time	Water Temper-ature	Specific Conduct-ance	Dissolved Oxygen	Biochemical Oxygen Demand (BOD)	pH, Field	Ammonia	Nitrite	Ammonia + Organic Nitrogen	Nitrite + Nitrate	Phos-phorus	Ortho-phosphate	Organic Carbon	Calcium	Magnesium	Sodium
1/31/2005	11:00	5.8	285	13.0	2.1	7.8	E .03	0.011	0.31	1.28	0.050	0.040	3.3	31.1	7.98	10.4
3/23/2005	9:00	9.6	389	11.6	2.5	7.9	< .04	0.011	0.24	1.67	0.059	0.048	2.4	43.6	13.20	15.8
4/14/2005	9:00	14.7	367	10.5	2.0	7.3	< .04	0.024	0.24	1.25	0.056	0.045	3.0	37.9	11.20	20.0
4/28/2005	10:00	18.8	343	7.5	1.5	7.7	< .04	< .008	0.33	1.15	0.063	0.050	3.8	34.0	11.20	14.1
5/11/2005	9:00	18.1	381	8.8	1.5	7.8	< .04	< .008	0.25	1.80	0.066	0.055	2.9	39.9	13.40	15.2
5/25/2005	10:30	23.9	410	8.4	1.9	7.9	< .04	E .005	0.25	1.68	0.060	0.049	3.2	43.5	15.10	16.8
6/15/2005	9:15	27.2		7.3	1.2	7.6							3.3			
6/29/2005	9:00	28.4	474	6.5	0.7	7.7	< .04	< .008	0.89	1.89	0.109	0.058	3.2	42.9	13.70	24.2
7/13/2005	9:30	29.4	492	7.6	0.6	8.0	< .04	< .008	0.47	1.90	0.116	0.082	3.5	46.9	15.50	23.7
8/9/2005	12:30	30.5	451	7.9		8.2	< .04	< .008	0.48	0.82	0.069	0.041	3.7	45.6	15.10	22.3
9/8/2005	9:30	28.0	426	6.3		7.8	< .04	< .008	0.55	0.62	0.111	0.076	3.6	40.8	13.90	27.8
Average		21.8	377	8.3	1.6	7.7	0.123	0.015	0.33	1.43	0.08	0.080	3.5	38.4	12.13	17.1

Table 2.3-18 (Sheet 3 of 6)
Water Quality Samples for Louisiana
USGS - Mississippi River at Baton Rouge, Louisiana

Code		935	940	945	1000	29836	29841	31625	31673	39086	50624	61028	61726	70300	70953	80154
Date	Time	Potassium	Chloride	Sulfate	Arsenic	Lead	Mercury	Fecal Coliform	Fecal Streptococci	Alka-linity	Absorbance, UV, 254 nm	Turbidity	Absorbance, UV, 280 nm	Residue	Chloro-phyll a	Suspended Sediment
1/14/2004	12:45															
1/26/2004	7:30															
2/9/2004	11:30															
3/3/2004	10:30															
3/17/2004	12:00															
4/8/2004	12:00															
5/11/2004	7:30															
5/18/2004	13:30	2.66	15.3	29.2	1.0			150	248	84	0.126	100	0.093	180	4.5	215
6/9/2004	8:30	3.40	20.7	44.0	1.3			170	73	99	0.110	340	0.082	221	2.8	324
6/23/2004	8:00	3.63	18.3	28.3	1.6	55	0.09	170	103	102	0.127	92	0.093	221	3.6	170
7/7/2004	8:00															
7/21/2004	9:30	3.43	23.8	37.8	1.8	55	0.09	21	14	112	0.122	67	0.089	238	6.8	120
8/5/2004	6:30															
8/9/2004	0:01															
8/16/2004	0:01															
8/16/2004	11:30															
8/18/2004	10:30	3.32	21.3	46.4	1.7			13	27	115	0.090		0.064	231	13.7	89
9/15/2004	10:00	3.87	15.7	38.3	1.7	34	< .01	21	56	97	0.114		0.084	199	5.2	168
10/27/2004	9:30	3.47	17.5	41.4	1.5					121	0.092		0.067	228		384
11/17/2004	8:30	4.07	16.9	32.8	1.3			120	103	96	0.132		0.099	198		186
12/21/2004	13:15	2.96	13.2	27.2	0.9	23	0.16	180	104	85	0.114		0.086	169	1.6	208

Table 2.3-18 (Sheet 4 of 6)
Water Quality Samples for Louisiana
USGS - Mississippi River at Baton Rouge, Louisiana

Code		935	940	945	1000	29836	29841	31625	31673	39086	50624	61028	61726	70300	70953	80154
Date	Time	Potassium	Chloride	Sulfate	Arsenic	Lead	Mercury	Fecal Coliform	Fecal Streptococci	Alka-linity	Absorbance, UV, 254 nm	Turbidity	Absorbance, UV, 280 nm	Residue	Chloro-phyll a	Suspended Sediment
1/31/2005	11:00	3.03	14.9	28.6	0.7	23	0.04	260	E 111	81	0.112		0.084	182	2.0	
3/23/2005	9:00	2.73	22.2	39.3	0.9			360	E 16	112	0.076		0.056	225	5.4	106
4/14/2005	9:00	2.85	26.1	39.6	0.8			130	E 36	95	0.093		0.070	206	2.7	222
4/28/2005	10:00	2.84	18.3	34.8	1.0	43	0.07	75	E 2	103	0.112		0.083	202		155
5/11/2005	9:00	3.00	19.7	43.6	0.9			E 43	E 11	106	0.090		0.066	225	1.9	192
5/25/2005	10:30	3.10	18.4	43.7	1.1			E 7	E 5	126	0.091		0.067	253	3.7	68
6/15/2005	9:15		24.6	46.6		13	0.04	E 6	E 4	138	0.089		0.064	273	5.1	67
6/29/2005	9:00	3.52	31.6	51.3	1.6			67	E 4	119	0.104		0.077	268	3.0	217
7/13/2005	9:30	3.70	30.0	51.5	2.1	23	0.04	E 13	E 5	140	0.110		0.080	282	7.9	71
8/9/2005	12:30	3.18	23.8	52.7	2.0			E 4	< 2	129	0.090		0.065	257	E 23.1	72
9/8/2005	9:30	3.92	33.9	49.7	2.2	24	0.06	E 30	E 8	105	0.104		0.077	255	12.5	59
Average		3.30	21.3	40.3	1.4	33	0.07	134	91	108	0.105	150	0.077	226	5.2	163

Legend

- < Actual value is known to be less than the value shown.
- > Actual value is known to be greater than the value shown.
- A Average value.
- E Estimated value.
- M Presence of material verified but not quantified.
- N Presumptive evidence of presence of material.
- S Most probable value.
- U Material specifically analyzed for but not detected.
- V Value affected by contamination.

Table 2.3-18 (Sheet 5 of 6) Water Quality Samples for Louisiana USGS - Mississippi River at Baton Rouge, Louisiana Code Legend

Code	Description
00010	Temperature, water, degrees Celsius
00095	Specific conductance, water, unfiltered, microsiemens per centimeter at 25 degrees Celsius
00300	Dissolved oxygen, water, unfiltered, milligrams per liter
00310	Biochemical oxygen demand, water, unfiltered, 5 days at 20 degrees Celsius, milligrams per liter
00400	pH, water, unfiltered, field, standard units
00608	Ammonia, water, filtered, milligrams per liter as nitrogen
00613	Nitrite, water, filtered, milligrams per liter as nitrogen
00623	Ammonia plus organic nitrogen, water, filtered, milligrams per liter as nitrogen
00631	Nitrite plus nitrate, water, filtered, milligrams per liter as nitrogen
00666	Phosphorus, water, filtered, milligrams per liter
00671	Orthophosphate, water, filtered, milligrams per liter as phosphorus
00681	Organic carbon, water, filtered, milligrams per liter
00915	Calcium, water, filtered, milligrams per liter
00925	Magnesium, water, filtered, milligrams per liter
00930	Sodium, water, filtered, milligrams per liter
00935	Potassium, water, filtered, milligrams per liter

Table 2.3-18 (Sheet 6 of 6)
Water Quality Samples for Louisiana
USGS - Mississippi River at Baton Rouge, Louisiana
Code Legend

Code	Description
00940	Chloride, water, filtered, milligrams per liter
00945	Sulfate, water, filtered, milligrams per liter
01000	Arsenic, water, filtered, micrograms per liter
29836	Lead, suspended sediment, total digestion, dry weight, micrograms per gram
29841	Mercury, suspended sediment, total digestion, dry weight, micrograms per gram
31625	Fecal coliform, M-FC MF (0.7 micron) method, water, colonies per 100 milliliters
31673	Fecal streptococci, KF streptococcus MF method, water, colonies per 100 milliliters
39086	Alkalinity, water, filtered, incremental titration, field, milligrams per liter as calcium carbonate
50624	Absorbance, UV, 254 nm, 1 cm pathlength, water, filtered, units per centimeter
61028	Turbidity, water, unfiltered, field, nephelometric turbidity units
61726	Absorbance, UV, organic constituents, 280 nm, 1 cm pathlength, water, filtered, units per centimeter
70300	Residue on evaporation, dried at 180 degrees Celsius, water, filtered, milligrams per liter
70953	Chlorophyll a, phytoplankton, chromatographic-fluorometric method, micrograms per liter
80154	Suspended sediment concentration, milligrams per liter

Source: Reference 2.3-22.

Table 2.3-19
Highlights of Water Discharge Permit Limits for the RBS
(Effective April 2006)

For continuous discharge of cooling tower blowdown and effluent from internal outfalls:	
Temperature	110°F (maximum daily)
Free Available Chlorine	0.5 mg/l (maximum daily)
Total Chromium	0.2 mg/l (monthly average)
Total Zinc	1.0 mg/l (monthly average)

Source: Reference 2.3-21.

Table 2.3-20 (Sheet 1 of 2)
Groundwater Chemical Analyses[a]

	A	B	C	D	E	F
Total Alkalinity (mg/l $CaCO_3$)	36	160	30	170	48	128
Ammonia (mg/l)	0.252	0.242	0.086	0.993	0.054	3.17
Bicarbonate as $CaCO_3$ (mg/l)	36	140	30	170	48	12
Biochemical Oxygen Demand (mg/l)	<6	<6	<6	<6	<6	9
Chemical Oxygen Demand (mg/l)	22.3	ND[b]	ND	5.4	5.77	50.1
Chloride, Total (mg/l)	16	ND	12.4	12.4	14.2	8.86
Chromium, Hexavalent (mg/l)	<0.01	ND	ND	ND	ND	ND
Apparent Color (PtCo Units)	47	38	50	127	29	23
True Color (PtCo Units)	21	3	28	10	6	10
Hardness (mg/l CO_3)	82	10	26	150	36	ND
Mercury (mg/l)	ND	ND	ND	ND	ND	ND
Antimony (mg/l)	ND	ND	ND	ND	ND	ND
Arsenic (mg/l)	ND	ND	ND	ND	ND	ND
Beryllium (mg/l)	ND	ND	ND	ND	ND	ND
Cadmium (mg/l)	ND	ND	ND	ND	ND	ND
Chromium (mg/l)	ND	ND	ND	ND	ND	ND
Copper (mg/l)	ND	ND	ND	ND	ND	ND
Lead (mg/l)	ND	ND	ND	0.073	0.0155	0.123
Nickel (mg/l)	ND	ND	ND	ND	ND	ND
Selenium (mg/l)	ND	ND	ND	ND	ND	ND
Silver (mg/l)	ND	ND	ND	ND	ND	ND
Thallium (mg/l)	ND	ND	ND	ND	ND	ND
Zinc (mg/l)	ND	ND	ND	0.0288	2.58	31.7
Nitrate Nitrogen (mg/l)	0.549	ND	0.653	0.017	0.523	ND
Nitrogen Nitrite (mg/l)	ND	ND	ND	ND	ND	ND

Table 2.3-20 (Sheet 2 of 2)
Groundwater Chemical Analyses[a]

	A	B	C	D	E	F
Odor, Threshold	ND	ND	ND	ND	ND	2
Orthophosphate (mg/l)	ND	0.184	0.062	0.397	0.397	ND
pH (SU)[c]	6.03	8.73	5.99	7.23	6.28	10.8
Phosphorus, (mg/l)	0.102	0.164	ND	0.507	0.072	0.189
Silica, Dissolved (as SIO_2) (mg/l)	21.3	22.1	27	31.2	22.5	ND
Sulfate (mg/l)	44.7	ND	7.25	ND	ND	ND
Total Dissolved Solids (mg/l)	177	214	124	206	80	189
Total Suspended Solids (mg/l)	37	14	11	14	17	408
Turbidity (ntu)	26.6	1.69	11.1	49.3	12.4	9.68
Total Nitrogen (mg/l)	2.03	0.49	0.56	0.91	0.7	
Fecal Coliform (col/100 ml)	<10	<10	<10	<10	<10	
Fecal Streptococcus (col/100 ml)	<100	<100	100	<100	1000	
Silica (mg/l)	3.56	2.37	2.84	4.21	4.16	
Total Coliform (col/100 ml)	6400	<100	8700	167000	1500	
CO_2 (mg/l)	26		26	14	11	0

a) Samples and analyses conducted in support of ER effort. Samples were collected on the following dates:

A - MW-4, 02/09/2007
B - P-1A, 02/14/2007
C - MW-18, 02/14/2007
D - P-1D, 02/13/2007
E - P-10, 02/13/2007
F - T-14, 03/22/2007

b) ND - Not detectable.

c) SU - Standard Units.

ER 2.3 Figures

Due to the large file sizes of the figures for ER Section 2.3, they are collected in a single .pdf file, which you can navigate via the figure numbers in the Bookmark pane. When cited in the text, the links for these figures will launch the .pdf file.

2.4 ECOLOGY

This section describes the terrestrial and aquatic environments surrounding the RBS, which include the biological communities in the site and vicinity as well as in the transmission corridors and off-site areas. This section is organized as follows:

- Terrestrial Ecology (Subsection 2.4.1).
- Biological Communities (Subsection 2.4.1.1).
- Threatened and Endangered Species (Subsection 2.4.1.2).
- Terrestrial Ecological Monitoring (Subsection 2.4.1.3).
- Aquatic Ecology (Subsection 2.4.2).
- Site and Vicinity (Subsection 2.4.2.1).
- Aquatic Resources of the RBS Site (Subsection 2.4.2.2).
- Commercial and Sport Fisheries (Subsection 2.4.2.3).
- Threatened and Endangered Aquatic Organisms (Subsection 2.4.2.4).
- Nuisance Species (Subsection 2.4.2.5).
- Aquatic Indicator Organisms (Subsection 2.4.2.6).
- Environmental Stressors (Subsection 2.4.2.7).
- Special Use Areas (Subsection 2.4.2.8).
- Transmission Corridors and Off-Site Areas (Subsection 2.4.2.9).
- Federal Regulations Regarding Aquatic Resources (Subsection 2.4.2.10).

This section summarizes the results of reconnaissance visits to the RBS and other studies to assess existing conditions of the ecological resources. These assessments address wildlife and vegetation and compare their current status to that described in Reference 2.4-1.

This section also includes the results of consultation and communication with the USFWS, National Marine Fisheries Service, LDWF, and the Louisiana Natural Heritage Program (LNHP) in regard to threatened and endangered species (Reference 2.4-2) and critical habitats.

2.4.1 TERRESTRIAL ECOLOGY

The RBS region overlaps the Mississippi Valley Alluvial Plain and the Mississippi Valley Loess Plains ecoregions (Reference 2.4-3). The general features of the region around the RBS site are illustrated in Figure 2.2-8 and the ecoregions of the vicinity are illustrated in Figure 2.4-1. The Mississippi Alluvial Plain ecoregion consists of a broad, flat alluvial plain with the main features of relief being river terraces, swales, and levees. Soils of the alluvial plain are fine-textured and poorly drained. Where the land has not been cleared for agriculture or other development, bottomland deciduous forest dominates the landscape. The Mississippi Valley Loess Plains rise somewhat abruptly to the east from the alluvial plain of the Mississippi River in the RBS vicinity. The Loess Plains (wind-deposited) consist of gently rolling coastal plains that are moderately dissected by low gradient streams with silt and sand bottoms. The Loess soils are slightly coarser and better drained than those of the alluvial plain. Oak-hickory and oak-hickory-pine forests were the natural vegetation of this ecoregion. Today, the area is a mosaic of cleared or brushy pastures, young cut-over forest, pine plantations, and only small parcels of natural forest (Reference 2.4-3).

Reconnaissance visits to the RBS site were made between December 2006 and November 2007. The purpose of these visits was to (1) identify jurisdictional waters of the United States, including wetlands and (2) qualitatively assess the existing conditions of the ecological resources, including vegetation and wildlife, compared to that described by the River Bend Station Environmental Report, Operating License Stage (Reference 2.4-1), which discussed Unit 1. Information provided in the 1984 report was based on field surveys conducted between 1971 and 1979 (Reference 2.4-4).

Figure 2.4-2 provides a topographic map of the RBS area showing the property boundaries and potential areas of the site that may be affected by the proposed project. Figure 2.4-3 is an aerial photograph of the RBS area taken in 1985 after the construction of Unit 1. The most recent study of the RBS site was prepared by Electric Power Research Institute (EPRI) Solutions in 2002 (Reference 2.4-5). The EPRI report includes studies of plant communities, wetlands, and protected species.

Figure 2.4-4 is an aerial photograph taken in 2005 that is representative of existing conditions in June 2007. A comparison of the two photographs shows that little change has occurred to the areas west of State Highway 965 (Powell Station Road) and along Grants Bayou. Areas immediately surrounding the facility that were cleared in 1985 are in the very early stages of succession and are now dominated by grasses or shrubs.

2.4.1.1 Biological Communities

2.4.1.1.1 Site and Vicinity

The following are brief discussions of the floral and faunal components found at the RBS site. These discussions are based on field studies conducted between November 2006 and December 2007, the 2002 EPRI Ecological Asset Value Development Draft Report (Reference 2.4-5), and an environmental assessment that was completed to the immediate south of RBS in 2003 by the LDOTD for a highway corridor and bridge crossing of the Mississippi River (Reference 2.4-6).

Vegetation on the RBS Site

The approximately 3330-ac. RBS site is primarily composed of roughly 15 percent developed areas, 19 percent bottomland forest, and 57 percent upland forest. Figure 2.4-5 illustrates the extent and location of the terrestrial habitats and developed areas of the RBS site, and Table 2.4-1 provides an accounting of the acres that are present of each habitat. Naturally occurring non-forested areas are essentially not present on the site. Non-forested areas, aside from developed areas, include small areas of open water, mowed lawns, maintained transmission line corridors, and a few areas cleared in the past but now in the early stages of succession; these areas are dominated by mostly planted grasses and invasive shrubs. According to Reference 2.4-1, most of the RBS site was logged in the past with some areas cultivated, which accounts for the lack of large specimen trees on the site and the overall reduced diversity of plants found in previously disturbed portions of the site.

Initial studies of the flora at the RBS site identified approximately 150 species present (Reference 2.4-1). This should be considered a conservative number of taxa since, in many instances, plants were not identified beyond genus. For example, "*Polygonum* sp." (smartweed) is represented on the site by at least three species; "*Carex* sp." (sedge) could be represented by 10 or more species; *Chasmanthium sessiliflorum* (long-leaf spikegrass) was not listed, yet is common in the upland forested areas. However, these oversights do not cause undue concern for the site evaluation because, as noted above, over time the site has undergone a variety of effects (e.g., logging, cultivation, and most recently, construction of RBS Unit 1), leaving the area in the relatively early stages of succession. None of the species newly listed herein for the site are considered rare or otherwise unusual, and many are introduced or otherwise weedy species. Table 2.4-2 lists the plant species observed during reconnaissance visits between December 2006 and November 2007; the pedestrian surveys of the site concentrated on areas that were expected to be affected by the project. The following paragraphs describe the terrestrial habitats at the RBS site on the basis of these surveys (refer also to Figure 2.4-5).

Bottomland Forest

The bottomland forest region of the RBS site occupies approximately 19 percent of the property. Wetlands comprise the majority of the area according to USACE guidelines (Reference 2.4-7), based on the vegetation, soils, and hydrology present. In this discussion, the bottomland forest is divided into four areas: B1 - Bottomland Developed, B2 - Bottomland Forest (Bald Cypress/ Tupelogum), B3 - Bottomland Forest (Tupelogum/Hackberry), and B4 - Bottomland Forest (Hackberry/Boxelder/Ash).

Bald Cypress/Tupelogum (B2)

In this area, the soils are mostly permanently saturated. The plant community is adapted to inundation, but is capable of withstanding periods of drought. Bald cypress (*Taxodium distichum*) and tupelogum (*Nyssa aquatica* and *N. biflora*) dominate the forest. Red maple (*Acer rubrum*) and green ash (*Fraxinus pensylvanica*) are much less common, but are sometimes found in the area. Buttonbush (*Cephalanthos occidentalis*) is a fairly common shrub, especially where the canopy is broken. In areas where there is permanent standing water, there may be dense blooms of watermeals (*Wolffia* spp.) and duckweeds (*Lemna* spp.) floating on the surface.

Tupelogum/Hackberry (B3)

The bottomland hardwood communities such as the tupelogum/hackberry (B3) and hackberry/boxelder/ash (B4) intergrade with each other on the floodplain. Tupelogum/hackberry communities tend to occur in low-lying, poorly drained flats and often are in close proximity to bald cypress. Tupelogum and sugarberry (*Celtis laevigata*) dominate, but red maple, green ash, oaks (*Quercus* spp.), as well as other tree species, are present. Herbaceous vegetation varies depending on how an area has been subjected to inundation, scouring, or prolonged drought. For instance, smartweeds (*Polygonum* spp.) could dominate an area subjected to early season inundation and summer drawdown, while sedges (*Carex* spp.) and rushes (*Juncus* spp.) might dominate an area that is usually wet but not inundated.

Hackberry/Boxelder/Ash (B4)

Compared to the tupelogum/hackberry community, this community occurs in slightly elevated areas where soils are better drained. However, the community is subject to periodic flooding. The tree canopy dominating the community includes sugarberry, boxelder (*Acer negundo*) and green ash, but many other species, such as eastern cottonwood (*Populus deltoides*), black willow (*Salix nigra*), oaks (*Quercus* spp.), and sweetgum (*Liquidambar stryaciflua*), occur. The understory tends to be brushy with saplings of the same tree species and vines, such as grapes (*Vitis* spp.) and briars (*Smilax* spp.).

Upland Forest (U2)

Upland forest dominates the Loess Plains in the project region. The canopy of this hardwood forest is not dominated by a few species, but rather co-dominated by a variety of species, such as the tulip tree (*Liriodendron tulipifera*), water oak (*Quercus nigra*), Shumard's oak (*Quercus shumardii*), red mulberry (*Morus rubra*), and sweetgum (*Liquidambar stryaciflua*). Although pines (*Pinus* spp.) are present on the RBS site, they are not native (Reference 2.4-1). The diversity of species found in the understory and as ground cover varies across the site and is largely dependent on the extent to which and how recently the area was disturbed. In general, areas to the immediate east of Powell Station Road (the portion west of the existing plant area) have little ground cover and, in some cases, support a remarkable variety of introduced shrubs and vines, such as privot (*Ligustrum* spp.), barberry (*Berberis thunbergii*), and Japanese honeysuckle (*Lonicera japonica*). West of Powell Station Road, the forest is slightly more mature. The introduced species are present, but the overall canopy and understory are increased and ground cover is more common. Ground cover may include Christmas fern (*Polystichum acrostichoides*), may-apple (*Podophyllum peltatum*), snakeroot (*Sanicula* sp.), Dutchman's pipe or Virginia snakeroot (*Aristolochia serpentaria*), and rattlesnake fern (*Botrychium virginianum*). Long-leaf spikegrass (*Chasmanthium sessiliflorum*) is perhaps the most common grass found within or near the edges of the forest.

Entergy Real Estate selectively logs portions of the property on a 12- to 15-year cycle. The most recent harvest was in 2005 on areas located outside the secured area. Future logging is not anticipated for at least 10 years, except for certain large pines near or in the secure area that have been affected by pine beetles. None of the site appears to have been logged recently, based on the 2006 and 2007 site visits.

Upland Forest Palustrine Wetland (U5)

Immediately west of Powell Station Road (the section west of the existing RBS Unit 1) is an area of approximately 4 ac. of wetland. The central portion is inundated emergent wetland, where rushes (*Juncus* spp.), sedges (*Carex* spp.), and wetland forbs are present. Surrounding the emergent wetlands is wetland forest, where bald cypress is common and sweetgum and water oak (*Quercus nigra*) are scattered.

Upland Fields (U3, U4)

Historically, these areas were upland forest, but were cleared of vegetation as recently as 1985 as a result primarily of activities associated with the construction of RBS Unit 1. Grass areas (U3) are generally dominated by broomsedge (*Andropogon virginicus*), Bermudagrass (*Cynodon dactylon*), panic grasses (*Dichanthelium* spp.), and a variety of weedy forbs, such as hop-clover (*Trifolium dubium*). In most instances, these areas are occasionally or regularly mowed. Most areas categorized as upland shrubs/pine (U4) were previously used for construction equipment laydown for earlier construction at RBS. These areas are now dominated by baccharis (*Baccharis halimifolia*) thickets and, in some cases, have been planted with loblolly pine (*Pinus taeda*).

Developed Areas (U1, B1)

Approximately 15 percent of the RBS site is developed. Developed areas include buildings, parking areas, equipment storage areas, and roads. Also included in this category are the transmission line corridors. While the largest portion of these corridors is vegetated, the natural condition of the vegetation is quite poor. Regular maintenance within the corridors clears the areas of tall brush and trees. Consequently, the upland corridors (U1) are generally dominated by a low tangle of undesirable brush, mostly Macartney rose (*Rosa bracteata*), baccharis, and poison ivy (*Toxicodendron radicans*), which are introduced or otherwise undesirable species. The same scenario exists for the herbaceous species present.

In the bottomland corridor (B1), trees have been removed, and most of the area is dominated by broom-sedge, baccharis, poison ivy, joe-pye weed (*Eupatorium capillifolium*), and numerous other invasive or otherwise weedy species. The soils in this area vary from ponded to drained.

Wildlife at the RBS Site

Habitat diversity in an area generally contributes to the diversity of wildlife present in the same area. The RBS site provides a relatively significant diversity of habitats, as described in the previous discussion of vegetation at the site. The majority of the RBS site is occupied by bottomland and upland hardwood forests, within which are small parcels of open shrub or grass. Adding to the diversity of habitat in the area are the wet cypress forest and the proximity and influence of the Mississippi River. The RBS site was extensively surveyed for wildlife prior to the construction of RBS Unit 1 and again following construction (Reference 2.4-1). Observations of wildlife present were made during pedestrian surveys of the site between December 2006 and November 2007. Direct observation and indirect evidence (e.g., scat and tracks) were used to assess species present. Detailed plot sampling was not conducted. Night surveys are not normally conducted unless an unusual species is known or suspected of occurring in the project area. No such wildlife is suspected at RBS, and no night surveys were conducted.

The construction of RBS Unit 3 is not expected to block existing travel corridors for wildlife movement, because the plant is being developed in close proximity to the existing facility and the existing corridors are being utilized (although widened in the case of the transmission line) for linear facilities. The area surrounding the existing units is a mosaic of developed land, mowed grass, woodlots, and second generation forests that do not appear to provide significant travel corridors as might be found along water courses or entry/exit locations for desirable foraging or resting habitats.

<u>Mammals</u>

Table 2.4-3 lists some of the more common mammals occurring at the RBS site. Forty-four mammal species of the approximately 62 species found in Louisiana may occur at or in the vicinity of RBS (Reference 2.4-1). The proposed layout is not expected to affect wildlife corridors or the movement of wildlife in the vicinity, since new development is adjacent to existing structures or simply widens existing corridors or roadways.

The black bear is mentioned in References 2.4-1 and 2.4-5 as potentially being in the project region. However, to date, there have been no documented sitings or reports for the area. Correspondence from the USFWS (Reference 2.4-8) and the LDWF (Reference 2.4-9) expressed no concerns for the federally protected Louisiana black bear in regard to the RBS Unit 3 project. The Louisiana black bear (*Ursus americanus luteolus*) is a subspecies of the widespread American black bear (Reference 2.4-10). Studies completed by private consultants and the USFWS for the LDOTD St. Francisville-New Roads bridge project across the Mississippi River immediately south of the RBS site concluded that there may be a few potential den sites in the region; however, there have been no recent bear sightings (Reference 2.4-6). No bear or evidence of bear was observed during 2006 and 2007 field investigations at the RBS site. The potential for the Louisiana black bear to be present in the RBS vicinity appears to be remote.

<u>Birds</u>

Avian surveys were made in the early 1970s (References 2.4-11 and 2.4-12); the topic was again addressed in References 2.4-1 (extensive tables are included that list the species observed at the site) and 2.4-5. Based on these works, approximately 177 species have been recorded in the RBS vicinity, including permanent residents, seasonal residents, and transients. This is not surprising, considering that the Mississippi River is a major continental migration flyway that can also pick up "strays" from the Central and Atlantic flyways. No additional species were encountered during the pedestrian surveys made between December 2006 and November 2007. The following are brief discussions of groups of birds.

Forest Community Birds

Forest community birds include year-round and seasonal residents. Examples include the American robin (*Turdus migratorius*), blue jay (*Cyanocitta cristata*), white-eyed vireo (*Vireo griseus*), red-bellied woodpecker (*Centurus carolinus*), and Carolina wren (*Thryomanes* *ludovicianus*). Many of these species use the grass or grass- and shrub-dominated openings in and around the forest to forage.

Water-Dependent Birds

These birds are mostly found in the bottomland forest or otherwise associated with the Mississippi River. The great blue heron (*Ardea herodias*), belted kingfisher (*Megaceryle alcyon*), red-winged blackbird (*Sturnella mogna*), and common egret (*Ardea alba*) can be regularly observed. The wood duck (*Aix sponsa*) is a permanent resident but, during the winter months, a wide variety of other ducks and waterfowl may be present. Examples of other waterfowl species expected to occur in the area include mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), blue-winged teal (*Anas discors*), green-winged teal (*Anas crecca*), and others.

Birds of Prey

Birds of prey observed on or near the RBS site include permanent residents such as the turkey vulture (*Cathartes aura*), Cooper's hawk (*Accipiter cooperii*), and great horned owl (*Bubo virginianus*). Winter residents can include the red-tailed hawk (*Buteo jamaicensis*), short-eared owl (*Asio flammeus*), and occasionally the bald eagle (*Haliaeetus leucocephalus*). These birds mostly utilize the ecotone between wooded and open areas, hunting or fishing in the open areas and roosting and nesting in the forest edge.

Game Birds

The mourning dove (*Zenaida macroura*), northern bobwhite (*Coplinus virginianus*), wild turkey (*Meleagris gallopavo*), and wood duck (*Aix sponsa*) are year-round residents at RBS. During the winter, a variety of ducks may occur in the area. The American woodcock (*Scolopax minor*) also winters in the area.

Reptiles and Amphibians

The Louisiana Gulf Coast Herpetological Society recognizes 130 species of amphibians and reptiles in Louisiana (Reference 2.4-13). According to Reference 2.4-1, RBS supports 79 known species, including 26 frogs and salamanders, 9 lizards, 29 snakes, and 15 turtles. The largest reptile present is the American alligator, which is occasionally seen in the wet, bottomland forest area of the site. Table 2.4-4 lists some of the most common species present on the RBS site.

Disease Vectors and Pests

No unusual species of concern (such as disease vectors or pests) are listed for the site, and none were identified by federal or state agencies. Mosquitoes and ticks that could be carriers of the West Nile virus and Lyme disease are in the area. However, the project should have no effect on the current status of these vectors in the project region. Certain large pine trees within the secured area have been affected by pine beetles, and these are expected to be removed.

Important Species and Habitats

NUREG-1555, Table 2.4.1.1, defines important species and habitat. Other than as described in Subsection 2.4.1.2.1, there are no important terrestrial species or critical habitat currently known to occur on the RBS site or in the vicinity. The status of endangered and threatened species is addressed in Subsection 2.4.1.2.

Important habitats at RBS include the following:

- ***Wetlands***. Wetlands are regulated by the USACE under Section 404 of the FWPCA and are delineated on the basis of the *Corps of Engineers Wetlands Delineation Manual* (Reference 2.4-7). On the RBS property, regulated wetlands can be found in a narrow corridor along the Grants Bayou east of the existing plant and include the bottomland forest that lies along Wickliffe Creek (Alligator Bayou) adjacent to the Mississippi River. These areas are featured in Figure 2.4-2, and the extent of habitat is illustrated in Figure 2.4-5. Habitats include bottomland forest--tupelogum/hackberry (B2) and bottomland forest--bald cypress/tupelogum (B3). Three small ponds are located on the property that are isolated and/or man-made.

- ***RBS Natural Area***. In 2004, the RBS site area described in Subsection 2.4.1.1.1 as bottomland forest (B1, B2, B3, B4) was designated a preservation area within the Louisiana Natural Areas Registry. The location of the preserve includes the areas identified as B1, B2, B3, and B4 in Figure 2.4-5. No effects are anticipated for this 550-ac. area.

2.4.1.1.2 Transmission Corridors and Off-Site Areas

The existing condition of the on-site transmission corridor with regard to biological communities, including disease vectors and pests and important species and habitats, is included in the site discussion in Subsection 2.4.1.1.1. Off-site transmission would include a new, 200-ft. wide, 148-mi. long corridor between the Fancy Point Substation at RBS and a new switching station at Natchitoches, Louisiana, that is located on the existing Hartburg-Mount Olive 500 kV transmission line. The switchyard would be approximately 1000 ft. by 1000 ft. This new 500 kV transmission system is discussed in Section 3.7 and is based on a routing study completed in January 2008. All statements in this subsection are based on the contents of the routing study.

The Natchitoches route was selected as the preferred route from five routes considered in the final selection round. Numerous routes were considered early in the study. The preferred route was chosen using a Geographic Information System (GIS) methodology. The GIS methodology provided a number of analytical tools for viewing and manipulating electronic feature (mapping) data. With the GIS capability, the user is able to stack information layers, one on top of another, and then drill down through the whole for analysis.

Between RBS and Natchitoches, numerous obstacles, avoidance areas, exclusion areas, and other constraints were initially identified. These include, but are not limited to, the following:

- Watercourse crossings for the Mississippi, Red, and Sabine Rivers and smaller water bodies.

- Forested and emergent wetlands.
- Reservoirs, impoundments, and unnamed oxbow lakes.
- Wildlife areas, preserves, and refuges.
- Five individual units of the Kisatchie National Forest.
- Chico State Park.

These constraints were classified with values representing desirability of the area for transmission corridor development. The values, or "weights," were established with a range of 1 (most desirable) to 8 (least desirable). GIS software was used to combine the constraint information and to develop routes between RBS and the Hartburg-Mount Olive 500 kV transmission line (Figure 2.4-6). The GIS software scored the constraints for each route; Natchitoches had the lowest score and was only slightly longer than the Sabine (142 mi.) and Newton (147 mi.) routes.

The ROW distribution for the routes was calculated for land use/habitat based on a new 200-ft. wide corridor. Table 2.4-5 provides the route acreage for the five final routes that were evaluated and provides a high-level breakdown of the habitat types found in each corridor. From an ecological perspective, forested and potential regulated wetland/water areas are the most significant acreages represented. Forest accounts for approximately 468 ac. or 14 percent of the Natchitoches route. Of the 468 acres, approximately two-thirds of the area is pine plantation (evergreen forest in Table 2.4-5); this results in the route containing approximately 5 percent forest that is not pine plantation. Wetlands and other waters that would potentially be regulated account for 684 acres or approximately 20 percent of the route, the lowest for any of the considered routes.

2.4.1.2 Threatened and Endangered Species

2.4.1.2.1 Site and Vicinity

This subsection describes the status of plant and animal species protected by federal and/or Louisiana legislation that are known to occur or potentially occur on the RBS property or immediate vicinity. Table 2.4-20 provides a list of threatened and endangered species potentially located near RBS.

Federally Protected Species

Correspondence from the USFWS (Reference 2.4-8) and LDWF (Reference 2.4-9) did not list any federally protected terrestrial species, plants, or animals, as occurring on or in the vicinity of the RBS site. The USFWS (Reference 2.4-8) stated that the project "is not likely to adversely affect those resources."

According to Reference 2.4-1, the RBS site is not included within the permanent range of any rare or endangered bird species. Further, the red-cockaded woodpecker (*Picoides borealis*) and the Arctic peregrine falcon (*Falco peregrinus tundrius*) are listed as federal endangered species and may occur on or pass through the site. There have been no sightings of the red-cockaded woodpecker since 1960 in East and West Feliciana Parishes, and little or no suitable habitat is available for this bird on the RBS site. As of 2004, the LDWF (Reference 2.4-14) did not include either parish within the range of the species. The USFWS de-listed the peregrine falcon as endangered in 1999 (Reference 2.4-15).

The bald eagle (*Haliaeetus leucocephalus*) was de-listed as threatened by the USFWS, effective August 8, 2007 (Reference 2.4-16). The USFWS (Reference 2.4-17) indicated that the bald eagle may occasionally nest along the Mississippi River corridor of Louisiana; if it did so, this would occur between September and February. The bottomland forest areas of the RBS site that are adjacent to the Mississippi River were inspected in December 2006 for the presence of bald eagle nests, and none were found. Following the USFWS National Bald Eagle Management Guidelines (Reference 2.4-17), it is unlikely that project activities would have any effect on bald eagles if they were present, since (1) the construction would not be visible from the river bottoms where the birds would most likely be expected to occur, and (2) the potential area of occurrence is located more than 0.5 mi. from the construction.

The only federally listed species known to occur at the RBS site is the threatened American alligator. The alligator is only considered threatened because of its similarity in appearance to the American crocodile. Thus, the threatened classification of the alligator assists in the protection of the crocodile. American alligator populations are themselves considered disjunct, being limited by available habitat, but the populations are stable (Reference 2.4-18).

The construction of RBS Unit 3 is not expected to block existing travel corridors for wildlife movement. The area surrounding the existing units is a mosaic of developed land, mowed grass, woodlots, and second generation forests that do not appear to provide significant travel corridors as might be found along water courses or entry/exit locations for desirable foraging or resting habitats.

State-Listed Species

The LDWF (Reference 2.4-9) was consulted regarding the presence of known or potential occurrences of state-listed threatened and endangered animals and plants around the project site. Only one mammal, the long-tailed weasel (*Mustela frenata*), and one fish, the pallid sturgeon (*Scaphirynchus albus*) (refer to Subsection 2.4.2), were mentioned as potentially occurring in the project area. The LDWF stated that "no other impacts to rare, threatened or endangered species or critical habitats are anticipated for the proposed project."

Animal Species

The LDWF indicated that "the proposed project may potentially impact the long-tailed weasel (*Mustela frenata*) which is considered rare to imperiled in Louisiana." No records of the weasel are known from the site, but it is presumed from the concern of the LDWF that they may occur in the region.

The long-tailed weasel is one of the most widespread mustelids in North America, ranging from southern Canada throughout the United States and into Mexico. This weasel lives in a wide variety of habitats, but mostly near water, and feeds on small mammals, insects, and small vertebrates (Reference 2.4-19). The long-tailed weasel has not been recorded on the RBS site, but if it were present, it would most likely be found in close association with the bottomland forested area. The forest in the area of the construction is upland, dry, and somewhat disturbed in most areas. It is assumed that if the weasel were in the RBS vicinity, it would not be attracted to the project construction area because better habitat is available elsewhere. It is further assumed that if this is the case, the project poses little or no threat to the continued existence of the long-tailed weasel.

Plant Species

No state-listed endangered or threatened plant species were identified by the LDWF (Reference 2.4-9) as occurring on or in the vicinity of the RBS site.

2.4.1.2.2 Transmission Corridors and Off-Site Areas

The off-site transmission system is discussed in detail in Section 3.7, based on a January 2008 routing study. Environmental methods of issue consideration in the study are discussed in Subsection 2.4.1.1.2. Federal- and Louisiana-listed threatened and endangered species data were obtained in GIS format from the U.S. Geological Survey National Biological Information Infrastructure Gap Analysis Program. The GIS data was buffered with a 1-mi. zone around records that were encountered during the GIS analysis to avoid these sensitive species. The Applicant has not consulted directly with the USFWS or LDWF about protected species at this time, but has deferred this activity until route development becomes finalized. Currently, no federal- or state-threatened or endangered species, or critical habitat for these species, appear to be affected by the Natchitoches route.

2.4.1.3 Terrestrial Ecological Monitoring

2.4.1.3.1 Site and Vicinity

No formal monitoring of the terrestrial environment has been conducted on the RBS site since the construction of Unit 1. Subsection 6.5.1 discusses the terrestrial monitoring plans that are to be implemented for the site preparation, construction, and operation phases of the project. Reconnaissance visits to the site were made between December 2006 and November 2007. The purpose of these visits was to qualitatively compare the existing terrestrial resources and wetlands with the descriptions provided in the RBS ER following the construction of Unit 1 (Reference 2.4-1).

Descriptions of the wetlands at the RBS site are provided in Subsection 2.4.1.1.1. There have been minimal environmental alterations to the terrestrial environment on the RBS site since the construction of Unit 1. Changes are in the form of areas that were heavily disturbed during the construction of Unit 1 that have since grown over with primarily undesirable species of grasses, forbs, and shrubs (U4 areas east of Powell Station Road in Figure 2.4-5). Aside from this area, there appear to have been no other significant alterations to the existing plant and animal communities described in Subsection 2.4.1.1.1.

Wetlands are considered a valuable habitat and are protected under provisions of Section 404 of the FWPCA. In addition, navigation on the Mississippi River is also protected by Section 10 of the

Rivers and Harbors Act of 1899, because the River is designated a navigable water. Wetlands and the Mississippi River at the RBS site are not expected to be affected by construction activities (refer to Subsection 4.3.1.1.6).

Although the American alligator is known to occur at the RBS site, there are no plans to monitor the alligator because of its status, as explained in Subsection 2.4.1.2.1.

2.4.1.3.2 Transmission Corridors and Off-Site Areas

The preferred off-site transmission corridor, Natchitoches, between RBS and the Hartburg-Mount Olive 500 kV transmission line, is described in Section 3.7 and in the January 2008 routing study. No active monitoring or detailed studies of the route are occurring at this time, because the route selection analysis is expected to go through a period of refinement. Once the route selection is finalized and the right-of-way is obtained, studies of the terrestrial ecosystem will be conducted to determine precisely what resources exist within the corridor vicinity.

2.4.2 AQUATIC ECOLOGY

The aquatic environment and biota of interest, those that could be potentially affected by the construction, maintenance, and operation of the RBS Unit 3, include on-site drainage areas, wetlands, and impoundments; a portion of the LMR; a floodplain area traversed and drained by Alligator Bayou; and Grants Bayou and its associated tributaries and distributaries. The subsections that follow describe the general ecology and aquatic communities of these surface water bodies.

2.4.2.1 Site and Vicinity

The RBS is located on the eastern shore of the LMR approximately 3 mi. southeast of St. Francisville, Louisiana, in West Feliciana Parish. The site extends along the banks of the St. Francisville reach of the LMR and is located on a terrace above the LMR's floodplain habitats. Aquatic resources at or in the vicinity of the RBS site with the potential to be affected by the construction, maintenance, and/or operation of RBS Unit 3 are expected to be limited to the LMR, Alligator Bayou, Grants Bayou and its associated tributaries and distributaries (West Creek [a concrete lined stormwater ditch] and Thompson Creek), and a single man-made pond (on-site impoundment). Section 2.3 provides a more detailed discussion of the RBS site hydrology and water quality parameters of water bodies located within the RBS site (refer to Figure 2.4-7).

2.4.2.2 Aquatic Resources of the RBS Site

Aquatic resources at the RBS site consist of three main water bodies and their tributaries and distributaries, including the following:

- LMR.
- Alligator Bayou.
- Grants Bayou.

- West Creek.
- Small on-site impoundment.

The following subsections address these water resources and their associated biological characteristics. This discussion is supported by industry and academia generated literature, biological sampling studies, and scientifically produced research conducted to support characterization of the LMR and other water bodies in the vicinity of the RBS site. Figure 2.4-8 illustrates the relative locations of these studies.

2.4.2.2.1 Lower Mississippi River

The LMR comprises a vast alluvial valley that directs the Mississippi River and its tributaries to the Gulf of Mexico. The Mississippi Alluvial Plain is a broad, gently sloping floodplain that lies between Cairo, Illinois, and Baton Rouge, Louisiana. The Deltaic Plain is a complex system of distributaries and natural levees that extend out from the main stem of the Mississippi River and are associated with forested swamps and coastal marshes. The areas above and below Baton Rouge are two distinct components of the LMR, as described herein. Above Baton Rouge, the river ecosystem is quite variable; the main channel is deep with numerous meanders and floodplain habitats are present. Approximately 55 percent of the aquatic habitat is deep, swift channels, and 45 percent is slack waters. Dikes and revetments are common. Below Baton Rouge, the river channel is deeper and narrower with fewer meanders. Approximately 85 percent of the aquatic habitat is deep, swift channels. Revetments are used extensively in this section of the river to help prevent erosion (Reference 2.4-20).

The RBS is located along the St. Francisville reach of the LMR. Bank width along this reach of the LMR ranges from 1700 ft. (520 m) at RM 264 (northwest edge of the site) to 4300 ft. (1300 m) at RM 260 (southern edge of the site). Maximum depth is approximately 100 ft. (30 m) based on the average annual water level of 20.4 ft. msl. River gauge data collected at RM 228.4, just south of the RBS site, from 2000 to 2007 indicate that the average river state is approximately 23 ft. msl. Additional bathymetric data on the LMR can be found in Section 2.3.

River flow varies substantially throughout the year, and water levels fluctuate an average of 10 m (Reference 2.4-20). Recent evaluations of the river flow near RBS indicate that the average velocity of the LMR is 3.88 fps (refer to Subsection 5.3.2 for more details), although historic hydrographic surveys performed at the RBS site recorded flows as high as 8.3 fps in the main channel of the LMR (References 2.4-1 and 2.4-21). Other hydrographic surveys performed on the LMR (RM 129.5) indicated that average seasonal flows are estimated to be 580,000, 650,000, 280,000 and 240,000 cfs for winter, spring, summer, and fall, respectively. The velocity in this portion of the river averages as high as 3.9 fps in April and as low as 1.1 fps (39-year average) in September (Reference 2.4-22).

A seasonal analysis of the ambient LMR temperature recorded at St. Francisville (RM 266) over a 27-year period (1980 - 2007) indicates that the lowest river temperatures occur in late winter months (January and February), and the highest river temperatures occur in mid-to-late summer months (July and August); refer to Subsection 5.3.2 for more details. Historic physicochemical surveys performed at RBS (1972 - 1977) documented surface water river temperatures ranging from 37.6°F to 88.7°F (3.1°C to 31.5°C), with low and peak temperatures occurring in January and August, respectively (References 2.4-1 and 2.4-21). General characterizations of the LMR indicate annual temperature ranges, on average, from 64.4°F to 84.2°F (18°C to 29°C) in habitats near the RBS site (refer to Subsection 2.4.2.2.1.1 for more details on aquatic habitats) (Reference 2.4-23). Surface-to-depth dissolved oxygen (DO) profiles documented the highest DO concentrations under cooler water temperature conditions and lowest DO concentrations under warmer water temperature conditions. Because DO concentration is inversely related to water temperature (warmer water has a lower ability to retain oxygen than cooler water), seasonal fluctuations of DO are expected. LMR characterization studies indicate that average annual DO concentrations can range from 6 to 12 mg/L (Reference 2.4-24). Recent studies (2006 - 2007) performed downstream of the RBS at RM 129.5 documented similar seasonal fluctuations in water temperature and DO, with cooler temperatures and higher DO concentrations occurring in winter months and higher temperatures and lower DO concentrations occurring in summer months. Minimum and maximum recorded temperatures in this study were 43.52 °F and 90.86°F (6.4°C and 32.7°C) (Reference 2.4-23).

Historic benthic studies conducted at the RBS site indicated that documented photic zone depths ranged from 8 to 21 in. (20 to 53 cm). The most turbid water was found during the rising river stages, and there was generally a gradual change in benthic substrate moving across the river. In the deepest zones, coarse textured sands were present, with gravel present in benthic zones exposed to repeated scouring. Medium-textured sand lined the channel slopes, with fine sand in shoal areas. Silt accumulation to 18 in. (16 cm) on top of fine sand or sandy mud was associated with slackwater zones. Firm clays occurred along the river banks adjacent to deep channels, while soft, organically rich mud was present along the west bank and along portions of the east bank. This type of sediment structure is common in large floodplain rivers. More recent river sediment characterizations performed for the Audubon Bridge project documented similar findings (Reference 2.4-25). Attached aquatic vegetation is rare in the river because of the strong flows and heavy sediment loads characteristic of the LMR, which constantly scour benthic habitat. Vegetation is limited almost entirely to filamentous algae, which become established on floating and anchored objects, such as fallen tree trunk bases that are grounded along the banks. Willow seedlings (*Salix* spp.) and cockleburs (*Xanthium strumarium*) are common along the west bank of the LMR from RM 262 to RM 263 (near the RBS site). When these areas become inundated as a result of high water levels, these plants temporarily serve as cover for certain fishes and invertebrates. Similar temporary stands of inundated vegetation, composed of willows and various grasses, were documented as occurring in small embayments along the east bank (References 2.4-1 and 2.4-21).

In 2004, the LDEQ performed 305(b)[a] surveys on all water bodies deemed waters of the United States. Findings of this survey for Mississippi River Segments LA070201 and LA070502 (segments of the Mississippi River and its tributaries in the vicinity of the project near St. Francisville, Louisiana) indicated that this segment of the river fully supports secondary contact recreational usage, as well as fish and wildlife propagation (Reference 2.4-26).

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a. 305(b) surveys are water condition assessments required by the state to be conducted on all surface waters of the state by the U.S. Environmental Protection Agency (EPA). These assessments are used to help identify impaired water bodies throughout the state.

2.4.2.2.1.1 Aquatic Communities

The ecosystem of the river is defined by the area within the river banks (main stem) and the areas beyond the river banks (floodplain) (Reference 2.4-24). The main stem includes the main river channel and slackwater areas. The floodplain includes natural levees, forested swamps, swales, ridges, and distributaries. The floodplain along the LMR is mostly cut off from the river because of an extensive levee system that was constructed to reduce flooding to the outlying areas. There is approximately 0.60 million hectares (ha) of natural floodplain remaining within the levees. Numerous habitats exist within the floodplain and the main stem portion of the river. Terminologies to describe these habitat variations include main channel, steep clay bank, and slackwater areas. However, these descriptions did not take into consideration the biotic communities associated with them. In an effort to account for the different aquatic zones within the river, several alterations to these classifications have been established. For this subsection, the classification presented by Baker et al. (1991), which accounts for 13 different habitats in the LMR, is used. Table 2.4-6 provides a description for each of the habitats.

Aquatic habitats found in the LMR near the RBS site include seasonally inundated floodplains along the river levee, revetment banks, natural steep banks, and channels (refer to Figure 2.4-9). A man-made, shallow-cut embayment houses the intake structure and barge slip. This area is most similar to the lotic sandbar habitat described in Table 2.4-6, because conditions in this habitat are quite similar to those of the channel habitat. Substrate in the embayment is predominant coarse sand and sandy muds, and this area is frequently disturbed for routine maintenance dredging. The seasonally inundated floodplains are heavily forested, except in those areas immediately adjacent to and in front of the intake pump house, barge landing area, and bermed access roads. These areas are mechanically cleared during plant ground maintenance activities. The floodplain habitat comprises forested wetland communities and isolated sloughs that are infrequently flooded seasonally (flooding in these habitats is more commonly caused by the Alligator and Grants Bayous watersheds). The natural steep bank habitats are located approximately 70 ft. from the main bank inside the intake embayment. Otherwise, natural steep bank habitat is flush with the river bank. The man-made embayment is the dominant habitat for the intake structure. As previously mentioned, this habitat is similar to lotic sandbar habitat, consisting of moderate to high river flows, relatively cool water temperatures, high turbidities, and high suspended solids. Bank habitats in the vicinity of the RBS site are supported by various forms of revetment banking. Concrete mats, commonly referred to as revetment mattresses, support the upstream and downstream banks. Riprap and small boulders are interspersed along the bank-line of the man-made embayment and near the discharge outfall.

Benthos (Table 2.4-7)

Diversity within the benthic communities can be directly related to substrate composition. Higher densities of benthic macroinvertebrates, such as oligochaetes, chironomids, and amphipods, are common to shallow depths with porous sediments, such as soft organic mud. Firm clays tend to limit benthic community diversity, due in part to the lack of organic elements for food and the compactness of soil particles (Reference 2.4-27). As previously described, soft muds are fairly common along the shoreline of the LMR near the RBS site, while sediments in the main channel of the LMR consist mainly of firm clays interspersed with gravel patches. This type of sediment distribution limits benthic community diversity to shoreline habitats, where suitable softer substrate is available.

Baker (1991) documented dominant benthic invertebrate communities within habitats of the LMR. As previously described, habitats types near the RBS site consist of channel, revetment bank, steep natural bank, and floodplain habitat. Oligochaetes (*Oligochaeta*) and midges (*Chironomidae*) are common throughout all habitat types (Reference 2.4-24).

From 1972 to 1977, benthic samples were collected quarterly at three locations on three transects across the LMR at the RBS site to characterize the spatial distribution of the benthic community (refer to Figure 2.4-10) (References 2.4-1 and 2.4-21). More than 70 taxa of benthic invertebrates were documented in this study (refer to Tables 2.4-7, 2.4-8, and 2.4-9).

Aquatic oligochaetes represented more than 58 percent of the organisms documented in these samples. All species identified in this study are universally distributed in freshwater habitats. Distribution within the LMR near the RBS site was documented to be patchy, with the largest organism concentration found in shoreline collections and fewer specimens captured in mid-river samples. This is likely due to a lack of appropriate benthic habitat for these organisms in the main channel of the LMR, as previously discussed. Oligochaetes are demersal organisms that typically feed by burrowing into and ingesting the substrate. These organisms comprise a large portion of the diets of bottom-feeding fishes such as the freshwater drum (refer to Figure 2.4-11).

Mayfly (*Ephemeridae*) larvae accounted for approximately 30 percent of benthic organisms collected in this study. These organisms were almost exclusively documented in areas near the east and west banks of the river. Mayflies are common to a variety of substrate types.

Other dominant genera noted in the surveys included caddisfly (*Trichoptera*) and midge (*Chironomidae*) larvae. These species prefer calmer habitats, as evidenced by higher numbers collected in west bank samples, and are important in the diets of benthic-feeding fishes.

The study also notes that seasonal fluctuations in overall benthic populations tend to be heavily influenced by river flow. Overall densities were generally lowest in the spring, when river flow was greatest and, therefore, most disruptive to the benthic substrates. In studies performed both during and after severe river flooding events, marked increases in the relative abundance of benthic animals were noted in the years following the flood event. Most of these increases were attributed to exceptionally high densities of oligochaete worms and mayfly larvae. The eastern banks of the LMR at the RBS site sustained significant damage during the documented flooding event. These banks slowly reverted to pre-flood conditions in the years following, resulting in the restoration of more stable clay substrates (References 2.4-1 and 2.4-21).

Macrocrustaceans (Table 2.4-8)

The documented macrocrustacean community of the LMR in the vicinity of the RBS site consists of three main genera: *Macrobrachium* sp. (river shrimp), *Procambarus* spp. (crayfish), and *Palaemonetes* spp. (grass shrimp). Crayfish are of significant commercial importance in Louisiana; however, the commercial crayfish industry is more significant in waters of the Atchafalaya Basin rather than the LMR.

The Ohio river shrimp (*Macrobrachium ohione*) and grass shrimp (*Palaermonetes* spp.) dominated invertebrate seine catch in historic studies performed at the RBS site (1974 - 1977) and were repeatedly documented to dominate invertebrate catch in biological surveys performed on the LMR (References 2.4-1, 2.4-21, 2.4-22, 2.4-23, 2.4-28, 2.4-29, and 2.4-30). Of the several species of grass shrimp, only two, *Palaemonetes paludosus* and *P. kadiakensis*, are common throughout Louisiana in the Mississippi River. The Ohio river shrimp is the most widely distributed and abundant river shrimp in the United States and is collected throughout Louisiana.

Mollusks (Table 2.4-9)

The Asian clam (*Corbicula manilensis*), the zebra mussel (*Dreissena polymorpha*), and an unidentified unioinid were the only three species of mollusks documented in biological surveys conducted on the LMR. Both the Asian clam and the zebra mussel are considered nuisance species and are further discussed in Subsection 2.4.2.5 (References 2.4-1, 2.4-21, 2.4-22, 2.4-23, 2.4-28, 2.4-29, 2.4-30, 2.4-31, and 2.4-32).

Phytoplankton (Table 2.4-10)

An inverse relationship exists between phytoplankton density and turbidity. This is a common phenomenon in rivers and is due in part to the reduced light available for photosynthesis in highly turbid water (Reference 2.4-27). Most of the algae documented in historic studies (1974 - 1977) performed in the LMR at the RBS site were periphytic or benthic forms that had been washed from substrates and had become suspended. True planktonic species within the LMR probably enter the river from bayous and other standing water areas. Others may originate in slower backwater areas and eddies upstream of the study area. Regardless of the source, these algae act as primary producers in the river, forming an important component of the aquatic food chain. It is important to emphasize, however, that the LMR is considered a detrital-based system (Reference 2.4-24). Phytoplankton are considered to be primary producers, but they do not comprise the main source of energy for the food web in the LMR.

Since 1972, more than 110 taxa of planktonic algae have been collected from the river at the RBS site (References 2.4-1, 2.4-21, 2.4-22, 2.4-24, and 2.4-33). In larger rivers like the LMR, phytoplankton speciation is often dominated by diatoms (*Bacillariophyceae*). This is thought to result from an interaction of hydrodynamic and biotic factors by which organisms of certain sizes and shapes are more likely to remain in suspension in the turbulent river waters.

Surveys documenting phytoplankton diversity and density in the LMR indicate wide variations in seasonal speciation and abundance. Plankton densities tend to be lowest in the winter and highest during the summer, with green (*Chlorophyta*) and blue-green (*Cyanophyta*) algae dominating in the summer and early fall, and golden algae dominant in the winter and spring. Diatoms are consistently abundant throughout the year. Distribution of phytoplankton within the river is extremely variable, although densities are usually greatest along the western shore (opposite the RBS site), particularly during low river stages.

Dominant plankton genera documented in this study are similar to those listed as being the most frequently encountered true plankton in larger rivers. Commonly occurring genera include diatoms, such as *Cyclotella, Celosira, Fragilaria, Synedra, Asterionella, Navicula*, and *Nitzchia* spp.; green algaes, such as *Chlorococcales, Scenedesmus, Chlorella, Ankistrodesmus,* *Tetraedron,* and *Crucigenia* spp.; and blue-green algae, such as *Microcystis* and *Anacystis* spp. (members of *Cyanophyta*) (References 2.4-1, 2.4-21, 2.4-22, 2.4-24, and 2.4-33).

Zooplankton (Table 2.4-11)

More than 140 invertebrate taxa have been identified in zooplankton samples of the LMR near the RBS site. In the historic studies conducted at the RBS site that characterized the zooplankton community of the LMR (1974 - 1977), rotifers were identified as the dominant organism in the samples collected. Rotifers are a highly diverse class of aquatic microorganisms, with more than 100 species characterized as completely planktonic (most species are sessile or benthic). Densities in freshwater systems commonly range from 20 to 30 organisms per liter; however, productive systems have documented rotifer densities upwards of 25,000 organisms per liter (25 million organisms per m^3) and much greater. Common species include *Brachionus, Keratella, Polyarthra, Synchaeta,* and *Trichocera* (References 2.4-1, 2.4-21, 2.4-22, 2.4-27, and 2.4-34).

Most rotifers are omnivorous or herbivorous, feeding on organic particles within their environment. Most sessile (free-swimming), nonpredatory species fall into this category. Predatory species of rotifers generally prey upon other rotifers and small planktonic and benthic Metazoans.

The historic survey performed at the RBS site included two separate data analyses: one quantitatively characterizing the zooplankton community in the LMR near the RBS site, and the other examining zooplankton speciation in the vicinity of the RBS cooling water intake and discharge (refer to Figures 2.4-12 and 2.4-13). As previously mentioned, rotifers dominated plankton tows conducted in the LMR. Other documented species included cladocerans (water fleas), copepods (mainly *Diaptomidae* and *Clyclopidae*), dipterans (midges), hydroids and bryozoan fragments, and Ohio river shrimp (*Macrobrachium ohione*) larvae. Highest densities were noted in late summer and early fall (July to September) months. Samples collected at the cooling water intake and discharge structures were dominated by copepods (members of *Diaptomidae, Cyclopidae,* and *Temoridae*), cladocerans (water flea *Daphnia* spp.), and hydroid fragments. While Ohio river shrimp larvae were present in samples, they did not comprise greater than 1 percent of the overall sample speciation (number per 100 m^3). It is also important to note that this study documented higher plankton densities in western bank samples than mid-channel and eastern bank (RBS site) locations. It was assumed that this difference could be attributed to slower river currents on the west side of the river (slight slackwater area formed along the west bank due to the easterly curve in the LMR) (References 2.4-1 and 2.4-21).

Other plankton surveys performed downstream of the RBS site on the LMR documented high numbers of rotifers, cladocerans (*Daphnia* and *Ceriodaphnia* spp.), and copepods (members of *Eucopedoda, Calanoida*, and *Cyclopodia*). Plankton densities were highly variable from year to year; however, speciation remained relatively constant (References 2.4-22, 2.4-27, 2.4-34, and 2.4-35).

Ichthyoplankton (Table 2.4-12)

With the exception of a few channel dwelling and open water spawning species, most fish common to the LMR utilize backwater habitats for spawning activities. Larval fish (ichthyoplankton) are typically swept into the LMR during flooding and high water periods because they have limited swimming capabilities and are usually distributed with the water currents.

Ichthyoplankton surveys characterizing both speciation and distribution of larval fishes (1974 - 1977) documented 45 species in the LMR near the RBS site. Four families: *Sciaenidae* (drums), *Clupeidae* (herrings), *Cyprinidae* (minnows), and *Catostomidae* (suckers) accounted for approximately 95 percent of the ichthyoplankton collected in these studies. Of these four families, freshwater drum (*Aplodinotus grunniens*, *Sciaenidae*) comprised approximately 43 percent of the total fish documented. Gizzard and threadfin shad were the second most abundant fish collected, representing 26 percent of the sample. The highest species diversity was documented in late spring and early summer months, corresponding with the spawning periods for most common LMR fishes.

Ichthyoplankton density tended to be greater at shoreline stations than in the mid-river samples. Shoreline stations with higher surface velocities (eastern shore near the site, western shore upriver of the site) tended to have higher concentrations of ichthyoplankton. Shad, however, displayed very little horizontal variation at transects near the site and were more abundant along the shores at the upstream transects. Carp were more abundant along the west shore and differed very little in distribution between transects. Minnows and shiners were also more abundant at shoreline stations with swift surface currents.

Diel distribution of ichthyoplankton was also documented during this study. Although no significant day-night differences in the total fish larval density were documented, certain taxa did exhibit periodicity. Suckers and threadfin shad were more abundant at night, while gizzard shad and drum were more abundant during the day. It was noted that differences in density between the stations were fewer at night, suggesting that net avoidance may have occurred at the slackwater shoreline stations during the day, possibly accounting for the higher densities reported for the swiftly flowing shoreline stations (References 2.4-1 and 2.4-21).

Ichthyoplankton studies conducted in the LMR near RM 133 at La Place (2002) investigated the relative abundance of egg and larval stages of fish that occur in natural steep bank and shallow to mid depths of the Mississippi River. Blue catfish accounted for 52.3 percent of all species collected, followed by freshwater drum at 11.5 percent. Channel catfish comprised 4.2 percent of the catch. Centrarchids, including redear sunfish, longear sunfish, largemouth bass, and white and black crappie, made up 0.5 percent of the relative abundance (Reference 2.4-28).

Adult Fish (Table 2.4-13)

In most large rivers, fish species diversity typically increases from headwater to river mouth. Vertical distribution is patchy, with the highest numbers at the river surface and at the bottom, while the mid-depth is virtually devoid of fish, probably because of the very high currents located mid-depth. Large floodplain rivers like the Mississippi are dynamic and made up of several diverse ecosystems composed of several habitats, including the main channel, side channel, floodplain, and backwater lakes that allow a diverse assemblage of organisms to persist (References 2.4-20, 2.4-22, and 2.4-24). One hundred ninety-five species of freshwater fishes have been recorded as occurring in the main stem of the Mississippi and Atchafalaya rivers, representing almost one-third of the freshwater fish species in North America. Sixty-seven species inhabit the headwaters, 132 species inhabit the UMR, and approximately 150 species inhabit the Lower Mississippi and Atchafalaya Rivers. Other studies have estimated that 91 species of freshwater fishes inhabit the LMR, with 30 or more other species present intermittently. The most common freshwater species in the LMR include the gizzard shad (*Dorosoma cepedianum*), threadfin shad (*Dorosoma petenense*), goldeye (*Hiodon alosoides*), carp (*Cyprinus carpio*), river carpsucker (*Carpiodes carpio*), smallmouth buffalo (*Ictiobus bubalus*), blue catfish (*Ictalurus furcatus*), channel catfish (*Ictalurus punctatus*), flathead catfish (*Pylodictis olivaris*), river shiner (*Notropis blennius*), and freshwater drum (*Aplodinotus grunniens*). Bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), and black and white crappie (*Pomoxis nigromaculatus* and *P. annularis*) are also fairly common. In addition to the fish, two species of shrimp, (river shrimp [*Macrobrachium ohione*] and grass shrimp [*Palaermonetes* spp.]) and a crayfish (*Cambarinae*) are abundant (References 2.4-20, 2.4-23, 2.4-24, 2.4-28, 2.4-29, 2.4-30, 2.4-34, and 2.4-36).

The LMR provides plentiful habitat for fishes that thrive in swiftly flowing water, but few species can tolerate the high current velocities of the upper and middle water columns of the channel. Most fishes inhabit areas near the banks and the channel bottom where the current is slower. Several fish species forage in the floodplain of the LMR when it is inundated by high water levels; these species include gars, bowfin, common carp, buffalos, river carpsucker, channel catfish, blue catfish, white bass, crappies, and freshwater drum. Many fishes also use the inundated floodplain for spawning. Densities of larval fishes in the LMR are highest in backwaters, which are important nurseries for fishes and contain a larval fish assemblage differing from that of the main stem river (Reference 2.4-24).

Spatial differences in population densities are caused by many factors, including habitat, water depth, and velocity. Most studies show higher fish densities at the channel bank and backwaters compared to the main channel. This is primarily due to increased habitat area, shallow water depths, and reduced river velocities. Most fish species found in the channel prefer the channel bottom where the current is slower. These species are usually represented by larger specimens of these species, such as freshwater drum, buffalo, common carp, and catfish. Most fishes likely inhabit areas near the banks, and most generally prefer the shallow, slower inside edge of a river as opposed to the deeper, faster current of the cut-bank edge. Since many fish exhibit a specific preference for certain types of habitat, stream or river locations with diverse habitats may be expected to contain more fish species than locations with fewer habitat types (References 2.4-20, 2.4-23, 2.4-24, 2.4-28, 2.4-29, 2.4-30, 2.4-34, and 2.4-36).

Two major conclusions can be drawn from extensive literature review regarding fisheries in the LMR: (1) population density and diversity are higher in the channel border and backwaters than in the main channel, and (2) the overall fisheries in the LMR have not changed substantially since the 1970s. The following are detailed descriptions of several site-specific quantitative fisheries studies supporting these conclusions.

Baker (1991) documented a total of 63 species of fish associated with natural steep banks and channels, 49 species with sandbars, and 70 species within the seasonally inundated floodplains that include oxbow lakes, sloughs, and barrow pits. The smaller seasonally inundated floodplain areas (i.e., flooded areas lacking ponds) are similar; however, they commonly support fewer permanent species. Of the 63 species associated with natural steep banks and channels, 25 species appear to be common to abundant in natural steep bank habitats, and 13 are common to abundant in channel habitat. Similarly, 24 are common to abundant in the floodplain areas. A review of the data collected at and near the RBS site both historically (1974 - 1979) and recently (2000 - 2001) suggests that the common to abundant species documented during the study are not significantly different from those characterized by Baker (1991).

Habitat types were also analyzed in the Sempra study (2002) conducted at Mississippi River RM 132.2 as part of the 316(b) demonstration study for a new power plant and cooling water intake structures (CWIS). It was determined that although there are 13 distinct habitat types found in the LMR, only a few dominate the river's landscape in the lower reaches (Reference 2.4-28). The researchers used the habitats developed by Baker and his colleagues (Reference 2.4-27) to determine a species' abundance potential in the study area. They defined Baker's 13 habitat zones as Habitat Zone Distribution, which is the correlation of a species to its preferred habitat throughout its life cycle. Preferred habitat also includes Habitat Range Distribution, which is the water column distribution most favored by the species throughout its life cycle. Gizzard shad were noted as abundant to common in all habitat zones except for the channel where they are considered uncommon. Threadfin shad are considered abundant or common in most habitats except lotic sandbars (similar to the man-made embayment habitat) where they are considered uncommon. No ranking was given for threadfin shad in the channel. Freshwater drum are considered abundant or common in all habitats except floodplain ponds where they were not given a ranking. Freshwater drum are considered common in the channel.

By examining habitat types available for fishes in the LMR near the RBS site, general assumptions can be made about the speciation of fish communities residing in the area. As previously discussed and further illustrated in Figure 2.4-9, four habitat types (channel, natural steep bank, revetment bank, and man-made embayment) are available to fishes at the RBS site. Table 2.4-14 lists common species documented in several fisheries' surveys performed on the LMR. As demonstrated, species commonly found at the RBS site (documented in both historic and recent surveys) are similar to those documented by Baker as common to these types of habitats, as well as those species documented in other studies. This finding emphasizes that the fish community of the LMR is fairly stable and that current fish speciation would be similar to documented historic populations.

Furthermore, the man-made intake embayment, which houses the intake structure, is similar in habitat dynamics to the lotic sandbar habitat. Strong currents and mobile bed materials characterize this type of habitat. Few fishes are adapted to survive in these types of conditions; therefore, it is likely that fish populations would be limited in this area. Further discussion of the intake structure and its effects on aquatic ecosystems can be found in Subsections 4.3.2 and 5.3.1.

Eighty-eight species (refer to Figures 2.4-14 through 2.4-16) were documented in the historic studies (1972 - 1977) performed in the LMR at the RBS site, with 39 species noted as common to abundant. Fishes documented in this study are similar to those identified in other studies characterizing fishes of the LMR.

Several gear types were utilized in sample collection. Gizzard shad and freshwater drum were most commonly captured in the trammel net samples, with blue catfish, white crappie, bowfin, carp, and flathead catfish also documented in these catches (refer to Figure 2.4-15). Hoop and trap net collections yielded freshwater drum, gizzard shad, and flathead catfish (refer to Figure 2.4-16). Seine collections yielded a variety of shiners (river shiner, blacktail shiner, emerald shiner, silverband shiner), as well as several other smaller bodied fish (mosquitofish and chubs) not well represented in hoop net and trammel net collections (refer to Figure 2.4-14). Fish diversity was highest in the spring and summer, and summertime catches yielded the highest numbers of fish. Samples collected during periods of high river flow yielded a higher diversity in fish speciation that is likely due to an influx of extra-riverine species resulting from increased connectivity to floodplain and backwater habitats.

Spatial distribution of adult fishes was also examined in this study. Although the specific locality of habitat was not described, some details as to the habitat types that commonly documented species were associated with were recorded. Blue catfish, goldeye, mooneye, speckled chub, sauger, and shovelnose sturgeon were commonly associated with swiftly flowing areas containing clean, fine sand substrate. Shad, silvery minnows, striped mullet, and river carpsucker were common to shallow embayments near sandbars and in calm pools downstream of sandbars. Carp, pugnose minnows, bullhead minnows, bowfin, needlefish, mosquitofish, silversides, and sunfish were common in slackwater habitats (References 2.4-1 and 2.4-21).

In 2007, a comparative analysis of recent (2000 - 2001) and historic (1977 - 1979) fish samples collected near St. Francisville and the RBS site (RM 240 to RM 273) was performed. Studies examined for this analysis documented 79 species of fish as common to scarce; no threatened or endangered species were encountered in either set of samples. A variety of gear was utilized during sampling efforts to ensure completeness of qualitative samples. Minnows (blackspotted topminnow, slivery minnow, emerald shiner, mimic shiner) and shad (gizzard and threadfin shad) were the most commonly collected species in both sets of samples examined, consistent with other studies conducted on the LMR (specifically, the historic RBS studies); refer to Figure 2.4-18. Additionally, samples collected in the immediate vicinity (less than1 mi. radius) of the RBS site were split out to highlight the fish captured. Minnows and shad were again the most abundant species documented (refer to Figure 2.4-19). Several statistical analyses were performed to aid in a more even comparison of the two studies. Final conclusions stated that the fish communities identified in both historic and recent surveys are similar, indicating that the fish community of the LMR near the RBS site is relatively stable, and speciation of common fishes has not changed significantly since historic studies (1970s) were performed (Reference 2.4-30).

Impingement and Entrainment Characterization Studies

In addition to quantitative biological surveys, impingement and entrainment characterization studies can aid in understanding the fish and plankton communities that are present near a CWIS or station water system (SWS) intake. Impingement refers to the pinning or trapping of an organism against some type of screening mechanism. Screening mechanisms are used to prevent aquatic organisms from entering the CWIS or SWS. Entrainment occurs when an organism is small enough to bypass the intake screening mechanism and enters the CWIS or SWS. Plankton and larval organisms are most commonly affected by entrainment. A more detailed discussion of impingement and entrainment effects at the RBS site can be found in Subsection 5.3.1.

Impingement studies were additionally examined to aid in demonstrating the uniformity of fish communities in the LMR. Impingement studies from facilities upstream and downstream of the RBS site (RM 93 to RM 433) spanning more than 30 years (1974 to 2007) were reviewed for the purpose of comparing (1) the effects of once-through facilities on LMR aquatic resources and

(2) differences in the speciation of historic and current samples to assess differences, if any, in fish populations in the LMR over time (References 2.4-22, 2.4-23, 2.4-28, 2.4-29, and 2.4-36).

Historic and current surveys both indicated that the most commonly impinged fish species included gizzard shad, threadfin shad, freshwater drum, and blue catfish. Skipjack herring and bluegill were also commonly documented. This supports the conclusion presented in the aforementioned comparative analysis survey that fish speciation of common fishes in the LMR has not changed significantly over time and lends credence to viewing historic data collections as representative of current conditions. It is important to note that most of the reviewed impingement studies examined intake structures located in the main channel of the LMR. This location precludes certain fishes from being captured because of their habitat preference. These species include several types of minnows and sunfish. Figure 2.4-17 illustrates species composition of impingement samples for a once-through cooling facility located south of the RBS site. Table 2.4-14 illustrates species commonly documented in biological surveys both at the RBS site and other locations on the LMR (References 2.4-22, 2.4-23, 2.4-28, 2.4-29, and 2.4-36).

2.4.2.2.2 Alligator Bayou

The upper portion of Alligator Bayou is formed by Alexander Creek as it flows into the floodplain and Wickliffe Creek. The bayou widens as it enters Needle Lake (also known as Grassy Lake) and continues intermittently southward where it is joined by Grants Bayou before flowing into Thompson Creek. The Alligator Bayou system is an organically rich system that is subject to periodic inundation by the Mississippi River from overbank flooding and backwater from Thompson Creek. The bayou is completely flooded by the Mississippi River when the river level exceeds 37 ft. msl because river water flows over the levee directly into the bayou. Partial flooding of the bayou can be expected during high river stages because of backflow into the bayou from Thompson Creek. Bayou flooding as a result of high river stage can last for extended periods of time, while rainfall-induced flooding typically subsides after 12 hours (References 2.4-1 and 2.4-21).

The biota of the bayou is highly productive due to material deposited during periods of inundation or runoff. Alligator Bayou is littered with natural detritus and forest debris, which contributes to the high organic load of Alligator Bayou as it slowly decomposes. Substrate throughout the bayou consists of thick mud to mud-muck, interspersed with logs and stumps.

Shallow embayments along Alligator Bayou contain dense stands of rooted aquatic vegetation. Sections of Alexander Creek located above the tramline[b] at the entrance to the bayou also exhibit the same dense vegetative community. Thick mats of stonewort (*Nitella* spp.) and strands of water starwort (*Callitriche heterophylla*) are present from late winter to early summer; perennial emergents, such as hedge hyssop (*Gratiola virginica)*, pickerelweed (*Pontederia cordata*), giant cutgrass (*Zizaniopsis miliacea*), arrowheads (*Sagittaria* spp.), sedges (*Cyperaceae*), and rushes (*Juncaceae*), are present year-round. These are an important refuge for young salamanders, fishes, crayfish, and a variety of other aquatic species. Panic grass (*Panicum gymnocarpon*) grows as an emergent aquatic plant and is the predominant ground cover throughout the bayou. Also important in the area is the epiphytic liverwort (*Porella* spp.), which grows on inundated parts of living wood and is particularly partial to the roots, trunks, and

b. The railway was constructed on the RBS site in the late 1800s.

knees of the bald cypress (*Taxodium distichum*). Scattered specimens of lizard's tail (*Saururus cernuus*) and smartweed (*Polygonum* spp.) are also present (References 2.4-1 and 2.4-21).

Benthos (Tables 2.4-15 through 2.4-17)

The Alligator Bayou watershed exhibits a more diverse benthic community than that of the LMR near the RBS site, as over 150 taxa of invertebrates were collected during historic studies (1972 - 1977). Dominant benthic organisms in the bayou areas surveyed include aquatic oligochaetes and dipteran (mainly midge and phantom midge) larvae.

The Alligator Bayou watershed provides a diversity of habitats, ranging from Alexander Creek (flowing stream areas) to Needle Lake (standing water with dense aquatic vegetation). The bayou is also less subject to the frequent scouring and high turbidity that are common in the LMR (References 2.4-1 and 2.4-21).

Macrocrustaceans - Crayfish (Table 2.4-15)

Crayfish are the most abundant macrocrustacean documented in the Alligator Bayou watershed. They are common inhabitants in most types of running, shallow water in lakes, ponds, sloughs, swamps, underground waters, and even wet meadows and ditches. During the day, adults remain hidden in their burrows under stones or debris, or half-buried in small depressions in the substrate. As opportunistic omnivores, crayfish feed primarily on detritus and its associated microbiota and animal material, with feeding occurring between dusk and dawn. When vegetation is not abundant, crayfish can become scavengers and are effective predators of gastropods. Crayfish are a major food item in the diet of reptiles, amphibians, fish, birds, and mammals (References 2.4-1, 2.4-21, and 2.4-37).

Fish (Table 2.4-18)

Sixty-four fish species have been documented to occur in Alligator Bayou. More than 50 percent of the species documented in Alligator Bayou are considered common to abundant in the Alligator Bayou watershed. Juvenile and sub-adult freshwater drum, river carpsuckers, and various buffalo species were commonly collected, with few adults documented, indicating that these species probably utilize the bayous for nursery and rearing grounds, moving out to the LMR as adults.

Ichthyoplankton sampling data emphasize the greater diversity and abundance of larval and early juvenile fishes in the inundated floodplain compared to the main river channel. These data support the hypothesis that floodplains tend to be relatively more important as spawning and/or nursery areas than main stream channels (References 2.4-22 and 2.4-24). Bowfin, gizzard shad, and carp were captured traversing the culverts. Nine more species and three times as many fishes occurred below the access road than above it. Besides shads, the migratory shortnose gar, skipjack herring, common carp, buffalo, and white bass were found less often and in much lower numbers per unit of effort above the access road (References 2.4-1 and 2.4-21).

2.4.2.2.3 Grants Bayou

Grants Bayou is an intermittent stream comprised of three segments (east fork, west fork, and the bayou proper) that flow south to join Alligator Bayou approximately 1.5 mi. (2.4 km) above Thompson Creek. The west fork of Grants Bayou and the bayou proper join together and flow through the RBS site. The east fork joins the bayou proper below the RBS site, where the bayou continues on for 2 mi. (3.2 km). The predominant substrate for all three segments is shifting sand, with occasional patches of fine gravel and infrequent exposures of firm clay.

Winter and spring bring continuous flows through the entire bayou system. The channel width ranges between 3 and 30 ft. (0.9 and 9.1 m), and depths can reach 3.5 ft. (1.1 m), although the bayou is typically less than 1 ft. in depth and subject to intermittent pooling throughout the remainder of the year. During flood events on the LMR, Grants Bayou is not directly affected by river waters, with the exception of areas of the bayou's confluence with Alligator Bayou.

Seasonal variations in water quality in Grants Bayou are largely dependent on local weather conditions. Monitoring studies performed from 1972 to 1977 documented temperature ranges from 53.6°F to 84.2°F (12°C to 29°C) and dissolved oxygen (DO) measurements from 3.6 to 12.6 mg/L (References 2.4-1 and 2.4-21).

Fish (Table 2.4-18)

Twenty-three fish species have been documented as occurring in Grants Bayou (refer to Table 2.4-18). Studies have determined that, because of the intermittent nature of the bayou and its associated streams, few species are able to maintain populations in the pools during dry periods. At times, several of the sites set for sampling dried entirely; however, the few species associated with these areas were quick to recolonize the streams upon return of water flow (References 2.4-1 and 2.4-21).

2.4.2.2.4 On-Site Impoundment

Several small ponds are found within the upland portion (above the tramline) of the RBS site; however, only a small man-made impoundment will be affected by the construction of RBS Unit 2. This pond (approximately 100 by 50 ft.) was constructed in association with a remnant sugar mill on-site. The pond is choked with emergent aquatic vegetation along its banks and has no external inputs other than stormwater received during heavy rain periods. The pond is fully impounded on all four sides and does not contribute to any on-site wetland or bayou habitats. Small ponds such as this typically exhibit low levels of DO due to the stagnant nature of the pond (i.e., no outputs and little input). Although no formal surveys have been conducted in the pond, this type of water body typically only supports aquatic species adapted to living in low oxygen environments, such as the mosquitofish and the bullhead minnow.

2.4.2.2.5 Ecology and Life History of Relevant Species (References 2.4-38 and 2.4-39)

Shortnose Gar (Lepisosteus platostomus)

The shortnose gar inhabits warm, sluggish waters as well as large lakes and streams. They are especially abundant in lakes of the Yazoo-Mississippi Delta where, because of their predaceous habits, they destroy quantities of more desirable fish, including choice game fishes. Gar larvae feed on ostracods, while older larvae and juveniles feed heavily on larvae of other fish. The diet of large gars is reported to consist almost wholly of fish and occasionally crayfish and shrimp. Minnows, young fish of suitable size, and food and game fish are taken. In their feeding habits, gars are competitors of game fish and commercial species. They do, however, eat many undesirable species such as the bowfin.

Shortnose gar typically spawn in the spring (April or May). The eggs are rather large and adhesive, approximately 0.08 in. (2 mm) in diameter and are deposited in shallow water in weedy places where they become attached to weeds, trees, or other objects in the water. This species is common to Louisiana and is statewide in abundance.

Gizzard Shad (Dorosoma cepedianum)

Gizzard shad are a widely distributed migratory fish commonly found in the Mississippi Valley. Gizzard shad are filter-feeders. Except for a short time after hatching, this species is almost entirely herbivorous, feeding heavily on microscopic phytoplankton and algae. Young-of-the-year gizzard shad (2 to 5 in. [5 to 13 cm] long) are reported to form a major part of the diet of at least 17 important game fishes. Adults can attain lengths of up to 14 in.

Spawning takes place during March, April, and May at temperatures between 50°F and 70°F (10°C and 21°C). The nearly transparent fertilized egg, which measures approximately 0.03 in. (0.75 mm) in diameter, is demersal and adhesive. Egg production is highest at age 11, when females average 378,990 eggs per individual. At age 11, almost all males and a good percentage of females are mature.

This species is abundantly taken in the LMR, and although the gizzard shad is a backwater dependent species, it may be found in all three main habitat zones in the LMR: the main channel, channel border, and backwaters. Gizzard shad have little commercial or recreational importance; however, they do serve as forage for game fish.

Threadfin Shad (Dorosoma petenense)

The threadfin shad is similar in appearance to the gizzard shad. Threadfin shad tend to be smaller than the gizzard shad, seldom reaching more than 8 - 10 in. (20 - 25 cm) in length. Threadfin shad are most likely to be found in waters with a noticeable current and are usually found in the upper 5 ft. of the water column. Numerous specimens have been collected from lakes and bayous connected with the Mississippi River system. Threadfin shad have a short life span, with few individuals reaching 2 years of age. Plankton is the principal food, with some *Chaeoborus* and *Chironomids* also comprising a portion of the diet.

Spawning begins in the spring and continues through summer, with females producing between 6700 and 12,400 adhesive eggs. Threadfin shad also have little commercial or recreational importance, yet are an important forage species for game fish.

Emerald Shiner (Notropis atherinoides)

The emerald shiner is a pelagic (open water) species inhabiting lakes and large rivers. In the Mississippi Delta, the emerald shiner serves as a forage fish for larger game fishes and is used extensively for bait during cool weather. Emerald shiners feed heavily on microcrustaceans, midge larvae, and algae and tend to migrate with their food supply.

Spawning occurs in late spring or early summer when water temperatures reach 75°F (24.0°C). Emerald shiners may attain a total length of approximately 4 in., with a life span of approximately 3 years.

Mimic Shiner (Notropis volucellus)

The mimic shiner is widely distributed throughout the United States. In Louisiana, the mimic shiner is most commonly found in low gradient streams of the Mississippi River Alluvial Plain. The mimic shiner is a schooling fish commonly found at the surface or mid-water. Mimic shiners feed on entomostracans (especially *Daphnia*), insects (particularly *Chironomidae*), and green and blue-green algae. It is speculated that spawning takes place at night during late June and early July. This species yields an average of 367 eggs per female.

Blue Catfish (Ictalurus furcatus)

The blue catfish reaches the peak of its abundance in the lower part of the Mississippi Valley, where it is the largest and, economically, the most important of all the catfishes. The blue catfish is primarily a fish of the deep waters of large streams and is typically captured in the LMR and in the lower stretches of its large tributaries. The blue catfish has also been found to inhabit the larger lakes connected with the river system. Zooplankton is the principal food of blue catfish under 4.92 in. (125 mm); immature benthic insects, organic debris, and a few fish are found in stomachs of larger blue catfish in the brackish waters in Louisiana. At the RBS site, this species has been documented to consume mayflies and other insect larvae, crayfish, microcrustaceans, other fish, mollusks, and detritus. The blue catfish spawn from late spring or early summer when water temperatures reach 75°F (23.8°C). Males select nest sites that are normally dark secluded areas, such as cavities in drift piles, logs, undercut banks, rocks, and cans.

Channel Catfish (Ictalurus punctatus)

Channel catfish are extremely adaptable and occur in a variety of habitats, but are especially characteristic of major rivers and large streams having low or moderate gradients. They prefer to live in cool to warm clear water habitats, but will tolerate turbid waters. They are highly active at night from dusk to midnight when they do most of their feeding. Channel catfish spawn during the months of May through July when water temperatures are above 75°F (23.8°C). This species prefers overhanging rock ledges, cut banks, and submerged trees and roots systems for their nesting.

Females mature at 14 in., and males are somewhat smaller. At 1 year old, channel catfish are approximately 4 in. long. By their fourth year, they have usually reached 12 in. The channel catfish is an opportunistic omnivore, feeding on nearly any living or dead material. Being primarily a nocturnal animal, channel catfish must rely on its sensory organs, including the well-developed barbels, to find food.

Their diet consists of aquatic insects, worms, clams, crayfish, snails, and fish, all of which could be dead or alive. Their stomachs might be packed with vegetable materials dropped into the water or minnows depending on what is available. However, large channel catfish feed almost exclusively on other fish. Channel catfish at the RBS site were found to feed on a variety of insect larvae, crayfish, oligochaetes, microcrustaceans, and detritus.

Mosquitofish (Gambusia affinis)

Mosquitofish are a small, live-bearing fish found in a variety of aquatic habitats. This species prefers shallow, vegetated backwater pool regions with little current. While this species was widely introduced to aid in mosquito control, this species feeds on a variety of small aquatic insects, microcrustaceans, and plant material.

Mosquitofish bear young from April to October. Several hundred young are produced in multiple broods by a female in a single season, the number usually varying with the size of the female. The young develop rapidly and become sexually mature in 4 months or less. Internal fertilization of the female is accomplished by the male's long intromittent[c] organ (gonopodium) of modified anal rays. Females store sperm in their reproductive tracts for up to several months and give birth to live young.

Mississippi Silverside (Menidia audens)

The Mississippi silverside inhabits the lower Mississippi Valley and other streams emptying into the Gulf of Mexico. The species also occurs in considerable numbers in the lakes of the Mississippi Delta. The silverside is an important forage fish for larger fish species.

Although spawning has never been observed, indirect evidence indicates that Mississippi silversides spawn from late March through July. Collections of larvae and juveniles from the RBS area indicate peak spawning activity in April/May and late July. Fecundity estimates ranged from 384 to 1699 eggs per female, with a mean number of 984, and maximum longevity was approximately 16 months.

Bluegill (Lepomis macrochirus)

The bluegill is widespread throughout the eastern United States and is distributed statewide in Louisiana. Young bluegills feed on zooplankton, while older fish feed on aquatic insects and insect larvae (e.g., midges, dragonflies, caddisflies, mayflies, etc.). All life stages consume various types of plant material, half of which is filamentous algae. This species is a very popular game fish, and the younger, smaller adults are common in the diets of a wide variety of predaceous game fishes.

c. Intromittent refers to conveying or sending into a body cavity and is used with respect to the male's external copulatory organ, which is used to conduct sperm into the female's reproductive tract.

The bluegill usually spawns from April to September when water temperatures exceed 68°F (20°C). Egg production for females (5.5 to 7.2 in. [140 to 183 mm] standard length [SL] and 0.31 to 0.59 lb. [141 to 268 gm] in weight) has been estimated to range from 7200 to 38,184. The maximum age of most bluegill is 8 to 10 years.

White Crappie (Pomoxis annularis)

The white crappie has a wide ecological tolerance and is typically found in impoundments, lakes, ponds, and large streams. This species prefers quiet waters and is attracted to structures, such as submerged logs and brush piles. Young crappie feed primarily on planktonic crustaceans, while adult white crappies eat aquatic insects, some crustaceans, and a large number of small fishes. The white crappie is also popular game and food fish.

Spawning takes place from April to early June when average daily water temperatures range from 57°F to 73°F (14°C to 23°C), with preferred spawning temperatures between 61°F and 68°F (16°F and 20°C). Egg numbers in females can range from 27,000 to 68,000. Eggs are 0.04 in. (0.89 mm) in diameter, colorless, demersal, and adhesive. Sexual maturity is attained in the second to fourth year and when fish are approximately 6 to 8 in. (152 to 203 mm) in length.

Black Crappie (Pomoxis nigromaculatus)

The black crappie is an important sport fish and resembles the white crappie in form and habits. It is usually found in the clear, quiet, warm water of large ponds, small lakes, bays, shallower areas of larger lakes, and slower flow areas of large rivers. The diet of the black crappie changes with size and age. Smaller, younger crappies feed on planktonic crustacea and free-swimming, nocturnal, insect larvae. The invertebrate diet continues into the third year of life and for individuals as large as 6.3 in. (160 mm). Beyond that size, a variety of very small fishes (mainly perches) makes up an increasing proportion of the diet. Stomach analysis of this species at the RBS site revealed a diet of insects, shrimp, and fish.

Black crappies spawn from March through early May when the water temperature is 66°F to 68°F (19°C to 20°C). Eggs are slightly less than 0.004 in. (1 mm) in diameter, whitish, demersal, and adhesive. Females that are 7.6 to 9.0 in. (195 to 230 mm) at 3 and 4 years of age typically contain 26,700 to 65,520 eggs, with an average number of 37,796 per female. Sexual maturity is attained in the second to fourth year.

Sauger (Sander canadense)

The sauger resembles the walleye, but is smaller, seldom exceeding 12 to 18 in. (46 cm) in length. The diet of the young changes from zooplankton and chironomid larvae to immature and adult mayflies. Adults feed on a variety of small fishes and various invertebrates such as leeches, crayfish, and insects. The sauger is an important game fish and is highly valued as food.

Spawning takes place for approximately a 2-week period in the spring, usually in late April or early May. Spawning has been reported to begin between 39°F and 43°F (3.9°C and 6.1°C) and occurs at night. Eggs are approximately 0.006 to 0.007 in. (1.44 to 1.86 mm) in diameter. They are sticky when laid, but after water hardening, are semibuoyant and nonadhesive. Females lay from 15,000 to 40,000 eggs per pound of fish, depending on size. The total number of eggs per female ranges from approximately 9000 to 96,000. Hatching occurs over a range of 25 to 29 days at temperatures from 40°F to 55°F (4.5°C to 12.8°C). Sexual maturity is achieved by males at 2 to 3 years of age and by females at 4 to 6 years of age. Maximum age does not exceed 5 to 6 years.

Freshwater Drum (Aplodinotus grunniens)

The freshwater drum has perhaps the greatest latitudinal range of any North American freshwater species and is generally distributed throughout the Mississippi drainage basin. The freshwater drum is considered a carnivorous bottom feeder, with the young eating small crustaceans and aquatic insect larvae. Crayfishes and small fishes are important in the diet of larger drums, and mayflies and amphipods are important food items for drums of all year classes. Stomachs of drum captured at the RBS site contained dipteran, mayfly, and caddisfly larvae, as well as other insects, crayfish, microcrustaceans, *Corbicula* spp., fish, and detritus. This species is landed commercially in West Feliciana Parish and is a popular sport fish throughout Louisiana.

Spawning occurs from mid-spring to late summer or when water temperatures range from 64.4°F to 76.1° F (18°C to 24.5°C), with the number of eggs per individual female ranging from 43,000 to 508,000. Eggs of the drum are semi-buoyant; they float at the surface in calm water and tend to be driven down to deeper levels when the surface is turbulent. Extruded eggs measured 0.004 to 0.007 in. (1.15 to 1.7 mm) in diameter and have a large oil globule 0.002 to 0.003 in. (0.64 to 0.72 mm) in diameter. Hatching takes place at a temperature of approximately 71.6°F (22°C). Sexual maturity is reached at a comparatively small size, from 12 to 15 in. (30.5 to 38.1 cm) long.

Ohio River Shrimp (Macrobrachium ohione)

The Ohio river shrimp occurs in coastal bays and medium- to large-sized rivers draining the Atlantic and Gulf slopes of North America from Virginia to central Texas, formerly penetrating inland in the Mississippi system to Illinois and Ohio. They are known to concentrate around submerged vegetation when it is available. This species can be omnivorous, although usually they are carnivores, and are an important food source for many predaceous fish. In the LMR, berried (egg-laden) females are found from late winter through early autumn, with high densities of juveniles apparent in the late spring and summer. Newly hatched larvae retain a large yolk-mass and lack functional mouth parts. The early larval instars are planktonic, later becoming nektonic.

2.4.2.3 Commercial and Sport Fisheries

Fish

Commercial harvest in the Upper Mississippi River (UMR) is dominated by four groups of fishes including the common carp, buffalos (bigmouth and smallmouth), catfishes (channel and flathead), and freshwater drum, which together represent 95 percent of the total commercial catch in the UMR and 99 percent of the monetary value. The common carp has ranked first among species in commercial catch for decades.

The same species harvested in the UMR also dominate the commercial fisheries for the freshwater portions of the LMR. Commercial harvest of fishes in the LMR is difficult to assess because of inconsistencies in methods of gathering and reporting data; however, limited information indicates commercial harvest is increasing. Neither the commercial nor recreational fisheries appear to be over harvested; however, future fisheries production may be threatened by loss of aquatic habitat, altered spatial and temporal aspects of floodplain inundation, and nuisance invasions. In addition, navigation traffic affects fish survival and recruitment via direct impacts and habitat alteration and is expected to increase in the future (References 2.4-20 and 2.4-40).

Although water quality in most reaches has improved substantially from formerly severely degraded conditions, fish health remains affected by various contaminants, in particular bioaccumulative organic compounds, throughout the river. Because of the extensive agriculture in the Mississippi floodplain and scattered urban areas, the river is an inland sink for fertilizers, pesticides, and domestic and industrial wastes (References 2.4-20, 2.4-24, and 2.4-40).

National Marine Fisheries Service (NMFS) statistics for 1954 to 1977 show catches of 6 to12 million kilograms (kg) and increasing over time in the LMR. Landings of blue catfish and flathead catfish have increased substantially, while harvests of common carp, buffalo fishes, channel catfish, and freshwater drum have been highly variable. Currently, in Louisiana, commercial catch is measured, but are not assigned to specific waters (Reference 2.4-20).

Historic catch data (1976) indicated that commercial landings of finfish for Pointe Coupee and West Feliciana parishes totaled less than 500,000 lb., approximately 6 percent of the Louisiana inland landings for that year. The principal commercial fish in the area are shad, buffalo, and catfish. No data are available on sport fisheries in this area; no organization in the state compiles creel census information or estimates sportfishing effort. Blue catfish, flathead catfish, and freshwater drum are most likely the most popular sport catches in this area of the river (References 2.4-1 and 2.4-21).

Current commercial and recreational fish catch data are not available for West Feliciana Parish; landings data (LMR or otherwise) have not been recorded by the LDWF.

Macrocrustaceans

The Ohio river shrimp is the most common freshwater shrimp in Louisiana and can be found in the LMR, where almost all of the current production is used for bait. However, little documented information is available on commercial or recreational catches, as the NMFS and the LDWF no longer maintain catch records for this species in Louisiana (Reference 2.4-20).

Crayfish are exploited for use as food, scientific specimens, and fish bait. An estimated 90 to 95 percent of crawfish produced for consumption is generated in Louisiana, mostly through aquaculture. (Commercial fishing of wild crawfish comprises less than 20 percent of Louisiana crawfish production.) The LDWF is charged with the management of Louisiana wild crayfish stocks; most wild production is supported by the Atchafalaya Basin. Only limited sportfishing for crayfish, mainly by local residents, is known to occur in the West Feliciana Parish (Reference 2.4-24).

Current commercial and recreational crustacean catch data are not available for West Feliciana Parish; landing data (LMR or otherwise) have not been recorded by the LDWF.

2.4.2.4 Threatened and Endangered Aquatic Organisms

The following threatened and endangered (T&E) species discussion focuses on federal- and/or state-listed species in Louisiana with the potential to be affected by plant operations at the RBS site. The federal T&E list (USFWS) and state lists (Louisiana and Mississippi) were reviewed, and those species with any potential to be affected are provided in Table 2.4-19. Literature was reviewed for the listed species, specifically for documented and expected occurrence in the LMR and other aquatic habitats within the RBS site. The T&E lists have been examined on a per-county/parish basis to determine the status of each species on a more regional level. Few species appear to have the potential to inhabit the LMR near the vicinity of the RBS site.

Aquatic organisms were sampled in the LMR near the RBS site, and in several water bodies on the RBS site, from 1972 to 1977. During that time, no aquatic T&E organisms were encountered. The NRC findings in the 1985 Final Environmental Statement (FES) for the RBS site stated that no T&E species were expected to occur at the site; therefore, none of the following species discussed would be affected by operations at the RBS site (Reference 2.4-41).

Other studies reviewed (RM 240 to RM 273 and RM 129.5) did not document any threatened or endangered species, although several listed fish species have the potential to exist in these areas of the LMR (References 2.4-22, 2.4-23, 2.4-28, and 2.4-30).

Both state and federal wildlife agencies were contacted regarding T&E species with the potential to inhabit the RBS site. A letter from the LDWF stated that, via a search through the T&E species searchable database of the LNHP, the only aquatic species of concern is the pallid sturgeon (Reference 2.4-42). Additionally, a letter sent to the USFWS deemed that aquatic species at the RBS site would be minimally affected through activities associated with RBS Unit 3 (Reference 2.4-43).

Pallid Sturgeon (Scaphirhynchus albus) (Federal and State Listed - Endangered)

The pallid sturgeon is listed as endangered by the USFWS, Mississippi, and Louisiana. This species can weigh up to 80 lb. and reach lengths of 6 ft., whereas the closely related shovelnose sturgeon rarely weighs more than 8 lb.

Pallid sturgeons evolved and adapted to living close to the bottom of large, silty rivers with a natural hydrograph[d]. This species is essentially restricted to the main channels of the Missouri and Mississippi Rivers, with its principal habitat in the main channel of large, turbid rivers, although some have been captured from mainstream reservoirs on the Missouri River. This species is occasionally collected in the LMR; the pallid sturgeon is a riverine-dependent species that is most likely to be found in the main channel or channel border.

d. Hydrograph refers to fluctuations in the flow regime of a stream or river over time. Sturgeon reproductive success has been linked to the presence of natural hydrographs in a stream or river system. Although the LMR still experiences fluctuations in hydrographs, these changes have been limited because of the implementation of lock and dam systems to aid in maintaining a navigable depth in the channelized portion of the Mississippi River (mostly the LMR).

Larger pallid sturgeons almost always swim against the current and often employ a tactic called "hunkering" or substrate oppression. This is where the fish extends the pectoral fins and holds on to available substrate. Doing this allows fish to alternately swim and rest when in strong currents.

Sexual maturity for males is estimated to be 7 to 9 years, with 2 to 3 year intervals between spawning. Females are not expected to not reach sexual maturity until 7 to 15 years, with up to 10-year intervals between spawning. Pallid sturgeons are long lived, with individuals perhaps reaching 50 years of age. Spawning coincides with spring runoff and occurs between March and June throughout the species range. Fishes in Louisiana and Mississippi begin spawning earlier than those in more northern areas (References 2.4-38 and 2.4-39).

Today, pallid sturgeons are scarce in the upper Missouri River above Ft. Peck Reservoir; scarce in the Missouri and lower Yellowstone Rivers between Ft. Peck Dam and Lake Sacagawea; very scarce in the other Missouri River reservoir reaches; scarce in the Missouri River downstream of Gavins Point Dam; scarce but slightly more common in the Mississippi and Atchafalaya Rivers; and absent from other tributaries.

All of the 3350 mi. of riverine habitat within the pallid sturgeon's range have been adversely affected by human activity. Approximately 28 percent has been impounded, which has created unsuitable lake-like habitat; 51 percent has been channelized into deep, uniform channels; the remaining 21 percent is downstream of dams that have altered the river's hydrograph, temperature, and turbidity. Commercial fishing and environmental contaminants may have also played a role in the pallid sturgeon's decline (Reference 2.4-40).

The LDWF identified the pallid sturgeon as a species of concern that could potentially inhabit the Mississippi River waters near the RBS site. Since this species is a deepwater, channel-dwelling species, the pallid sturgeon is not expected to be affected by construction and operational activities at the RBS site (searches based on LNHP's T&E species searchable database) (References 2.4-42 and 2.4-44).

Gulf Sturgeon (Acipenser oxyrinchus desotoi) (Federal and State Listed - Endangered)

The gulf sturgeon is listed by the USFWS and the LDWF/LNHP as endangered. While the gulf sturgeon does not typically occur in non-tidal portions of the LMR, some concerns have been raised regarding historic sitings of this species in reaches of the LMR in Mississippi. In 2003, the USFWS released a critical habitat designation for this species (Reference 2.4-45). The LMR was not included in this designation. Further discussion with the USFWS indicated that this species should not be considered as a species of concern for this project (Reference 2.4-46). No further consideration of the gulf sturgeon is discussed in this document.

Rainbow Darter (Etheostoma caeruleum) (State Listed - Imperiled to Rare)

The rainbow darter is listed by the LNHP as imperiled to rare in West Feliciana Parish; however, the LDWF (in conjunction with the LNHP) did not express concerns regarding the effects on this species from the RBS project.

Rainbow darters prefer the fast-moving currents of shallow riffles in creeks and small rivers. They also have a preference for gravel or rocky-bottom streams. Typically, adult fish are found in faster and deeper running waters, while younger rainbow darters are more common in slower, shallower areas and pools.

Male darters become very brightly colored during spawning season to help attract the females. Spawning occurs in the spring season in shallow riffles, and the female lays about 800 eggs. The eggs of rainbow darters are usually 0.06 to 0.07 in. (1.6 to 1.9 mm) in diameter and typically hatch between 10 to 12 days after fertilization. A small fish, the rainbow darter only grows to be 3 in. (5 to 7 cm) long. Rainbow darters can typically live for up to 4 years.

The rainbow darter is found in North America, throughout the Great Lakes region and the Ohio River valley, extending into northern Alabama, and as far west as Missouri and Arkansas. Distinct populations of rainbow darters have also been discovered in the tributaries of the LMR in southwest Mississippi and eastern Louisiana (References 2.4-38 and 2.4-39).

Central Stoneroller (Campostoma anomalum) (State Listed - Imperiled)

The central stoneroller is listed by the LNHP as imperiled in West Feliciana Parish; however, the LDWF (in conjunction with the LNHP) did not express concerns regarding the effects on this species from the RBS project.

Although this species is one of the most widely distributed and locally abundant fishes in central and eastern U.S. streams, it is uncommon in Louisiana, with limited distribution in a few parishes (West Feliciana and Catahoula). The central stoneroller prefers pool and riffle habitats with sand-gravel substrate and will also concentrate along the banks of perennial streams in submerged vegetation or other cover (References 2.4-38 and 2.4-39).

Bluntface Shiner (Cyprinella camura) (State Listed - Imperiled)

The bluntface shiner is listed by the LNHP as imperiled in West Feliciana Parish; however, the LDWF (in conjunction with the LNHP) did not express concerns regarding the effects on this species from the RBS project.

The bluntface shiner is common in clear streams with moderate to swift flow and sand or gravel substrata. Spawning occurs from late March through mid-August. Females of 1.4 to 2.3 in. (36 to 58 mm) contain 76 to 370 mature oocytes, and clutch size is positively correlated with fish length. Mature oocytes average 0.04 in. (1.09 mm) in diameter. The maximum life span is approximately 3 years. The minimum size at sexual maturity is 1.3 in. (32 mm) for females; all females larger than 1.6 in. (40 mm) are mature. Males are also mature by 1.6 in. (40 mm).

The bluntface shiner is common in the more upland reaches of streams of the Mississippi River basin. In Louisiana, it has been taken only in eastern tributaries of the Mississippi River. These tributaries represent the southernmost limits of the population from the LMR drainage (References 2.4-38 and 2.4-39).

Paddlefish (Polyodon spathula)

Paddlefish, which were once prevalent in all of the tributaries of the Mississippi River, have been in decline as a result of habitat destruction and river modification and were proposed for listing under the Endangered Species Act (ESA) in the 1990s. Although they were not listed under the ESA, trade in paddlefish became regulated under the Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora in 1992. Fish and wildlife studies and state reviews caused several states to list and protect paddlefish, while adjacent states continued to maintain sport and commercial fisheries. This interstate problem was addressed in the 1991 founding of the Mississippi Interstate Cooperative Resource Association (MICRA) and its development of regional plans and research projects. MICRA continues to address the issues of interjurisdictional problems posed by the migratory paddlefish.

In Louisiana, the paddlefish has been protected from both sport and commercial harvest since 1992, to protect it from overharvest. At that time, the LDWF had little information on the population status. Since 1992, the department has investigated its numbers and established artificial spawning techniques, and the collection ban was recently lifted for recreational fishermen in 2007. New state regulations would allow properly licensed recreational fishermen using legal recreational gear to take paddlefish under limited conditions. Commercial collection of this species is still restricted (Reference 2.4-47). The paddlefish was still included in this analysis, because the species has a long-standing record of being listed by the LDWF/LNHP as rare in Louisiana, although the recent lifting of this status demonstrates that the paddlefish does not present a concern for effects from the RBS project.

Paddlefish spawn in the spring and usually require fast-flowing water (floods that last several days), and clean sand or gravel bottoms for successful spawning. During spawning, paddlefish gather in schools. Young fish grow quickly, as much as 6 in. in several months. Fish generally become mature at 5 to 10 years and may live to be 20 to 30 years old. Paddlefish are plankton feeders inhabiting open waters where they can filter large quantities of water (References 2.4-38 and 2.4-39).

Agency Communications

State and federal fish and wildlife agencies were contacted to identify and address aquatic T&E species with the potential to be affected by construction and operational activities at RBS site.

The LDWF reviewed the proposed construction activities at the RBS site, as detailed in a letter sent to the Applicant on February 22, 2007, and identified the pallid sturgeon (endangered) as a species of concern that could potentially inhabit the Mississippi River waters near the RBS site. Because this species is a deepwater, channel-dwelling species, the pallid sturgeon is not expected to be affected by construction and operational activities at the RBS site (searches based on LNHP's T&E species searchable database) (References 2.4-42 and 2.4-44). Additionally, in historic and recent fisheries studies performed at and near the RBS site, the pallid sturgeon has not been identified in fish collections, as previously described (References 2.4-23, 2.4-28, 2.4-29, and 2.4-30). Impingement studies conducted at a facility downstream of the RBS site at RM 129.9 have also not documented collection of this species (Reference 2.4-22). Based on these references and discussions with LMR experts, the pallid sturgeon is not expected to occur near the RBS site.

The USFWS reviewed proposed construction activities at the RBS site, as detailed in a letter sent to the Applicant on February 10, 2007, and deemed that "resources…currently protected by the Endangered Species Act of 1973 (Act)…are not likely to affect those resources. This finding fulfills the requirements under Section 7(a) (2) of the Act" (as quoted from the USFWS stamp of approval on the letter submitted to the agency) (Reference 2.4-43). Based on the USFWS conclusion and the results of this review, no federally listed aquatic T&E species are expected to be affected by activities at RBS site.

As previously mentioned, the USFWS was contacted to discuss the potential for gulf sturgeon to occur in the LMR near the RBS site. Gulf sturgeon is not commonly found in this area and should not be a concern for effects from the RBS project (Reference 2.4-46).

Copies of correspondence between state and federal wildlife agencies (LDWF, USFWS, National Oceanic and Atmospheric Administration [NOAA]) and the Applicant or others acting on behalf of the Applicant can be found in Appendix 2A.

2.4.2.5 Nuisance Species

Nuisance species are organisms whose introduction or presence in an ecosystem produces a harmful effect or interference with other natural resources or human use of resources within the ecosystem. This subsection focuses on aquatic nuisance species known to occur near the RBS site, based on organisms identified in biological collections performed in the LMR and reports produced by the Aquatic Nuisance Species (ANS) Task Force.[e]

Asian clam (Corbicula sp.)

First introduced into the United States in 1938, the Asian clam has become established in many major U.S. waterways, including the Mississippi River. The Asian clam is a biofouling agent commonly found near industrial outfalls releasing thermal discharge, responsible for more than $1 billion in damages to the power industry (References 2.4-31 and 2.4-32). However, distribution is limited in Louisiana, with few species documented in benthic collections taken near the RBS site (References 2.4-1, 2.4-21, 2.4-22, and 2.4-23).

Zebra Mussel (Dreissena polymorpha)

The zebra mussel was first introduced to the United States from Europe in 1986 into the Detroit River-Lake St. Clair region of the Great Lakes. This species has since spread rapidly throughout the Great Lakes, the St. Lawrence River, and the navigable inland waterways of the Mississippi Drainage. A projected cost of $2 billion has been proposed for the control of *D. polymorpha* over the decade of the 1990s in the Great Lakes alone, with this figure likely to rise exponentially as zebra mussels continue to expand their range in North America (Reference 2.4-31).

A zebra mussel monitoring and control program (ZMMCP) is currently in place at the RBS site to monitor the occurrence and relative densities of zebra mussels in the LMR, the clarifier influent and effluent, and the clarifier internals. When zebra mussels are suspected or apparent,

e. The ANS Task Force is an intergovernmental organization dedicated to preventing and controlling aquatic nuisance species and implementing the Nonindegenous Aquatic Nuisance Prevention and Control Act (NANPCA) of 1990 and the National Invasive Species Act (NISA) of 1996. The Task Force is co-chaired by the USFWS and NOAA.

inspection and/or sampling of the adult populations in the LMR near the intake piping are performed, and the intake screens and adjacent piping are cleaned when deemed necessary.

2.4.2.6 Aquatic Indicator Organisms

One of the best assessments of stream or water body integrity is the examination of its biological inhabitants. Because biological communities incorporate and reflect the quality of their surroundings, the presence or absence of certain types of organisms can be utilized as an ecological measure of fluctuating environmental conditions.

Stressor sensitive and tolerant species provide an effective mechanism to assess the condition of a water body. One such tool of aquatic macroinvertebrate community condition is the richness measure, the EPT (Ephemeroptera, Plecoptera, Tricoptera [mayflies, stoneflies, caddisflies]) index that is utilized as a measure of the degradation status of a site by documenting the presence or absence of key indicator species.

Other assessment tools for both aquatic macroinvertebrate and fish communities include the comparisons between reference/sample site conditions and upstream/downstream conditions measuring taxa richness and abundance. These assessments of benthic macroinvertebrates and fish provide insight into the relative condition of a water body. Because of their relative limited migration patterns or sessile mode of life, benthic invertebrates are well-suited for assessing site-specific effects. Fish are good indicators of longer term effects and broad habitat conditions because they are relatively long-lived and mobile.

Benthic macroinvertebrates representing 8 phyla, 57 families, and 145 species were identified from Alligator Bayou. This list included a wide range of organisms from tolerant to intolerant; feeding groups-scrapers, predators, collector-gatherers, collector-filterers, and shredders; and habitat categories for movement and positioning-swimmers, clingers, sprawlers, climbers, and burrowers. Fourteen of the 145 species (10 percent) were representative of the richness measure, EPT, indicating a low perturbation response (Reference 2.4-48). Fifty-one families from 8 phyla (representing 73 species) were documented from the Mississippi River near the RBS site. Twelve of the 73 species comprised the EPT index measure and indicate a low perturbation response in the Mississippi River. Alligator Bayou, with its higher number of total taxa, was probably indicative of an increase in available habitat. Both systems appeared to be in relatively good condition, based upon these measures of biological integrity (Reference 2.4-48).

2.4.2.7 Environmental Stressors

The on-site aquatic habitats have been subjected to a variety of historical and environmental stresses, both man-induced and natural. Man-induced stresses include water turbidity due to shoreline erosion resulting from the clearing of forested areas, dredging of the LMR and on-site stream beds, and the construction of the railway tram in the 1800s. Natural stresses included periodic flooding of the LMR and on-site rivers and streams, water turbidity in the LMR due to high velocity currents mixing sediments throughout the water column, scouring of the LMR river bed, and drying-out of bayous during droughts.

Water Turbidity

Timber harvesting and land clearing, both for construction and agricultural purposes, leave topsoils (previously held in place by root masses) loose enough to be washed into the LMR and on-site bayous and streams. Turbidity in the LMR can also be attributed to rapid river currents that naturally erode portions of the river banks and carry sediment deposits away from the shore which are churned within the water column. Turbidity in these water bodies limits the growth and production of phytoplankton and other primary producers, limiting food and habitat resources for aquatic species, thus limiting the species richness of the water bodies at the RBS site. High sediment load in the LMR increases the process of benthic scouring in the river, leaving gravel and bedrock as exposed river bottom, limiting the growth and production of the benthic community.

Dredging

The habitat of the LMR has been altered since the late 1800s, when design plans were put in place to construct a series of locks and dams on the Mississippi River to help control river flooding. In 1928, work was authorized to begin dredging of the LMR to maintain a 9-ft. depth in the LMR from Cairo, Illinois, to the river's confluence with the Gulf of Mexico at Louisiana's Gulf Coast. In 2005, Ahead of Pass[f] (AHP) portions of the LMR were repaired or re-dredged as needed. Continual dredging of large rivers depletes the benthic community and prevents organism succession and development of higher level, more complex food webs. While some organisms have adapted to survive in this type of harsh, ever-changing environment, the aquatic community capable of thriving in this type of system is limited (Reference 2.4-20).

Widening and alteration in streams can have the same type of limiting effects on the organism hierarchy; however, these effects may be exaggerated because of the small size of the community. Isolated environments, such as those found in small ponds, and small aquatic communities common in small streams and bayous, do not typically rebound from alterations to the environment as rapidly as those found in larger river systems' watersheds.

Although some habitat alteration has occurred at the RBS site, to date, studies have yet to document ill-effects to aquatic communities due to stream alteration.

Construction of the Railroad Tram

The old, abandoned railroad tram, built during the Civil War era, runs along the base of the bluffs and across a portion of the floodplain in the western portion of the property. The northern one-half of the tram crosses the LMR floodplain and forms a levee 12 to 15 ft. (4 to 5 m) high. Railroad trestles along the tram occur where Alexander Creek leaves the hills and enters the floodplain, becoming Alligator Bayou. The flow from Alexander Creek enters Alligator Bayou through the two relatively narrow gaps in the tram, causing floodwaters to back up in the area upstream of the tram. Over the years, this has created approximately 56 ac. (22.6 ha) of swamp where none previously existed. Siltation in the bottomlands east of the tram is heavy and, in

f. "Ahead of pass" refers to above head of passes, the head of pass point where the mainstream Mississippi River branches off into three different directions at the mouth of the Gulf of Mexico.

places, the recent water-saturated silt is 5 in. deep. This area has developed into a tupelo gum-bald cypress swamp.

While silting-in of the floodplains' habitats surrounding the tramline has occurred at the RBS site, to date, studies have yet to document ill-effects to aquatic communities due to this process (References 2.4-1 and 2.4-21).

Floods and Droughts

The Alligator Bayou system is subject to periodic inundation by the LMR from overbank flooding and backwater from Thompson Creek. The bayou is completely flooded by the Mississippi River when the river level exceeds 37 ft. msl, because river water flows over the levee directly into the bayou. Partial flooding of the bayou can be expected when the river level is above 32 ft. msl due to water backflow into the bayou from Thompson Creek.

In addition to flooding from the LMR, certain components of the Alligator Bayou watershed have been known to dry completely, either as part of seasonal fluctuations in water availability or due to a complete lack of source water during droughts.

Flooding of an aquatic environment can cause severe damage to the organisms within the community. However, areas that are exposed to flooding on a regular basis tend to adapt to the flooding cycle over time. Rehabilitation of the environment is not a slow process, because it tends to be in areas not exposed to flood conditions on a cyclic basis. The same is true for aquatic communities repeatedly exposed to drought conditions; organism growth and succession becomes a rapid, cyclic process, and the environment is quick to recover from extreme conditions. While cyclic bouts of flooding and drought occur at the RBS site, to date, studies have yet to document ill-effects to aquatic communities due to these processes (References 2.4-1 and 2.4-21).

2.4.2.8 Special Use Areas

Wetlands located within the RBS site were identified utilizing satellite imagery and topographic maps of the site. The identified wetlands were associated with Alligator Bayou and other floodplain areas along the LMR. Riparian wetland communities were identified along the banks of streams and ponds associated with Grants Bayou and its tributaries; refer to Subsection 2.4.1 for more details.

2.4.2.9 Transmission Corridors and Off-Site Areas

The existing transmission corridors from the RBS traverse mostly terrestrial habitats. However, there is one crossing of the LMR near the RBS site, as well as crossings of several smaller rivers, creeks, streams, canals, and bodies of standing water.

With the exception of the LMR, no data have been collected describing the biota of these water bodies. Furthermore, no data are available from the LDWF to provide this information. As discussed in Subsections 4.3.2.2 and 5.6.2, the transmission system should have little potential effect on aquatic life in the water bodies crossed.

Although several T&E aquatic species have been documented as having the potential to occur in the LMR at the RBS site, none were surveyed in the 1972 - 1977 and 2000 - 2001 aquatic studies performed at the site; therefore, no T&E species are expected to occur at the RBS site.

The NRC findings in the 1985 FES for the RBS site stated that no T&E species were expected to occur at the site; therefore, none of the species discussed herein would be affected by operations at the site (Reference 2.4-41).

2.4.2.10 Federal Regulations Regarding Aquatic Resources

Essential Fish Habitat

Essential fish habitat (EFH) is evaluated under the authority of the Magnuson-Stevens Fishery Conservation and Management Act of 1976 (MSFCMA), as amended (16 USC 1801-1882). The act established national standards that require fishery management plans to create conservation and management measures based on the best scientific information to prevent overfishing and to ensure optimum yield. The MSFCMA was amended in 1996 by the Sustainable Fisheries Act, which established procedures for identifying EFH and required interagency coordination to further the conservation of federally-managed fisheries. Rules published by the NMFS (50 CFR Sections 600.805-600.930) specify that any federal agency that authorizes, funds, or undertakes, or proposes to authorize, fund, or undertake an activity that could adversely affect EFH is subject to the consultation provisions of the act; the rules also identify consultation requirements.

EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." These waters are generally found in estuaries and tidally influenced sections of rivers that flow into estuaries. The tidally influenced portion of the LMR extends from its confluence with the Gulf of Mexico approximately up to RM 228, just below Baton Rouge, Louisiana. Because this project is located upstream beyond tidal influence, there are no federally-managed species that would be affected by this project. Therefore, there are no EFH considerations or consultation requirements needed for this project, and there is no further discussion of this issue (References 2.4-49 and 2.4-50).

2.4.3 REFERENCES

2.4-1 Gulf States Utilities Company, "River Bend Station Environmental Report, Operating License Stage," Volumes 1-4, Supplements 1-9, November 1984.

2.4-2 Endangered Species Act, as amended, 87 Stat. 884, 16 USC 1531, et seq., Website, http://www.fws.gov/endangered/esa.html, accessed 1973.

2.4-3 Daigle, J. J., G. E. Griffith, J. M. Omernik, P. L. Faulkner, R. P. McCulloh, L. R. Handley, L. M. Smith, and S. S. Chapman, Ecoregions of Louisiana (color poster with map, descriptive text, summary tables, and photographs), Reston, Virginia, U.S. Geological Survey (map scale 1:1,000,000), Website, ftp://ftp.epa.gov/wed/ecoregions/la/la_map.pdf, accessed 2006.

2.4-4 Noble, R. E., *Vegetation of Gulf States Utilities' Plant Site near St. Francisville, Louisiana,* Submitted to Gulf States Utilities Company, Baton Rouge, Louisiana, April 24, 1972.

2.4-5 Electric Power Research Institute Solutions, *Phase 1 Ecological Asset Value Development Draft Report*, Entergy River Bend Power Plant, West Feliciana Parish, Louisiana, 31 pages and appendices, 2002.

2.4-6 Louisiana Department of Transportation, Final Environmental Assessment: Route LA 10 Mississippi River Bridge, St. Francisville-New Roads, West Feliciana-Pointe Coupee Parishes, 2003.

2.4-7 U.S. Army Corps of Engineers, Environmental Laboratory, *Corps of Engineers Wetlands Delineation Manual*, Technical Report Y-87-1, U.S. Army Engineers Waterways Experiment Station, Vicksburg, Mississippi, 1987.

2.4-8 U.S. Fish & Wildlife Service, Response dated February 16, 2007 and signed by J. Boggs (Acting Field Supervisor, Louisiana Field Office, Lafayette) to letter written by R. Brooks (Black & Veatch) requesting consultation on potential impact of project on protected species, February 10, 2007.

2.4-9 Louisiana Department of Wildlife & Fisheries, Letter from G. Lester, Coordinator, Natural Heritage Program to R. Brooks (Black & Veatch), concerning Federal and State Protected Species, February 22, 2007.

2.4-10 U.S. Fish & Wildlife Service, *Louisiana Black Bear Recovery Plan*, Jackson, Mississippi, 52 pages, 1995.

2.4-11 Noble, R. E., *Breeding Bird Census in the Loess Bluff Forest of GSU's River Bend Nuclear Power Plant Site*, Submitted to Gulf States Utilities Company, Baton Rouge, Louisiana, 1973.

2.4-12 Noble, R. E., *Breeding Bird Census in the Loess Bluff Forest of GSU's River Bend Nuclear Power Plant Site*, Submitted to Gulf States Utilities Company, Baton Rouge, Louisiana, 1974.

2.4-13 Boundy, J., *Louisiana Amphibians and Reptiles: Checklist,* Louisiana Gulf Coast Herpetological Society, Website, http://www.lgchs.org/LGCHS% 20Herp% 20Checklist.pdf, accessed 2007.

2.4-14 Louisiana Department of Wildlife & Fisheries, Red-cockaded Woodpecker, Website, http://www.wlf.state.la.us.gov/experience/threatened/redcockaded woodpecker.cfm, accessed 2004.

2.4-15 64 FR 46541, "Final Rule to Remove the American Peregrine Falcon from the Federal List of Endangered and Threatened Wildlife," *Federal Register*, Website, http://ecos.fws.gov/docs/federal_register/fr3444.pdf, accessed August 25, 1999.

2.4-16 50 CFR 17, "Endangered and Threatened Wildlife and Plants; Removing the Bald Eagle in the Lower 48 States from the List of Endangered and Threatened Wildlife," *Federal Register*, Website, http://www.fws.gov/migratorybirds/issues/BaldEagle/baldeaglefinaldelisting.pdf, accessed July 9, 2007.

2.4-17 U.S. Fish & Wildlife Service, National Bald Eagle Management Guidelines, Website, http://www.fws.gov/migratorybirds/baldeagle.htm, accessed 2007.

2.4-18 52 FR 21059, "Reclassification of the American Alligator to Threatened Status Due to Similarity of Appearance Throughout the Remainder of Its Range," *Federal Register*, Website, http://ecos.fws.gov/docs/federal_register/fr1263.pdf, accessed June 4, 1987.

2.4-19 Pugh, K., Long-tailed Weasel in Alabama, Alabama Department of Conservation and Natural Resources, Website, http://www.outdoralabama.com/watchable-wildlife-wildlife/what/Mammals/Carnivores/ltw.cfm, accessed 2007.

2.4-20 Schramm, H. L., "Status and Management of the Mississippi River Fisheries," Large River Symposium Proceedings, Vol. I, 2003.

2.4-21 U.S. Atomic Energy Commission, "River Bend Nuclear Power Station Units 1 and 2," Final Environmental Statement, 1974.

2.4-22 Louisiana Power & Light, "Demonstration Under Section 316(b) of the Clean Water Act, Waterford Steam Electric Station Unit No. 3," 1979.

2.4-23 Entergy, "316(b) Sampling Final Report, Waterford 1 & 2 Plant," October 2007.

2.4-24 Baker, J. A., K. J. Killgore, and R. L. Kasul, "Aquatic Habitats and Fish Communities in the Lower Mississippi River," *Reviews in Aquatic Sciences* 3(4):313-356, 1991.

2.4-25 Louisiana Department of Transportation and Development, "Final Environmental Assessment, Mississippi River Bridge, Route LA 10, St. Francisville-New Roads, West Feliciana-Pointe Coupee Parishes," State Project 700-28-0022, Baton Rouge, Louisiana, 2003.

2.4-26 Louisiana Department of Environmental Quality, "State of Louisiana Water Quality Management Plan Water Quality Inventory Section 305(b)," 2004.

2.4-27 Wetzel, R. G., *Limnology: Lake and River Ecosystems*, 3rd Ed., Elsevier Academic Press, San Diego, California, 2001.

2.4-28 SEMPRA, Bonnet Carre Power, LLC, "Application Addendum for a Louisiana Pollutant Discharge Elimination System Permit and Comprehensive Demonstration Study under the 316 (b) Rule for Track II," Prepared by CK Associates and URS, LaPlace, Louisiana, June 2002.

2.4-29 System Energy Resources, Inc., "Environmental Impact Statement for an Early Site Permit (ESP) at the Grand Gulf ESP Site," June 2006.

2.4-30 Bart, H. J., "Extraction, Analysis, and Summary of Fish Community Data from the St. Francisville, Louisiana Area of the Lower Mississippi River Archived in the Tulane University Museum of Natural History," 2008.

2.4-31 Mathews, M. A. and R. F. McMahon, *Survival of Zebra Mussels (Dreissena polymorpha) and Asian Clams (Corbicula fluminea) under Extreme Hypoxia*, USACE, Technical Report EL-95-3, 1995.

2.4-32 U.S. Geological Survey, "Summary Report of Nonindigenous Species in U.S. Fish and Wildlife Services Region 4," Florida Caribbean Science Center, 2001.

2.4-33 Ciugulea, I., D. Waters, J. Day, and R. Chapman, "Phytoplankton of a Mississippi River Watershed in Coastal Louisiana, *Phytoplankton Taxa List*," 2001.

2.4-34 Demetters, J. M, D. H. Wahl, D. A. Soluk, and S. Gutreuter, "Life in the Fast Lane: Fish and Foodweb Structure in the Main Channel of Large Rivers," *Journal of the North American Benthological Society*, 20(2):255-265, 2001.

2.4-35 Williams, L. G., "Dominant Planktonic Rotifers of Major Waterways of the United States," *Limnology and Oceanography*, 11(1):83-91, 1966.

2.4-36 Electric Power Research Institute, *Evaluating the Effects of Power Plant Operations on Aquatic Communities: Summary of Impingement Survival Studies,* 2003.

2.4-37 McClain, W. R., R. R. Romaire, C. G. Lutz, and M. G. Shirley, "Publication 2637 of the Louisiana State University Agriculture Center and Experiment Station," *Louisiana Crawfish Production Manual*, 2007.

2.4-38 Douglas, N. H., *Freshwater Fishes of Louisiana,* Claitor's Publishing Division, Baton Rouge, Louisiana, 1974.

2.4-39 Ross, S. T., "Inland Fishes of Mississippi," Mississippi Department of Wildlife, Fisheries, and Parks, 2001.

2.4-40 Miranda, L. E., "Fish Assemblages in Oxbow Lakes Relative to Connectivity with the Mississippi River," *Transactions of the American Fisheries Society,* 134:1480-1489, 2005.

2.4-41 U.S. Nuclear Regulatory Commission, *Final Environmental Statement Related to the Operation of River Bend Station*, NUREG-1073, Docket No. 50-458, January 1985.

2.4-42 Louisiana Department of Wildlife & Fisheries, "Louisiana Department of Wildlife & Fisheries Regarding Threatened and Endangered Species at the River Bend Site," Letter to R. Brooks of Black & Veatch, February 22, 2007.

2.4-43 U.S. Fish & Wildlife Service, "USFWS Regarding Threatened and Endangered Species at the River Bend Site," Letter to R. Brooks of Black & Veatch, February 10, 2007.

2.4-44 Louisiana Natural Heritage Program Database, Rare, Threatened, and Endangered Species and Natural Communities Tracked by the Louisiana Natural Heritage Program, West Feliciana Parish, March 2007.

2.4-45 50 CFR 226, "Critical Habitat Designation for the Gulf Sturgeon."

2.4-46 Stephens, J. (ENSR), Telephone Conversation with D. Walthers (USFWS) regarding Gulf Sturgeon near the RBS Site, 2008.

2.4-47 Louisiana Department of Wildlife & Fisheries, "Recreational Fishing for Paddlefish to be Allowed," Media Release, May 20, 2007.

2.4-48 Barbour, M. T., J. Gerritsen, B. D. Snyder, and J. B. Stribling, *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish*, 2nd Edition, EPA 841-B-99-002, U.S. Environmental Protection Agency, Office of Water, Washington, D.C., 1999.

2.4-49 National Oceanic and Atmospheric Administration, *Essential Fish Habitat: New Marine Fish Habitat Conservation Mandate for Federal Agencies*, National Marine Fisheries Service, Southeast Regional Office, 1999.

2.4-50 Magnuson-Stevens Act Provisions, "Essential Fish Habitat (EFH)," 67 *Federal Register* 2343, 2007.

Table 2.4-1
Approximate Acres per Habitat Type Present on the RBS Property (as Illustrated in Figure 2.4-5)

Habitat	Acres
U1 - Upland Developed Areas	498.7
U2 - Upland Forest	1893.7
U3 - Upland Fields - Grass	83.4
U4 - Upland Fields - Shrubs/Pine	84.7
U5 - Upland Forest Palustrine Wetland	12.5
B1 - Bottomland Developed	11.1
B2 - Bottomland Forest (Bald Cypress/Tupelogum)	304.2
B3 - Bottomland Forest (Tupelogum/Hackberry)	318.1
B4 - Bottomland Forest (Hackberry/Boxelder/Ash)	123.6
Total	3330.0

Table 2.4-2 (Sheet 1 of 6)
Plants Observed on the RBS Site in December 2006 and November 2007 and Habitat in Which Each Species was Observed

Scientific Name	Common Name	BF[(a)]	UF[(b)]	UG-S[(c)]
Acer negundo	Boxelder	x		
Acer rubrum var. drummondii	Drummond red maple	x		
Acer rubrum var. rubrum	Red maple	x		
Albizia julibrissin	Mimosa		x	x
Ambrosia trifida	Giant ragweed	x		
Ampelopsis cordata	Heartleaf peppervine	x		
Andropogon virginicus.	Broom-sedge			x
Apios americana	Groundnut	x		
Aristolochia serpentaria	Dutchman’s pipe		x	
Arthraxon hispidus	Joint-head arthraxon	x		
Arundinaria gigantea	Switchcane	x		
Asclepias tuberosa	Butterfly milkweed			x
Asimina triloba	Pawpaw	x	x	
Asplenium platyneuron	Ebony spleenwort		x	
Athyrium filix-femina	Lady fern	x		
Athyrium pycnocarpon	Glade-fern	x		
Azolla caroliniana	Floating fern	x		
Baccharis halimifolia	Eastern baccharis			x
Berberis thunbergii	Japanese barberry			x
Bignonia capreolata	Crossvine		x	x
Botrychium dissectum	Dissected grapefern	x		
Botrychium virginianum	Rattlesnake fern		x	
Bromus japonicus	Japanese brome			x
Broussonetia papyrifera	Paper mulberry		x	
Callicarpa americana	French mulberry		x	
Campsis radicans	Trumpet creeper		x	x
Carpinus caroliniana	Hornbeam		x	
Carya aquatica	Water hickory	x		

Table 2.4-2 (Sheet 2 of 6)
Plants Observed on the RBS Site in December 2006 and November 2007 and Habitat in Which Each Species was Observed

Scientific Name	Common Name	BF[(a)]	UF[(b)]	UG-S[(c)]
Carya glabra	Pignut hickory	x		
Carya illinoinensis	Sweet pecan	x		
Catalpa bignonioides	Southern catalpa	x		
Celtis laevigata	Sugarberry	x		
Cephalanthus occidentalis	Buttonbush	x		
Cercis canadensis	Eastern redbud		x	
Chamaecrista fasciculata	Partridge pea			x
Chasmanthium sessiliflorum	Long-leaf spikegrass		x	
Clitoria mariana	Butterfly pea			x
Cocculus carolinus	Red-berried moonseed		x	
Cornus florida	Flowering dogwood		x	
Croton capitatus	Woolly croton			x
Cynodon dactylon	Bermudagrass			x
Cyperus esculentus	Chufa	x		x
Cyperus odoratus	Rusty flatsedge	x		
Cyperus polystachyos	Many-spike flatsedge	x		
Dactyloctenium aegyptium	Crowfootgrass			x
Dichanthelium sp.	Panicgrass	x	x	x
Diospyros virginiana	Persimmon	x	x	
Eleocharis sp.	Spikesedge	x		
Equisetum hyemale	Common scouring rush	x		
Eragrostis cilianensis	Stinkgrass	x		x
Eragrostis reptans	Creeping lovegrass	x		
Euonymus americanus	Strawberry bush		x	
Eupatorium album	Dog fennel		x	
Eupatorium capillifolium	Joe-pye weed			x
Fagus grandifolia	American beech		x	
Forestiera acuminata	Swamp privet	x	x	

**Table 2.4-2 (Sheet 3 of 6)
Plants Observed on the RBS Site in December 2006 and November 2007
and Habitat in Which Each Species was Observed**

Scientific Name	Common Name	BF[(a)]	UF[(b)]	UG-S[(c)]
Fraxinus pennsylvanica	Green ash	x		
Galactia volubilis	Milkpea	x		x
Gleditsia triacanthos	Honey locust	x	x	
Gordonia lasianthus	Loblolly bay	x		
Hibiscus aculeatus	Hibiscus	x		
Hordeum pusillum	Little barley			x
Ilex opaca	American holly		x	
Juncus bufonius	Toad rush	x		x
Juncus effusus.	Soft rush			
Juncus tenuis	Path rush	x		x
Lemna sp.	Duckweed	x		
Leptochloa filiformis	Red sprangletop	x		
Ligustrum sinense	Chinese privet	x	x	
Lindera benzoin	Spicebush	x	x	
Liquidambar styraciflua	Sweetgum	x	x	
Liriodendron tulipifera	Yellow-poplar		x	
Lolium perenne	Italian rye grass			x
Lonicera japonica	Japanese honeysuckle		x	
Lygodium japonicum	Japanese climbing fern	x	x	x
Magnolia acuminata	Cucumber magnolia		x	
Magnolia virginiana	Sweetbay		x	
Malus angustifolia	Southern crab apple		x	
Morus rubra	Red mulberry		x	
Nyssa aquatica	Water tupelo	x		
Nyssa biflora	Swamp tupelo	x		
Onoclea sensibilis	Sensitive fern	x		
Osmunda cinnamomea	Cinnamon fern	x		
Osmunda regalis	Royal fern	x		

Table 2.4-2 (Sheet 4 of 6)
Plants Observed on the RBS Site in December 2006 and November 2007 and Habitat in Which Each Species was Observed

Scientific Name	Common Name	BF[(a)]	UF[(b)]	UG-S[(c)]
Panicum capillare	Witchgrass			x
Panicum rigidulum	Redtop panicgrass	x		
Parthenocissus quinquefolia	Virginia creeper	x	x	
Paspalum notatum	Bahia grass	x		
Phalaris arundinacea	Reed canary grass	x		
Phoradendron serotinum	American mistletoe		x	
Phytolacca americana	Pokeweed		x	
Pinus taeda	Loblolly pine		x	x
Planera aquatica	Planetree	x		
Platanus occidentalis	American sycamore	x		
Pleopletis polypodioides	Resurrection fern	x	x	
Podophyllum peltatum	May-apple		x	
Polygonum convolvulus	Black bindweed			x
Polygonum hydropiper	Marshpepper smartweed	x		
Polygonum lapathifolium	Pale smartweed	x		
Polygonum pensylvanicum	Pinkweed	x		
Polygonum saggitatum	Tear-thumb	x	x	x
Polystichum acrosticoides	Christmas fern		x	
Pontederia cordata	Pickerelweed	x		
Populus deltoides	Eastern cottonwood	x		
Pteridium aquilinum	Bracken	x	x	
Pueraria lobata	Kudzu			x
Quercus alba	White oak		x	
Quercus lyrata	Overcup oak	x		
Quercus michauxii	Swamp chestnut oak		x	
Quercus nigra	Water oak	x	x	
Quercus nuttallii	Nuttall oak	x		
Quercus phellos	Willow oak	x		

Table 2.4-2 (Sheet 5 of 6)
Plants Observed on the RBS Site in December 2006 and November 2007 and Habitat in Which Each Species was Observed

Scientific Name	Common Name	BF[(a)]	UF[(b)]	UG-S[(c)]
Quercus shumardii	Shumard oak		x	
Quercus velutina	Black oak		x	
Robinia pseudoacacia	Black locust			x
Rosa bacteata	Macartney rose			x
Rosa multiflora.	Multiflora rose			x
Rubus cf. flagellaris.	Dewberry			x
Rumex acetosella	Sheep sorrel	x		x
Rumex altissimus	Pale dock	x		x
Rumex crispus	Curly dock	x		
Sabal palmetto	Cabbage palm	x		
Salix exigua	Sandbar willow	x		
Salix nigra	Black willow	x		
Sambucus canadensis	Elderberry	x	x	x
Sanicula sp.	Snakeroot		x	
Sassafras albidum	Sassafras		x	
Saururus cernuus	Lizard's-tail	x		
Sisyrinchium angustifolium	Blue-eye grass			x
Smilax glauca	Cat greenbrier	x		
Smilax laurifolia	Laurel greenbrier	x		
Solidago sp.	Goldenrod	x		x
Sorghum halepense	Johnsongrass	x		x
Spirodela polyrhiza	Greater duckmeal	x		
Stylosanthes biflora	Pencilflower			x
Taxodium distichum	Bald cypress	x		
Thelypteris kunthii	Southern shield fern	x		
Thelypteris palustris	Marsh fern	x		
Tilia americana var. caroliniana	Carolina basswood		x	
Toxicodendron radicans	Poison ivy	x	x	x

Table 2.4-2 (Sheet 6 of 6)
Plants Observed on the RBS Site in December 2006 and November 2007 and Habitat in Which Each Species was Observed

Scientific Name	Common Name	BF[(a)]	UF[(b)]	UG-S[(c)]
Trifolium dubium	Hop-clover			x
Trifolium repens	White clover			x
Ulmus alata	Winged elm	x		
Ulmus americana	American elm	x	x	
Verbena bonariensis	Vervain			x
Vitis rotundifolia	Muscadine		x	
Wisteria frutescens	American wisteria	x		
Wolffia columbiana	Watermeal	x		
Wolffia borealis	Watermeal	x		
Zizaniopsis miliacea	Giant cutgrass	x		

a) BF = Bottomland Forest.

b) UF = Upland Forest.

c) UG-S = Upland Grass and Shrub Areas.

Table 2.4-3
Common Mammals Found on the RBS Site

Common Name	Scientific Name
Beaver	*Castor canadensis*
Bobcat	*Lynx rufus*
Red Fox	*Vulpes fluva*
Mink	*Mustel vison*
Opossum	*Didelphis virginiana*
Cottontail Rabbit	*Sylvilaqus floridanus*
Swamp Rabbit	*Sylvilaqus aquaticus*
Raccoon	*Procyon lotor*
Striped Skunk	*Mephyitis mephitis*
Fox Squirrel	*Sciurus niger*
Gray Squirrel	*Sciurus carolinensis*
White-Tailed Deer	*Odocoileus virginianus*
Muskrat	*Ondatra zibethica*
River Otter	*Lutra canadensis*

Source: Reference 2.4-1.

Table 2.4-4
Common Amphibians and Reptiles at the RBS Site

Common Name	Scientific Name
Snakes	
Banded Water Snake	*Natrix sipedon fasciata*
Canebrake Rattlesnake	*Crotalus horridus atricaudatus*
Copperhead	*Aqkistrodon contortrix contortrix*
Cottonmouth	*Aqkistrodon piscivorus leucostoma*
Eastern Coachwhip	*Masticophus flagellum flagellum*
Eastern Hognose Snake	*Heterodon platyrhinos*
Northern Black Racer	*Coluber constrictor constrictor*
Speckled Kingsnake	*Lampropeltis getulus holbrooki*
Western Ribbon Snake	*Thamnophis sauritus proximus*
Turtles	
Alligator Snapping Turtle	*Macroclemmys temmincki*
Common Musk Turtle	*Sternothaerus odoratus*
Red-Eared Turtle	*Pseudemys coccinna mobilensis*
Southern Painted Turtle	*Chrysemys picta dorsalis*
Three-Toed Box Turtle	*Terrapene carolina triunquis*

Source: Reference 2.4-1.

Table 2.4-5
Route Acreage for 500 kV Transmission Routes Considered Between RBS and Hartburg-Mount Olive Transmission Line

Land Use Type	Bienville Site 1	Bienville Site 2	Natchitoches Site[(a)]	Newton Site	Sabine Site
Route length	171.29 mi.	153.01 mi.	147.71 mi.	147.36 mi.	141.86 mi.
			acres		
Barren Land	0.7	----	0.7	4.9	3.3
Cultivated Crops	784.0	481.1	675.4	817.8	587.8
Deciduous Forest	73.8	350.7	73.4	10.0	8.5
Developed, High Intensity	3.1	----	1.1	----	----
Developed, Low Intensity	105.6	24.7	100.7	110.3	44.5
Developed, Medium Intensity	6.7	----	6.7	2.0	0.7
Developed, Open Space	148.6	104.1	135.4	8.2	81.8
Emergent Herbaceous Wetlands	44.3	36.7	44.3	22.0	17.6
Evergreen Forest	448.4	872.9	298.5	433.9	566.9
Hay/Pasture	901.0	166.6	862.5	587.4	396.8
Herbaceous	41.6	28.0	41.6	163.5	255.8
Mixed Forest	96.1	137.2	96.3	50.5	117.7
Open Water	169.9	89.2	92.1	42.5	33.6
Shrub/Scrub	407.9	633.2	357.8	374.1	411.4
Woody Wetlands	648.8	594.9	547.6	797.5	750.6
Total Acreage	3880.3	3519.3	3334.1	3424.6	3276.9

a) Preferred route.

Table 2.4-6 (Sheet 1 of 3)
Description of Aquatic Habitats in the Lower Mississippi River

River Habitat[a]	Features	Description	Location
Channel	Main channel and secondary channel	Channel habitat is characterized by those portions of the river with continuous flowing water. Habitats change little from season or river stage. Microhabitats associated with shifting sediments are common and change on a daily basis. Sediment loads vary by location on the river.	Channel habitats are present throughout the entire reach of the river. Channel steepness and depth are dependent upon sediment types in the substrate.
Natural Steep Bank	Steep slopes or cut banks	Occur on the concave sides of river bends. Steep banks typically adjoin channel habitats. Highly subject to erosion.	More common in portions of the river north of Baton Rouge where sediments are comprised of sand and gravel, mud, and point bar deposits.
Revetment	Protective materials usually consisting of man-made materials such as concrete, tires, riprap, etc.	Usually associated with the concave side of bends. Commonly used throughout the Lower Mississippi River along the steep banks.	Due to increased erosion, revetments are commonly used in the Lower Mississippi River.
Lotic Sandbar	Shallow sloping habitats	Habitats located along point bars, borders of islands, middle bars, and dike systems. Moderate to swift currents, coarse sand, or sand-gravel substrate. Conditions are similar to the channel habitats.	Materials from these habitats typically create dunes on the river bottom. Usually occurs a few meters from shore.
Pool	Slack or slow water areas	Slow or no current areas associated with downstream sides of dikes, islands, middle bars, and point bars. They are typically deep and have fine sediments and do not support substantial amounts of brush or debris.	Pools are more common during low flow conditions and can be found along the entire reach of the river. However, most pools are associated with dike systems that are common in portions of the river north of Baton Rouge.

Table 2.4-6 (Sheet 2 of 3)
Description of Aquatic Habitats in the Lower Mississippi River

River Habitat[(a)]	Features	Description	Location
Lentic Sandbar	Shallow sloping habitats	Usually associated with low currents, fine sediments, and shallower depths. These habitats are ephemeral and are more common during constant river stage.	Usually occurs near the shoreline.
Contiguous Slough	Slackwater, floodplain habitats. Connected to the main channel during most river stages	Usually remnants from abandoned river channels; however, they are usually quite narrow and closer to the mainstem river.	Typically found in those portions of the river where substantial river meanders occur. Also present throughout the river during low flow conditions.
Isolated Slough	Slackwater, floodplain habitats.	Usually remnants from abandoned river channels; however; they are usually quite narrow and closer to the mainstem river.	Typically found in those portions of the river where substantial river meanders occur.
Oxbow Lake	Former river channels	Remnant portions of the river that were cut off from the main river channel. They are fairly deep and fairly large (200 to > 1600 ha). Shorelines associated with oxbows are usually wooded and heavily vegetated.	Located along meandering sections of the river. The greatest numbers of oxbow lakes are found north of Baton Rouge.
Levee Borrow Pit	Man-made floodplain habitats	These habitats are formed by the removal of fill materials for levee construction. They vary in size, time period in which they are flooded, and habitats associated with them.	Located in those reaches of the river that have high sediment deposits in the floodplain and are typically above river flood stage.
Floodplain Ponds	Permanent, small, shallow ponds	These ponds are located in the alluvial river swamps. They are similar to isolated sloughs and oxbow lakes; however, they are much smaller. They form in depressional areas and tributaries to the river and are associated with Tupelo-Cypress wetlands.	Typically found in those portions of the river where substantial river meanders occur.

Table 2.4-6 (Sheet 3 of 3)
Description of Aquatic Habitats in the Lower Mississippi River

River Habitat[a]	Features	Description	Location
Seasonally Inundated Floodplain	High river stages over low-lying lands	Areas used to include lands well outside the main river. However, construction of the levee system has separated those floodplain areas and isolated those within the river channel areas. Some of the outlying areas still receive flood waters associated with tributary flooding. The river floodplain within the levees is inundated during peak flood periods. Habitats in these areas are associated with swift currents to slack areas near the periphery.	Located in those areas near old river meanders and around sandbar deposits. Found throughout the entire reach of the river except where revetments occur.
Tributary	Downstream portion of tributary where it meets the mainstem river.	Habitats are associated with the backwater flooding of the tributaries. Usually low flowing areas with sand-silt to mud bottoms. Have areas of significant brush and debris accumulation.	Some of the major tributaries to the upper Mississippi River include the Ohio, St. Francis, Arkansas, Yazoo, Ouachita, and Red Rivers. There are no significant tributaries to the Mississippi River below Baton Rouge.

a) Habitats presented in this table are derived from Reference 2.4-24.

Table 2.4-7 (Sheet 1 of 3)
Comprehensive List of Species Documented in Benthic Surveys Conducted in the Lower Mississippi River at the RBS Site

	Common Name	Scientific Name
1	Sponge	Unidentified Poriferan
2	Hydra	Unidentified Hydrozoan
3	Flatworm	*Mesostoma* sp.
4	Flatworm	Unidentified Planarian
5	Roundworm	Unidentified Nematode
6	Bryozoa	*Plumatella repends*
7	Bryozoa	Unidentified Bryozoan
8	Oligochaete	Unidentified Oligochaete
9	Oligochaete	*Aulophorus furcatus*
10	Oligochaete	*Dero digitata*
11	Oligochaete	*Dero nivea*
12	Oligochaete	*Limnodrilus augustipennis*
13	Oligochaete	*Limnodrilus cervix*
14	Leech	Unidentified Hirudinian
15	Fish lice	*Argulus* sp.
16	Isopod	*Lirceus* sp.
17	Isopod	Unidentified Epicaridean
18	Isopod	*Probopyrus bithynis*
19	Calliopid Amphipod	*Corophium lacustre*
20	Gammarid Amphipod	*Gammarus fasciatus*
21	Talitrid Amphipod	*Hyalella azteca*
22	Water mites	Unidentified Hydracarinids
23	Springtail	Unidentified Collembolid
24	Stonefly	*Isoperla* sp.
25	Mayfly	*Hexagenia limbata*
26	Mayfly	*Heagenia* sp.
27	Mayfly	*Pentagenia vittigera*

**Table 2.4-7 (Sheet 2 of 3)
Comprehensive List of Species Documented in Benthic Surveys Conducted in the Lower Mississippi River at the RBS Site**

	Common Name	Scientific Name
28	Mayfly	*Trotopus primus*
29	Mayfly	*Trotopus* sp.
30	Mayfly	*Stenonema* sp.
31	Dragonfly	*Gomphus* sp.
32	Dragonfly	*Ophiogomphus* sp.
33	Dragonfly	*Dromogomphus* sp.
34	Dragonfly	*Libellula* sp.
35	Dragonfly	*Macromia* sp.
36	Damselfly	*Ischnura* sp.
37	Water bug	*Belostoma* sp.
38	Water boatman	Unidentified Corixids
39	Backswimmer	*Notonecta* sp.
40	Fishfly	*Chauliodes* sp.
41	Caddisfly	*Hydropsyche orris*
42	Caddisfly	Unidentified Hydropsychid
43	Caddisfly	*Neuroclipsis* sp.
44	Caddisfly	Unidentified Psychomydid
45	Moth	Unidentified Lepidopterid
46	Diving beetle	*Cybister* sp.
47	Beetle	*Cylloepus* sp.
48	Whirlygig beetle	*Dieutus* sp.
49	Biting midge	Unidentified Ceratopogonid
50	Mosquito	*Aedes* sp.
51	Mosquito	*Anopheles* sp.
52	Phantom midge	*Chaoborus* sp.
53	Phantom midge	Unidentified Chaoborid

Table 2.4-7 (Sheet 3 of 3)
Comprehensive List of Species Documented in Benthic Surveys Conducted in the Lower Mississippi River at the RBS Site

	Common Name	Scientific Name
54	Chironomid	*Demicryptochironomus* sp.
55	Chironomid	*Pentanuera* sp.
56	Chironomid	Unidentified Chironomid
57	Crane fly	Unidentified Tipulid

Source: References 2.4-1 and 2.4-21.

Table 2.4-8
Comprehensive List of Aquatic Macroinvertebrates
Collected in the Lower Mississippi River at the RBS Site

	Common Name	Scientific Name
1	Crayfish	*Cambarellus schufeldtil*
2	Crayfish	*Cambarus diogenes diogenes*
3	Crayfish	*Probcambarus clarkii*
4	Crayfish	*Procambarus acutus*
5	Crayfish	*Procambarus vioscai*
6	Grass shrimp	*Palaemonetes kadiakensis*
7	River shrimp	*Macrobrachium ohione*

Source: References 2.4-1 and 2.4-21.

Table 2.4-9
Comprehensive List of Aquatic Mollusks
Collected in the Lower Mississippi River at the RBS Site

	Common Name	Scientific Name
1	Pebble snail	*Somatogyrus* sp.
2	Pouch snail	*Physa* sp.
3	Planorbid snail	Unidentified Planorbid
4	Snail	*Goniobasis* sp.
5	Asian clam	*Corbicula manilensis*
6	Mussel	Unidentified Unionid
7	Mussel	*Dreissena polymorpha*

Source: References 2.4-1 and 2.4-21.

Table 2.4-10 (Sheet 1 of 5)
Comprehensive List of Phytoplankton
Collected in the Lower Mississippi River at the RBS Site

	Common Name	Scientific Name
1	Green algae	*Carteria*
1	Green algae	*Carteria*
2	Green algae	*Chlamydomonas*
3	Green algae	*Chlorogonium*
4	Green algae	*Eudorina*
5	Green algae	*Pandorina*
6	Green algae	*Pleodorina*
7	Green algae	*Volvox*
8	Green algae	*Gloeocystis*
9	Green algae	*Sphaerocystis*
10	Green algae	*Chlorosarcina*
11	Green algae	*Dispora*
12	Green algae	*Ourococcus*
13	Green algae	*Binucleria*
14	Green algae	*Geninella*
15	Green algae	*Ulothrix*
16	Green algae	*Microspora*
17	Green algae	*Bulbochaete*
18	Green algae	*Chlorococcum*
19	Green algae	*Golenkinia*
20	Green algae	*Micractinium*
21	Green algae	*Dictyosphaerium*
22	Green algae	*Characium*
23	Green algae	*Schroederia*
24	Green algae	*Pediastrum*
25	Green algae	*Ceolastrum*
26	Green algae	*Ankistrodesmus*

Table 2.4-10 (Sheet 2 of 5)
Comprehensive List of Phytoplankton
Collected in the Lower Mississippi River at the RBS Site

	Common Name	Scientific Name
27	Green algae	*Chlorella*
28	Green algae	*Closteriopsis*
29	Green algae	*Franceia*
30	Green algae	*Kirchneriella*
31	Green algae	*Lagerheima*
32	Green algae	*Oocystis*
33	Green algae	*Planktosphaeria*
34	Green algae	*Quadriqula*
35	Green algae	*Selenastrum*
36	Green algae	*Tetraedron*
37	Green algae	*Treubaria*
38	Green algae	*Actinastrum*
39	Green algae	*Crucigenia*
40	Green algae	*Scenedesmus*
41	Green algae	*Tetradesmus*
42	Green algae	*Tetrastrum*
43	Green algae	*Mougeotia*
44	Green algae	*Spirogyra*
45	Green algae	*Arthrodesmus*
46	Green algae	*Closterium*
47	Green algae	*Cosmarium*
48	Green algae	*Euastrum*
49	Green algae	*Hyalotheca*
50	Green algae	*Micrasterias*
51	Green algae	*Penium*
52	Green algae	*Spondylosium*
53	Green algae	*Staurastrum*

Table 2.4-10 (Sheet 3 of 5)
Comprehensive List of Phytoplankton
Collected in the Lower Mississippi River at the RBS Site

	Common Name	Scientific Name
54	Euglena	*Euglena*
55	Euglena	*Lepocinclis*
56	Euglena	*Phacus*
57	Euglena	*Trachelomonas*
58	Golden algae	*Ophiocytium*
59	Golden algae	*Tribonema*
60	Golden algae	*Centritractaceae*
61	Golden algae	*Dynobryon*
62	Golden algae	*Coscinodiscus*
63	Golden algae	*Cyclotella*
64	Golden algae	*Melosira*
65	Golden algae	*Stephanodiscus*
66	Golden algae	*Biddulphia*
67	Golden algae	*Tabellaria*
68	Golden algae	*Meridion*
69	Golden algae	*Diatoma*
70	Golden algae	*Opephora*
71	Golden algae	*Asterionella*
72	Golden algae	*Fragilaria*
73	Golden algae	*Synedra*
74	Golden algae	*Eunotia*
75	Golden algae	*Achnanthes*
76	Golden algae	*Cocconeis*
77	Golden algae	*Rhoicosphenia*
78	Golden algae	*Bebissonia*
79	Golden algae	*Frustulia*
80	Golden algae	*Gyrosigma*

Table 2.4-10 (Sheet 4 of 5)
Comprehensive List of Phytoplankton
Collected in the Lower Mississippi River at the RBS Site

	Common Name	Scientific Name
81	Golden algae	*Mastogloia*
82	Golden algae	*Navicula*
83	Golden algae	*Neidium*
84	Golden algae	*Pinnularia*
85	Golden algae	*Pleurosigma*
86	Golden algae	*Stauroneis*
87	Golden algae	*Gomphonema*
88	Golden algae	*Amphora*
89	Golden algae	*Cymbella*
90	Golden algae	*Rhopalodia*
91	Golden algae	*Hantzschia*
92	Golden algae	*Nitzschia*
93	Golden algae	*Cymatopleura*
94	Golden algae	*Surirella*
95	Dinoflagellate	*Gymnodiniaceae*
96	Dinoflagellate	*Glenodinium*
97	Dinoflagellate	*Ceratium*
98	Blue-green algae	*Agmenellum*
99	Blue-green algae	*Anacystis*
100	Blue-green algae	*Aphanocapsa (Anacystis)*
101	Blue-green algae	*Aphanothece (Coccochloris)*
102	Blue-green algae	*Chroococcus (Anacystis)*
103	Blue-green algae	*Coelosphaerium*
104	Blue-green algae	*Dactylococcopsis*
105	Blue-green algae	*Gomphosphaeria*
106	Blue-green algae	*Microcystis (Polycystis)*
109	Blue-green algae	*Phormidium*

Table 2.4-10 (Sheet 5 of 5)
Comprehensive List of Phytoplankton
Collected in the Lower Mississippi River at the RBS Site

	Common Name	Scientific Name
110	Blue-green algae	*Spirulina*
111	Blue-green algae	*Anabaena*
112	Blue-green algae	*Nodularia*

Source: References 2.4-1 and 2.4-21.

Table 2.4-11 (Sheet 1 of 6)
Comprehensive List of Species Documented in Zooplankton Collections in the Lower Mississippi River at the RBS Site

	Common Name	Scientific Classification
1	Protozoan	*Ciliata* sp. (unidentified)
1	Protozoan	*Suctoria* sp. (unidentified)
2	Hydroid	*Cordylophora lacustris*
3	Hydroid	*Hydra* spp.
4	Roundworm	*Nematoda* spp. (unidentified)
5	Entoprocts	*Urnatella gracilis*
6	Oligochaete	*Stylaria lacustris*
7	Oligochaete	*Oligochaeta* spp.(unidentified)
8	Oligochaete	*Tubificidae* spp. (unidentified)
9	Leech	*Hirudinea* spp. (unidentified)
10	Rotifer	*Bdelloidea* sp. (unidentified)
11	Rotifer	*Branchionus angularis*
12	Rotifer	*Branchionus budapestinensis*
13	Rotifer	*Branchionus calycifloris*
14	Rotifer	*Branchionus quadridentatus*
15	Rotifer	*Branchionus urceolaris*
16	Rotifer	*Kellicottia bostoniensis*
17	Rotifer	*Kellicottia bostoniensis*
18	Rotifer	*Keratella cochlearis*
19	Rotifer	*Keratella quadrata*
20	Rotifer	*Keratella valga*
21	Rotifer	*Platyas* sp.
22	Rotifer	*Lecane* sp.
23	Rotifer	*Monostyla* sp.
24	Rotifer	*Gastropus* spp.
25	Rotifer	*Asplancha* spp.
26	Rotifer	*Polyarthra* spp.

**Table 2.4-11 (Sheet 2 of 6)
Comprehensive List of Species Documented in
Zooplankton Collections in the Lower Mississippi River at the RBS Site**

	Common Name	Scientific Classification
27	Rotifer	*Filinia* sp.
28	Rotifer	*Collotheca* spp.
29	Seed shrimp	*Ostracoda* sp. (unidentified)
30	Fish lice	*Argulus* spp.
31	Isopod	*Lirceus louisianae*
32	Amphipod	*Hyallela azteca*
33	Amphipod	*Gammarus* sp.
34	Mysid shrimp	*Taphromysis louisianae*
35	Ohio river shrimp	*Macrobrachium ohione*
36	Water flea	*Leptodora kindti*
37	Water flea	*Holopedium amazonicum*
38	Water flea	*Sida crystallina*
39	Water flea	*Diaphanosoma brachyurum*
40	Water flea	*Diaphanosoma leutenbergianum*
41	Water flea	*Latona setifera*
42	Water flea	*Latonopsis occidentalis*
43	Water flea	*Pseudosida bidentata*
44	Water flea	*Daphnia similis*
45	Water flea	*Daphnia parvula*
46	Water flea	*Daphnia pulex*
47	Water flea	*Daphnia laevis*
48	Water flea	*Simocephalus exspinosus*
49	Water flea	*Simocephalus serrulatus*
50	Water flea	*Simocephalus vetulus*
51	Water flea	*Ceriodaphnia reticulata*
52	Water flea	*Ceriodaphnia lacustris*
53	Water flea	*Ceiodaphnia megalops*

Table 2.4-11 (Sheet 3 of 6)
Comprehensive List of Species Documented in
Zooplankton Collections in the Lower Mississippi River at the RBS Site

	Common Name	Scientific Classification
54	Water flea	*Scapholeberis kingi*
55	Water flea	*Moina brachiata*
56	Water flea	*Moina micrura*
57	Water flea	*Bosmina longirostris*
58	Water flea	*Grimaldina brazzai*
59	Water flea	*Ilyocryptus sordidus*
60	Water flea	*Ilyocryptus spinifer*
61	Water flea	*Macrothrix laticornis*
62	Water flea	*Eurycercus* sp.
63	Water flea	*Eurycercus orientalis*
64	Water flea	*Chydorus sphaericus*
65	Copepod	*Eurytemora affinis*
66	Copepod	*Osphranticum labronectum*
67	Copepod	*Diaptomus clavipes*
68	Copepod	*Diaptomus birgei*
69	Copepod	*Diaptomus dorsalis*
70	Copepod	*Diaptomus louisianensis*
71	Copepod	*Diaptomus stagnalis*
72	Copepod	*Diaptomus reighardi*
73	Copepod	*Diaptomus* spp.
74	Copepod	*Cyclops vernalis*
75	Copepod	*Cyclops bicuspidatus thomasi*
76	Copepod	*Cyclops varicans rubellus*
77	Copepod	*Cyclops* spp.
78	Copepod	*Macrocyclops albidus*
79	Copepod	*Macrocyclops fuscus*
80	Copepod	*Mesocyclops edax*

Table 2.4-11 (Sheet 4 of 6)
Comprehensive List of Species Documented in Zooplankton Collections in the Lower Mississippi River at the RBS Site

	Common Name	Scientific Classification
81	Copepod	*Mesocyclops inversus*
82	Springtail	*Isotoma* sp.
83	Springtail	*Sminthurides* sp.
84	Mayfly	*Tortopus primus*
85	Mayfly	*Pentagenia vittigera*
86	Mayfly	*Hexagenia limbata*
87	Mayfly	*Caenis* sp.
88	Mayfly	*Baetidae* sp. (unidentified)
89	Mayfly	*Stenonema* spp.
90	Mayfly	*Heptagenia* sp.
91	Damselfly	*Enallagma* sp.
92	Damselfly	*Coenagrion* sp.
93	Dragonfly	*Gomphus* sp.
94	Dragonfly	*Libellula* sp.
95	Pygmy backswimmer	*Plea* sp.
96	Water boatman	*Trichocorixa* sp.
97	Water boatman	*Corixiidae* spp. (unidentified)
98	Water bug	*Pelocoris* sp.
99	Alderfly	*Sialis* sp.
100	Caddisfly	*Neureclipsis* sp.
101	Caddisfly	*Psychomyidae* spp. (unidentified)
102	Caddisfly	*Hydropsyche orris*
103	Caddisfly	*Cheumatopsyche* sp.
104	Caddisfly	*Hydroptila* sp.
105	Caddisfly	*Leptocerus* sp.
106	Moth	*Synclita* sp.
107	Moth	*Parargyractis* sp.

**Table 2.4-11 (Sheet 5 of 6)
Comprehensive List of Species Documented in
Zooplankton Collections in the Lower Mississippi River at the RBS Site**

	Common Name	Scientific Classification
108	Beetle	*Hydroporus* sp.
109	Beetle	*Coptotomus* sp.
110	Beetle	*Dytiscus* sp.
111	Beetle	*Cybister* sp.
112	Beetle	*Laccophilus* sp.
113	Beetle	*Dineutrus* sp.
114	Beetle	*Gyrinus* sp.
115	Beetle	*Hydrophilus* sp.
116	Beetle	*Tropistenus* sp.
117	Beetle	*Staphylinidae* sp. (unidientified)
118	Beetle	*Dryops* sp.
119	Beetle	*Stenelmis* sp.
120	Beetle	*Elmidae* spp. (unidentified)
121	Beetle	*Donacia* sp.
122	Beetle	*Curculionidae* sp. (unidentified)
123	Fly (Diptera)	*Helius* sp.
124	Fly (Diptera)	*Chaoborus* sp.
125	Fly (Diptera)	*Mochlonyx* sp.
126	Fly (Diptera)	*Eucorethra* sp.
127	Fly (Diptera)	*Culex* sp.
128	Fly (Diptera)	*Aedes* sp.
129	Fly (Diptera)	*Anopheles* sp.
130	Fly (Diptera)	*Hemerodromia* sp.
131	Midge	*Chironomus* spp.
132	Midge	*Cricotopus* spp.
133	Midge	*Pentaneura* spp.
134	Midge	*Procladius* sp.

Table 2.4-11 (Sheet 6 of 6)
Comprehensive List of Species Documented in
Zooplankton Collections in the Lower Mississippi River at the RBS Site

	Common Name	Scientific Classification
135	Midge	*Corynoneura* sp.
136	Midge	*Tanytarsus* sp.
137	Midge	*Spaniotoma* sp.
138	Midge	*Chironomidae* spp. (unidentified)
139	Midge	*Bezzia* sp.
140	Midge	*Ceratopogonidae* sp. (unidentified)
141	Midge	*Hemerodromia* sp.
142	Water mite	*Hydracarina* spp. (unidentified)
143	Snail	*Physa* sp.
144	Snail	*Helisoma* sp.
145	Snail	*Lymnaea* sp.
146	Clam	*Corbicula manilensis*

Source: References 2.4-1 and 2.4-21.

Table 2.4-12 (Sheet 1 of 2)
Comprehensive List of Ichthyoplankton
Collected in the Lower Mississippi River at the RBS Site

	Common Name	Scientific Name
1	Paddlefish	*Polyodon spathula*
1	Gar	*Lepisosteus* spp.
2	Skipjack herring	*Alosa chrysochloris*
3	Gizzard shad	*Dorosoma cepedianum*
4	Threadfin shad	*Dorosoma petenense*
5	Shad	*Dorosoma* spp.
6	Goldeye	*Hiodon alosoides*
7	Mooneye	*Hiodon tergisus*
8	Carp	*Cyprinus carpio*
9	Silvery minnow	*Hybognathus argyritis*
10	Speckled chub	*Macrhybopsis aestivalis*
11	Chub	*Macrhybopsis* spp.
12	Golden shiner	*Notemigonus crysoleucas*
13	Emerald shiner	*Notropis atherinoides*
14	River shiner	*Notropis girardi*
15	Silverband shiner	*Notropis shumardi*
16	Blacktail shiner	*Cyprinella venusta*
17	Shiner	*Notropis* spp.
18	Bullhead minnow	*Pimephales vigilax*
19	River carpsucker	*Carpiodes carpio*
20	Blue sucker	*Cycleptus elongatus*
21	Paddlefish	*Polyodon spathula*
22	Smallmouth buffalo	*Ictiobus bubalus*
23	Bigmouth buffalo	*Ictiobus cyprinellus*
24	Buffalo	*Ictiobus* spp.
25	Spotted sucker	*Minytrema melanops*
26	Pirate perch	*Aphredoderus sayanus*

Table 2.4-12 (Sheet 2 of 2)
Comprehensive List of Ichthyoplankton
Collected in the Lower Mississippi River at the RBS Site

	Common Name	Scientific Name
27	Mosquitofish	*Gambusia affinis*
28	Mississippi silverside	*Menidia audens*
29	White bass	*Morone chrysops*
30	Yellow bass	*Morone mississippiensis*
31	Bass	*Morone* spp.
32	Warmouth	*Lepomis gulosus*
33	Bluegill	*Lepomis macrichirus*
34	Longear sunfish	*Lepomis megalotis*
35	Sunfish	*lepomis* spp.
36	Largemouth bass	*Micropterus salmoides*
37	Bass	*Microterus* spp.
38	White crappie	*Pomoxis annularis*
39	Black crappie	*Pomoxis nigromaculatus*
40	Crappie	*Pomoxis* spp.
41	Darter	*Etheostoma* spp.
42	Darter	*Percina* spp.
43	Sauger	*Sander canadensis*
44	Freshwater drum	*Aplodinotus grunniens*

Source: References 2.4-1 and 2.4-21.

Table 2.4-13 (Sheet 1 of 4)
Comprehensive List of Adult Fish Collected in the Lower Mississippi River at the RBS Site

	Common Name	Species Name
1	Skipjack herring	*Alosa chrysochloris*
2	Black bullhead	*Ameiurus melas*
3	Bowfin	*Amia calva*
4	Bay Anchovy	*Anchoa mitchilli*
5	American eel	*Anguilla rostrata*
6	Pirate perch	*Aphredoderus sayanus*
7	Freshwater drum	*Aplodinotus grunniens*
8	River carpsucker	*Carpiodes carpio*
9	Flyer	*Centrarchus macropterus*
10	Blue sucker	*Cycleptus elongatus*
11	Shiner hybrid	*Cyprinella* sp.
12	Red shiner	*Cyprinella lutrensis*
13	Blacktail shiner	*Cyprinella venusta*
14	Carp	*Cyprinus carpio*
15	Gizzard shad	*Dorosoma cepedianum*
16	Threadfin shad	*Dorosoma petenense*
17	Banded pygmy sunfish	*Elassoma zonatum*
18	Grass pickerel	*Esox americanus vermiculatus*
19	Mud darter	*Etheostoma aspringene*
20	Bluntnose darter	*Etheostoma chlorosoma*
21	Slough darter	*Etheostoma gracile*
22	Cypress darter	*Etheostoma proeliare*
23	Western starhead minnow	*Fundulus blairae*
24	Golden topminnow	*Fundulus chrysotus*
25	Blackstripe topminnow	*Fundulus notatus*
26	Blackspotted topminnow	*Fundulus olivaceus*
27	Mosquitofish	*Gambusia affinis*

Table 2.4-13 (Sheet 2 of 4)
Comprehensive List of Adult Fish Collected in the Lower Mississippi River at the RBS Site

	Common Name	Species Name
28	Goldeye	*Hiodon alosoides*
29	Mooneye	*Hiodon tergisus*
30	Western Silvery minnow	*Hybognathus argyritis*
31	Cypress minnow	*Hybognathus hayi*
32	Mississippi silvery minnow	*Hybognathus nuchalis*
33	Silver carp	*Hypophthalmichthys molitrix*
34	Blue catfish	*Ictalurus furcatus*
35	Channel catfish	*Ictalurus punctatus*
36	Smallmouth buffalo	*Ictiobus bubalus*
37	Bigmouth buffalo	*Ictiobus cyprinellus*
38	Black buffalo	*Ictiobus niger*
39	Brook silverside	*Labidesthes sicculus*
40	Spotted gar	*Lepisosteus oculatus*
41	Longnose gar	*Lepisosteus osseus*
42	Shortnose gar	*Lepisosteus platostomus*
43	Green sunfish	*Lepomis cyanellus*
44	Warmouth	*Lepomis gulosus*
45	Orangespotted sunfish	*Lepomis humilis*
46	Bluegill	*Lepomis macrochirus*
47	Dollar sunfish	*Lepomis marginatus*
48	Longear sunfish	*Lepomis megalotis*
49	Redear sunfish	*Lepomis microlophus*
50	Red spotted sunfish	*Lepomis miniatus*
51	Spotted sunfish	*Lepomis puncatatus*
52	Bantam sunfish	*Lepomis symmetricus*
53	Striped shiner	*Luxilus chrysocephalus*
54	Speckled chub	*Macrhybopsis aestivalis*
55	Sturgeon chub	*Macrhybopsis gelida*

Table 2.4-13 (Sheet 3 of 4) Comprehensive List of Adult Fish Collected in the Lower Mississippi River at the RBS Site

	Common Name	Species Name
56	Shoal chub	*Macrhybopsis hyostoma*
57	Silver chub	*Macrhybopsis storeriana*
58	Mississippi silverside	*Menidia audens*
59	Tidewater silverside	*Menidia beryllina*
60	Spotted bass	*Micropterus punctulatus*
61	Largemouth bass	*Micropterus salmoides*
62	White bass	*Morone chrysops*
63	Yellow bass	*Morone mississippiensis*
64	Striped bass	*Morone saxatilis*
65	Hybrid Moronid bass	*Morone* sp.
66	Striped mullet	*Mugil cephalus*
67	Golden shiner	*Notemigonus crysoleucas*
68	Pallid shiner	*Notropis amnis*
69	Emerald shiner	*Notropis atherinoides*
70	River shiner	*Notropis blennius*
71	Ghost shiner	*Notropis buchanani*
72	Ribbon shiner	*Notropis fumeus*
73	Arkansas river shiner	*Notropis giardi*
74	Longnose shiner	*Notropis longirostris*
75	Tailight shiner	*Notropis maculatus*
76	Silverband shiner	*Notropis shumardi*
77	Weed shiner	*Notropis texanus*
78	Mimic shiner	*Notropis volucellus*
79	Pugnose minnow	*Opsopoeodus emiliae*
80	Rainbow Smelt	*Osmerus mordax*
81	Southern flounder	*Paralichthys lethostigma*
82	Logperch	*Percina caprodes*
83	Blackside darter	*Percina sciera*

Table 2.4-13 (Sheet 4 of 4)
Comprehensive List of Adult Fish Collected in the Lower Mississippi River at the RBS Site

	Common Name	Species Name
84	River darter	*Percina shumardi*
85	Saddleback darter	*Percina vigilax*
86	Bluntnose minnow	*Pimephales notatus*
87	Bullhead minnow	*Pimephales vigilax*
88	Sailfin molly	*Poecilia latipinna*
89	White crappie	*Pomoxis annularis*
90	Black crappie	*Pomoxis nigromaculatus*
91	Flathead catfish	*Pylodictis olivaris*
92	Sauger	*Sander canadensis*
93	Creek chub	*Semotilus atromaculatus*
94	Atlantic needlefish	*Strongylura marina*
95	Gulf pipefish	*Syngnathus scovelli*

Source: References 2.4-1 and 2.4-21.

Table 2.4-14 (Sheet 1 of 2)
Common Fishes Documented in Lower Mississippi River Studies at and near the RBS Site[(a)]

	Baker	RBS (Historic)	RBS (Current)	Other LMR Sites (IM&E Surveys)[(b)]
Shovelnose sturgeon	X	X		
Shortnose gar	X	X		
Bowfin		X		
Skipjack herring	X	X		
Gizzard shad	X	X	X	X
Threadfin shad	X	X	X	X
Bay anchovy				X
Carp	X	X	X	X
Western silvery minnow	X	X		
Emerald shiner	X	X	X	
River shiner	X	X	X	
Silverband shiner	X	X	X	
Mimic shiner	X	X		
Blacktail shiner		X	X	
River carpsucker	X		X	
Speckled chub	X	X		
Shoal chub		X		
Silver chub	X	X		
Mosquitofish		X	X	
Smallmouth buffalo	X	X		X
Black buffalo		X		
Freshwater drum	X		X	X
Blue catfish	X			X
Channel catfish	X		X	X
Black bullhead		X		
Flathead catfish	X	X		

Table 2.4-14 (Sheet 2 of 2)
Common Fishes Documented in Lower Mississippi River Studies at and near the RBS Site[a]

	Baker	RBS (Historic)	RBS (Current)	Other LMR Sites (IM&E Surveys)[b]
Tidewater silverside	X	X	X	
White bass	X	X		
Bluegill		X		
Black crappie		X		
White crappie		X		
Sauger	X			X

a) Fish species presented in this table are those documented to comprise greater than 1 percent of species documented in a biological survey. Fishes documented by Baker (1991) as common to abundant in channel, natural steep bank, revetment bank, and lotic sandbar habitats were included for comparson of species.

b) IM&E - Impingement and entrainment characterization studies. These are fishes documented to comprise more than 1 percent of the total number of species collected.

Source: References 2.4-1, 2.4-20, 2.4-21, 2.4-22, 2.4-23, 2.4-24, 2.4-28, 2.4-29, 2.4-34, 2.4-36, and 2.4-40.

Table 2.4-15
Comprehensive List of Aquatic Macroinvertebrates Collected in Alligator Bayou

	Common Name	Scientific Name
1	Crayfish	*Cambarellus schufeldtil*
2	Crayfish	*Cambarus diogenes diogenes*
3	Crayfish	*Orconectes palmeri palmeri*
4	Crayfish	*Orconectes lancifer*
5	Crayfish	*Probcambarus clarkii*
6	Crayfish	*Procambarus acutus acutus*
7	Crayfish	*Procambarus vioscai*
8	Grass shrimp	*Palaemonetes kadiakensis*
9	River shrimp	*Macrobrachium ohione*

Source: References 2.4-1 and 2.4-21.

Table 2.4-16 (Sheet 1 of 5)
Comprehensive List of Species Documented in Benthic Studies Conducted in Alligator Bayou

	Common Name	Scientific Name
1	Sponge	Unidentified Spongillid
2	Hydra	Unidentified Hydrozoan
3	Flatworm	*Mesostoma* sp.
4	Flatworm	*Dugesia tigerina*
5	Flatworm	Unidentified Planarian
6	Roundworm	Unidentified Nematode
7	Bryozoa	*Hyalinella punctata*
8	Oligochaete	Unidentified Oligochaete
9	Oligochaete	*Sparanophilus eiseni*
10	Oligochaete	Unidentified Lumbriculid
11	Oligochaete	*Aulophorus furcatus*
12	Oligochaete	*Dero digitata*
13	Oligochaete	*Dero nivea*
14	Oligochaete	*Paranais* sp.
15	Oligochaete	*Pristina* sp.
16	Leech	*Mooreobdella microstoma*
17	Leech	*Helobdella stagnalis*
18	Leech	*Placobdella parasitica*
19	Leech	*Macrobdella ditetra*
20	Leech	*Philobdella gracilis*
21	Leech	Unidentified Piscicolid
22	Fish lice	*Argulus* sp.
23	Water flea	*Ceriodaphnia* sp.
24	Seed shrimp	*Candona* sp.
25	Isopod	*Asellus militaris*
26	Isopod	*Asellus* sp.
27	Isopod	*Lirceus* sp.

Table 2.4-16 (Sheet 2 of 5)
Comprehensive List of Species Documented in Benthic Studies Conducted in Alligator Bayou

	Common Name	Scientific Name
28	Isopod	*Sphaeroma* sp
29	Gammarid Amphipod	*Gammarus fasciatus*
30	Gammarid Amphipod	*Gammarus* sp.
31	Talitrid Amphipod	*Hyalella azteca*
32	Talitrid Amphipod	Unidentified Talitrid
33	Water mite	Unidentified Hydracarinid
34	Springtail	Unidentified Collembolid
35	Stonefly	*Perlesta placida*
36	Stonefly	*Isoperla* sp.
37	Mayfly	*Caenis* sp.
38	Mayfly	*Paraleptophlebia* sp.
39	Mayfly	*Tricorythodes* sp.
40	Mayfly	*Siphlonurus* sp.
41	Mayfly	*Hexagenia limbata*
42	Mayfly	*Hexagenia* sp.
43	Mayfly	*Oreianthus* sp.
44	Mayfly	*Heptagenia* sp.
45	Mayfly	*Stenonema* sp.
46	Dragonfly	*Boyeria* sp.
47	Dragonfly	*Coryphaeschna ingens*
48	Dragonfly	*Dromogomphus spinosus*
49	Dragonfly	*Dromogonphus spoliatus*
50	Dragonfly	*Dromogomphus* sp.
51	Dragonfly	*Gomphus* sp.
52	Dragonfly	*Ophigomphus* sp.
53	Dragonfly	*Progomphus obscurus*
54	Dragonfly	*Progomphus* sp.
55	Dragonfly	*Dythemis* sp.

Table 2.4-16 (Sheet 3 of 5)
Comprehensive List of Species Documented in Benthic Studies Conducted in Alligator Bayou

	Common Name	Scientific Name
56	Dragonfly	*Epicordulia* sp.
57	Dragonfly	*Holocordulia* sp.
58	Dragonfly	*Libellula* sp.
59	Dragonfly	*Macromia* sp.
60	Dragonfly	*Neurocordulia* sp.
61	Dragonfly	*Pachydiplax longipennis*
62	Dragonfly	*Perithemis domitia*
63	Dragonfly	*Plathemis lydia*
64	Dragonfly	*Somatochlora* sp.
65	Dragonfly	*Tetragoneuria* sp.
66	Damselfly	*Agrion* sp.
67	Damselfly	*Agria* sp.
68	Damselfly	*Enallagma* sp.
69	Damselfly	*Ischnura* sp.
70	Damselfly	*Nehallenia* sp.
71	Water bug	*Belostoma* sp.
72	Water bug	*Lethocerus* sp.
73	Water boatman	*Graptocorixa* sp.
74	Water boatman	*Trichorixa* sp.
75	Water boatman	Unidentified Corixids
76	Water strider	*Gerris* sp.
77	Water strider	*Rheumatobates* sp.
78	Water strider	*Trepobates* sp.
79	Water strider	*Hydrometra* sp.
80	Water strider	*Ranatra* sp.
81	Water strider	*Notonecta* sp.
82	Fishfly	*Chauliodes* sp.
83	Fishfly	*Sialis* sp.

Table 2.4-16 (Sheet 4 of 5)
Comprehensive List of Species Documented in Benthic Studies Conducted in Alligator Bayou

	Common Name	Scientific Name
84	Caddisfly	*Cheumatopsyche* sp.
85	Caddisfly	*Hydropsyche* sp.
86	Caddisfly	Unidentified Psychomyiid
87	Diving beetle	*Dytiscus* sp.
88	Diving beetle	*Graphoderus* sp.
89	Diving beetle	*Hydroporus* sp.
90	Diving beetle	*Laccophilus* sp.
91	Riffle beetle	*Macronychus glabratus*
92	Whirligig beetle	*Dineutus* sp.
93	Water beetle	*Peltodytes* sp.
94	Water beetle	*Tropisternus* sp.
95	Sand fly	*Atrichopogan* sp.
96	Sand fly	*Stilobezzia* sp.
97	Sand fly	Unidentified Ceratopogonid
98	Midge	*Ablabesmyia* sp.
99	Midge	*Chironomus* sp.
100	Midge	*Chironomus Cryptochironomus* sp.
101	Midge	*Chironomus Dicrotendipes* sp.
102	Midge	*Chironomus Keiferulus* sp.
103	Midge	*Chironomus Xenochironomus* sp.
104	Midge	*Clinotanypis* sp.
105	Midge	*Glyptotendipes* sp.
106	Midge	*Goeldrichironomus* sp.
107	Midge	*Polypedilum* sp.
108	Midge	*Procladius* sp.
109	Midge	*Pseudochironomus* sp.
110	Midge	*Stenochironomus* sp.
111	Midge	*Tanypus* sp.

Table 2.4-16 (Sheet 5 of 5)
Comprehensive List of Species Documented in Benthic Studies Conducted in Alligator Bayou

	Common Name	Scientific Name
112	Midge	*Tanytarsus* sp.
113	Mosquito	*Aedes* sp.
114	Mosquito	*Anopheles* sp.
115	Phantom midge	*Chaoborus punctipennis*
116	Phantom midge	*Chaoborus* sp.
117	Horse fly	*Chrysops* sp.
118	Horse fly	*Tabanus* sp.
119	Crane fly	*Erioptera* sp.
120	Crane fly	*Helius* sp.
121	Crane fly	*Prionocera* sp.
122	Mealybug	*Ferrisia* sp.

Source: References 2.4-1 and 2.4-21.

Table 2.4-17
Comprehensive List of Aquatic Mollusks Collected in Alligator Bayou

	Common Name	Scientific Name
1	Snail	*Campeloma* sp.
2	Trapdoor snail	*Vivaparus* sp.
3	Trapdoor snail	Unidentified Vivaparid
4	Pond snail	*Lymnaea* sp.
5	Snail	*Gyraulus* sp.
6	Snail	*Helisoma trivolvis lentum*
7	Clam	*Eupera* sp.
8	Fingernail clam	*Musculium* sp.
9	Fingernail clam	*Sphaerium* sp.
10	Swan mussel	*Anodonta* sp.

Source: References 2.4-1 and 2.4-21.

Table 2.4-18 (Sheet 1 of 3)
Comprehensive List of Adult Fish Collected in Alligator Bayou and Grants Bayou at the RBS Site

	Common Name	Species Name	Alligator Bayou	Grants Bayou
1	Paddlefish	*Polyodon spathula*	X	
2	Spotted gar	*Lepisosteus oculatus*	X	
3	Shortnose gar	*Lepisosteus platostomus*	X	
4	Bowfin	*Amia calva*	X	
5	Gizzard shad	*Dorsoma cepedianum*	X	X
6	Goldeye	*Hiodon alosoides*	X	
7	Grass pickerel	*Esox americanus vermiculatus*	X	X
8	Car	*Cyprinus carpio*	X	
9	Silvery minnow	*Hybognathus nuchalis*	X	
10	Silver chub	*Hybognathus storeriana*	X	
11	Golden shiner	*Notemigonus crysoleucas*	X	X
12	Emerald shiner	*Notropis atherinoides*	X	
13	River shiner	*Notropis blennius*	X	
14	Striped shiner	*Notropis chrysocephalus*	X	X
15	Pugnose minnow	*Notropis emiliae*	X	
16	Ribbon shiner	*Notropis fumeus*	X	
17	Longnose shiner	*Notropis longirostris*	X	
18	Tailight shiner	*Notropis maculatus*	X	
19	Silverband shiner	*Notropis shumardi*	X	
20	Weed shiner	*Notropis texanus*	X	
21	Blacktail shiner	*Notropis venustus*	X	X
22	Mimic shiner	*Notropis volucellus*	X	
23	Bluntnose minnow	*Pimephales notatus*	X	X
24	Bullhead minnow	*Pimephales vigilax*	X	X
25	Creek chub	*Semotilus atromaculatus*		X
26	River carpsucker	*Carpiodes carpio*	X	
27	Creek chubsucker	*Erimyzon oblongus*	X	X

Table 2.4-18 (Sheet 2 of 3)
Comprehensive List of Adult Fish Collected in Alligator Bayou and Grants Bayou at the RBS Site

	Common Name	Species Name	Alligator Bayou	Grants Bayou
28	Lake chubsucker	*Erimyzon sucetta*	X	
29	Smallmouth buffalo	*Ictiobus bubalus*	X	
30	Bigmouth buffalo	*Ictiobus cyprinellus*	X	
31	Spotted sucker	*Minytrema melanops*	X	
32	Blue catfish	*Ictalurus furcatus*	X	
33	Black bullhead	*Ictalurus melas*	X	X
34	Yellow bullhead	*Ictalurus natalis*	X	X
35	Channel catfish	*Ictalurus punctatus*	X	
36	Tadpole madtom	*Noturus gyrinus*	X	
37	Pirate perch	*Aphredoderus sayanus*	X	X
38	Golden topminnow	*Fundulus chrysotus*	X	
39	Blackspotted topminnow	*Fundulus olicaceus*	X	X
40	Mosquitofish	*Gambusia affinis*	X	X
41	Least killifish	*Heterandria formosa*	X	
42	Sailfin molly	*Poecilia latipinna*	X	
43	Brook silverside	*Labidesthes sicculus*	X	
44	White bass	*Morone chrysops*	X	
45	Yellow bass	*Morone mississippiensis*	X	
46	Flier	*Centrarchus macropterus*	X	
47	Banded pygmy sunfish	*Elassoma zonatum*	X	X
48	Green sunfish	*Lepomis cyanellus*	X	
49	Warmouth	*Lepomis gulosus*	X	X
50	Orangespotted sunfish	*Lepomis humilis*	X	
51	Bluegill	*Lepomis macrochirus*	X	X
52	Dollar sunfish	*Lepomis marginatus*	X	
53	Longear sunfish	*Lepomis megalotis*	X	X
54	Redear sunfish	*Lepomis microlophus*	X	

Table 2.4-18 (Sheet 3 of 3)
Comprehensive List of Adult Fish Collected in Alligator Bayou and Grants Bayou at the RBS Site

	Common Name	Species Name	Alligator Bayou	Grants Bayou
55	Spotted sunfish	*Lepomis punctatus*	X	
56	Bantam sunfish	*Lepomis symmetricus*	X	
57	Largemouth bass	*Micropterus salmoides*	X	X
58	White crappie	*Pomoxis annularis*	X	
59	Black crappie	*Pomoxis nigromaculatus*	X	
60	Hybrid	*Lepomis macrochirus X L. cyanellus*	X	X
61	Hybrid	*Lepomis macrochirus X L. gulosus*	X	
62	Hybrid	*Lepomis macrochirus X L. microlophus*	X	
63	Mud darter	*Etheostoma asprigene*	X	
64	Bluntnose darter	*Etheostoma chlorosomum*	X	X
65	Slough darter	*Etheostoma gracile*	X	
66	Goldstripe darter	*Etheostoma parvipinne*		X
67	Cypress darter	*Etheostoma proeliare*	X	X
68	Freshwater drum	*Aplodinotus grunniens*	X	
69	Striped mullet	*Mugil cephalus*	X	

Source: References 2.4-1 and 2.4-21.

Table 2.4-19
Threatened and Endangered Species Located Near the RBS Site

Scientific Name	Common Name	Status[(a)]	Distance from RBS Site[(b)]	Source
Scaphirhynchus albus	Pallid sturgeon	FE; S1	<3.2 km (2 mi.)	LNHP2007; USFWS 2007
Etheostoma caeruleum	Rainbow darter	S2; S3	Beyond 3.2 km (2 mi.) but within 16 km (10 mi.)	LNHP 2007
Cyprinella camura	Bluntface shiner	S2; S3	<3.2 km (2 mi.)	LNHP 2007
Campostoma anomalum	Central stoneroller	S2	n/a	LNHP 2007
Polyodon spathula	Paddlefish	Not listed; refer to Subsection 2.4.2.4 for further details.	n/a	LDWF 2007

a) Federal status rankings developed by the US Fish & Wildlife Service under the Endangered Species Act (ESA), FE - Federal endangered (USFWS 2007). State status rankings developed by the Louisiana Natural Heritage Program (LNHP 2007): S1 - critically endangered, S2 - imperiled, S3 - rare. 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; n/a - the information was not available at the time of inquiry.

Source: References 2.4-42, 2.4-43, and 2.4-44.

Table 2.4-20
Threatened and Endangered Terrestrial Species Potentially Located Near RBS

Scientific Name	Common Name	Status[(a)]	Comments	Source
Picoides borealis	Red cockaded woodpecker	FE	Possibly migrates across region	LNHP 2007
Alligator mississippiensis	American alligator	FT	Observed on property in lowlands along Mississippi River	LNHP 2007
Haliaeetus leucocephalus	Bald eagle	S2, S3	No nests in vicinity; possibly foraging in vicinity during winter	LNHP 2007
Sorex longirostris	Southeastern shrew	S2, S3	No records in vicinity	LNHP 2007
Spilogale putorius	Spotted skunk	S1	No records in vicinity	LNHP 2007
Mustela frenata	Long-tailed weasel	S2, S4	Known from region but no reports from RBS site	LNHP 2007

a) Federal status rankings developed by the U.S. Fish and Wildlife Service under the Endangered Species Act (ESA): FE - Federal endangered, FT - Federal threatened (USFWS 2007). State status rankings developed by the Louisiana Natural Heritage Program (LNHP 2007): S1 - critically imperiled in Louisiana, S2 - imperiled in Louisiana because of rarity; S3 - rare and local throughout the state or found locally; S4 apparently secure in Louisiana with many occurrences.

ER 2.4 Figures

Due to the large file sizes of the figures for ER Section 2.4, they are collected in a single .pdf file, which you can navigate via the figure numbers in the Bookmark pane. When cited in the text, the links for these figures will launch the .pdf file.

2.5 SOCIOECONOMICS

The existing socioeconomic characteristics of the project area around the proposed RBS Unit 3 are established in this section, which is divided into subsections covering the following subjects:

- Demography (Subsection 2.5.1).
- Community Characteristics (Subsection 2.5.2).
- Historic Properties (Subsection 2.5.3).
- Environmental Justice (Subsection 2.5.4).
- Noise (Subsection 2.5.5).

This section includes a discussion of the baseline socioeconomic characteristics within a 50-mi. (80-km) radius of the proposed RBS Unit 3 site. In addition, socioeconomic characteristics are described for the 10-mi. (16-km) emergency planning zone (EPZ) and the 2-mi. (3.2-km) low population zone (LPZ) or exclusion area population zone. Data are provided in sufficient detail to support analyses and conclusions made in subsequent sections regarding the socioeconomic impacts of RBS Unit 3 construction and operation.

2.5.1 DEMOGRAPHY

The demographics of the project area around the proposed RBS Unit 3 are described in this subsection. In most instances, the population statistics were taken from the 2000 U.S. Census data contained in the LandView® 6 software.[a] This software is a flexible tool capable of identifying economic and demographic information for selected areas that can be defined as concentric circles lying at various distances from a given geographic location. The most commonly used geographic area in this subsection is the RBS Unit 3 region, which is defined as the area encompassed by a 50-mi. radius from the center of the proposed RBS Unit 3 power block. The region includes all or a portion of the 24 parishes and counties in Louisiana and Mississippi listed in Table 2.5-1. These areas are also shown in Figure 2.5-1, where a 50-mi. concentric circle from the proposed RBS Unit 3 power block is indicated. With the exception of East Baton Rouge and West Baton Rouge parishes, the region is predominantly rural.

Figure 2.5-2 indicates the area within 10 mi. of the proposed RBS Unit 3 power block. On this map, the proposed RBS Unit 3 power block is located at the center of the drawing, and concentric circles are drawn around the center at distances of 1, 2, 3, 4, 5, and 10 mi. The circles are divided into 22.5-degree segments, with each segment centered on one of the 16 cardinal

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a. LandView® 6 software (December 2003) is the result of a collaborative effort among the U.S. Environmental Protection Agency (EPA), the U.S. Census Bureau, the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Geological Survey (USGS) to provide the public readily accessible published federal spatial and demographic data. It is composed of two software programs: the LandView® 6 database manager and the MARPLOT® map viewer. These two programs work in tandem to create a computer mapping system that displays individual map layers and the associated demographic and spatial data.

compass points (e.g., north, north-northeast, etc.). Within each area defined by the concentric circles and radial lines, the resident population for 2000 is listed, based on data from LandView® 6.[b] These population statistics are also listed in Table 2.5-2. Consistent with the rural nature of the vicinity, the population within 10 mi. of the proposed RBS Unit 3 is relatively low, numbering 24,756 in 2000. The largest population areas are associated with New Roads, Louisiana (i.e., southwest, west-southwest segments, with a 2000 population of 7759), and Jackson, Louisiana (i.e., northeast segment, with a 2000 population of 3540); both cities are more than 5 mi. from the proposed RBS Unit 3 power block. St. Francisville, Louisiana, had a population of 1712 in 2000.

Figure 2.5-3 indicates the area up to 50 mi. of the proposed RBS Unit 3 power block. The proposed RBS Unit 3 power block is centered, and concentric circles are drawn at distances of 10, 20, 30, 40, and 50 mi. The circles are divided into 22.5-degree segments, with each segment centered on one of the 16 cardinal compass points (e.g., north, north-northeast, etc.). Within each area defined by the concentric circles and radial lines, the resident population for 2000 is liste, based on LandView® 6. The population statistics are also listed in Table 2.5-3. The data indicate that the largest regional population segments lie 20 to 40 mi. southeast and south-southeast of the site and are associated with the Baton Rouge metropolitan area, which had a 2000 population of 479,019. Total regional population was 859,874 in 2000.

2.5.1.1 Transient Populations

Transient populations include those populations that do not reside permanently in an area but, instead, are present on a temporary basis. There are a large number of categories that can potentially be considered as part of the transient population. Such categories include employees at businesses located outside the workers' area of residence, hotel and motel guests, and patrons of sporting events and recreational facilities. There are also special facilities with populations that can be counted as transient, including schools, hospitals, nursing homes, and correctional facilities.

It should be kept in mind, when viewing transient population figures, that a portion of the population in some categories (e.g., the workforce at an employer, guests in a hotel, etc.) reside within the area of study, and therefore, the category can lead to double-counting, especially in

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b. The segment population was derived from LandView® 6 using Census Block Points. Census Block Points represent a small population for a limited but unspecified area around the block point. According to the LandView® 6 Help, "a search for population at a radius about a point would search out data at the Census Block level, the smallest unit of Census statistics and its most accurate." Figure 2.5-4 shows all the Census Block Points for West Feliciana Parish, in addition to the demographic information that each block point represents.

To develop the population for each segment, the following methodology was used. For the 0- to 1-mi. distance from the plant, the population was not divided into directional segments. Rather, the population for all Census Block Points lying within the 1-mi. radius was summed in accordance with Figure 2.5.1-1 in NUREG-1555 (October 1999). For the 1- to 3-mi. segments, Census Block Points were allocated to a segment based upon their location indicated in LandView® 6, as further modified based upon a review of aerial photographs. For segments beyond 3 mi., the population in a Census Block Point was allocated in its entirety to the segment in which it was reported in LandView® 6, refer to Figure 2.5-5.

larger geographic areas. Consequently, the sum of the resident and transient populations tends to overstate the total area population. Nevertheless, transient population estimates for the 10-mi. radius around the RBS and the 10- to 50-mi. radius can be useful and are provided in the following subsections.

2.5.1.1.1 Transient Population within Approximately 10 Mi.

An estimate of the total transient population, which includes the transient population (persons who live outside of the EPZ boundary but enter the EPZ for a specific reason, and then leave the EPZ; examples include campers or recreational facility users) plus commuter-employees (persons who live outside the EPZ yet commute to work within the EPZ) for the EPZ has been estimated in the "River Bend Station Development of Evacuation Time Estimates" (the "Evacuation Time Estimate" [ETE]) (Reference 2.5-1).

The ETE reports the transient population for the two groups listed above. The information is organized by the distance and compass direction from the RBS site. Based on the resident population developed above and the total transient population from the ETE, the total 10-mi. radius population (permanent plus transient total) is estimated at 30,247 in Table 2.5-4, and the transient population of 5491 comprises approximately 18.2 percent of this figure.

Figure 2.5-6 is a map of the resident plus transient population in the 10-mi. RBS EPZ. Concentric circles have been drawn on this map, with the center of the proposed power block location on the site as the center point, at distances of 1, 2, 3, 4, 5, and 10 mi. The circles are then divided into 22.5-degree segments, with each segment centered on one of the 16 cardinal compass points (e.g., north, north-northeast). Table 2.5-4 also presents the permanent and total transient population estimates, as well as population densities, for concentric circles within the 10-mi. radius of the planned RBS Unit 3 power block.

2.5.1.1.2 Transient Population, 10 to 50 Mi.

The estimated total transient population for the RBS 50-mi. radius is 58,567 (refer to Table 2.5-5). This table also presents the resident, transient, and total population and the population density for the 10- to 50-mi. concentric circles. Approximately 6.4 percent of the total population within the 50-mi. radius concentric circle is estimated to be transient. Most of Baton Rouge, Louisiana, is in the 20- to 30-mi. concentric circle range, making the population density for this distance more than two times the Louisiana state average.

Figure 2.5-7 is a map indicating the resident and transient population distribution in the 50-mi. RBS region. Concentric circles have been drawn on this map, with the center of the proposed power block location on the site as the center point, at distances of 10, 20, 30, 40, and 50 mi. The circles are then divided into 22.5-degree segments, with each segment centered on one of the 16 cardinal compass points (e.g., north, north-northeast). The estimated total transient population for each segment within each concentric circle, which sums to the totals in Table 2.5-5, was calculated by combining estimates of the following data:

- 2000 U.S. Census commuter information for each county/parish (Reference 2.5-2).

- 2000 U.S. Census information from LandView® 6 on the number of recreational, seasonal, and occasional housing units in the 50-mi. region (Reference 2.5-3).
- Special facilities transient population data from Table 2.5-6.
- Louisiana tourism information from the 2003 TravelScope® Profile of U.S. Travelers to Louisiana (Reference 2.5-4).[c]

The 2000 U.S. Census reports commuter information for each county/parish. The data detail the residents' county/parish of residence and employment. Table 2.5-7 shows the results of the U.S. Census information for parish and county commuters within 50 mi. of the RBS. Once the commuter information was compiled, ArcGIS software was used to find the percentage of each parish or county lying within a segment. The commuter transient population for each county/parish was multiplied by this percentage to produce an estimate of the commuter transient population for each concentric circle segment for the 10- to 50-mi. radius.

The LandView® 6 software was used to estimate the transient population associated with the use of recreational, seasonal, or occasional housing units and to determine the number of houses in each segment based on Census Block Point data. For each segment, the number of housing units was then multiplied by the percentage of total housing units in the generally corresponding Census Block Group (CBG) classified as recreational, seasonal, or occasional use. Next, to translate this into a population estimate, the number of units for recreational, seasonal, or occasional use for each segment was multiplied by the average parish household size to arrive at the maximum population in recreational, seasonal, or occasional housing units in each segment. Finally, because these units are only occupied part of the year, it was arbitrarily assumed that three-quarters of the housing units would only be occupied for 3 months (one-quarter) of the year. Thus, by multiplying the maximum population in recreational, seasonal, or occasional housing units by 0.1875 (0.75 * 0.25), an estimate of the equivalent transient housing population for recreational, seasonal, or occasional use for each segment was derived.

Table 2.5-6 lists special facilities transient population information for several categories (e.g., correctional facilities, college dormitories, nursing homes, hospitals, religious group quarters, and other nonhousehold living situations) for each parish or county within 50 mi. of the RBS. ArcGIS software was used to find the percentage of each parish or county lying within a segment. The transient population for each county was multiplied by this percentage to produce an estimate of transient population for each concentric circle segment for these several categories. Some modifications to this analysis were necessary to take into account large populations that apply wholly to a specified segment. For example, the college dormitory population for Louisiana State University (LSU) was assumed to wholly apply to the Baton Rouge area. Likewise, correctional facility populations were applied to the specific segment based on the facility's location (Reference 2.5-5).

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c. The list of transient populations for the 10- to 50-mi. range does not include students and school staff, because students and school staff would likely be captured in the Census information. While school-related population was included in the 10-mi. EPZ total population, this was not considered appropriate for the 10- to 50-mi. range, because most students both reside and attend schools within the same 50-mi. area, making the potential for double-counting significantly higher than for the 0- to 10-mi. area.

Louisiana tourism information from the 2003 TravelScope® Profile of U.S. travelers to Louisiana reports the number of resident and nonresident trips made for the purpose of visiting friends/relatives, entertainment, outdoor recreation, other pleasure/personal trips, business, attending convention/conference/seminar, or combined business/pleasure, to the state and seven major Louisiana cities, including Baton Rouge. The report further describes the average length of stay for each visit and the seasonal (by month) travel distribution. Multiplying the number of visitor in-person trips by the average length of stay and the seasonal distribution for Baton Rouge provides the weighted average transient population due to business and leisure for Baton Rouge. Multiplying this estimate by the permanent population percentages for the concentric circle segments that contain Baton Rouge results in a transient population for the Baton Rouge concentric circle segments.

2.5.1.1.3 Projected Total Population

Assessing the potential socioeconomic impact of RBS Unit 3 requires a population projection. The parishes expected to be primarily affected by RBS Unit 3 construction and operation are of particular interest. Based on the distance to the RBS and the population concentrations, the *primary impact area* is assumed to include the parishes of West Feliciana, East Feliciana, West Baton Rouge, East Baton Rouge, and Pointe Coupee. These five parishes are located within 10 mi. of the RBS and include the population centers of Baton Rouge, Jackson, and New Roads. The primary impact area includes 493,687 people, according to the 2000 U.S. Census, which is more than half of the number of people located within 50 mi. of the RBS. The primary impact area covers approximately 2000 sq. mi., which is equivalent to the area of a 25-mi. radius.

One factor to be considered in developing long-term population projections is the impact of Hurricane Katrina (August 29, 2005) and Hurricane Rita (September 25, 2005). Combined, these hurricanes displaced 780,000 people and inflicted major or severe damage to at least 123,000 homes in the Louisiana-Mississippi area (Reference 2.5-6). Table 2.5-8 indicates that some parishes, primarily in the New Orleans area, suffered very significant population losses between July of 2005 and January of 2006. As the population from the hardest hit areas relocated, the less affected Louisiana parishes and even many counties in surrounding states encountered population increases. In the primary impact area, the increase in household population was 3.8 percent or 17,858 persons, with a range of 4.3 percent for East Baton Rouge to a negative 1.1 percent for West Baton Rouge. The household population in West Feliciana Parish increased by 2.5 percent or 246 persons between July of 2005 and January of 2006.

Hurricane Katrina and Hurricane Rita were unprecedented natural disasters, and there is uncertainty regarding how much of the displaced population will return to their pre-hurricane area of residence over the next few years. There are a number of assistance programs that facilitate returning, including *The Road Home* program that provides up to $150,000 for repair or rebuilding to help those whose residences were affected. By October 2007, the federally funded program had received more than 184,000 applications and had distributed approximately $4.2 billion in funds to more than 62,000 homeowners (Reference 2.5-7). The program filing date remained open until July 31, 2007, and the program allowed eligible homeowners to: (1) stay in their homes, (2) rebuild another home in Louisiana, or (3) sell their homes and not remain in Louisiana (References 2.5-8 and 2.5-9). As a result, it may be some time before final settlement patterns of the affected populations can be discerned. If a substantial majority of the displaced population returns to their pre-hurricane area of residence, the long-term population forecast for the primary impact area should treat the hurricane impacts as temporary phenomena that would not alter the long-term trend in the primary impact area population, which was only slightly positive.

Table 2.5-9 shows the historical trend in population growth from 1990 through 2005, as well as the average annual population growth rates for regional parishes and counties. Table 2.5-9 indicates that the primary impact area population increased at an average annual rate of 0.84 percent from 1990 to 2000, decreased at an annual rate of 0.17 percent from 2000 to (July) 2005, and increased at an annual rate of 0.50 percent from 1990 to (July) 2005.

For purposes of projecting the long-term impact of the hurricanes on the primary impact area population, the population projections developed in this subsection were based on long-term, 1990 through July 2005, population and growth trends. To the degree that a significant portion of the hurricane-related population does permanently stay in the primary impact area and the long-term growth is higher than 0.50 percent, the population base and the related workforce - including the construction workforce from which the RBS Unit 3 workforce can be hired - would increase and the potential for negative impacts associated with the hiring of a high percentage of RBS Unit 3 construction workers from outside the region would decrease.

Population projections for the segments within 10 mi. of the RBS Unit 3 power block for 2017 (i.e., the assumed first year of operation) and for each subsequent decade for five decades through the year 2067 (i.e., the assumed end of the initial plant license period) are shown in Table 2.5-10. The projections were based on the average annual growth rate in census population from 1990 through 2005 (refer to Table 2.5-9) for the regional parish and counties, applied to the 2000 resident and transient population estimate for each segment.[d] The transient population was estimated to grow at the same rate as the resident population because schools, employment, and a number of other transient categories are generally linked to resident population. As indicated in Table 2.5-10, the segments lying in the northeast (Jackson) and west-southwest (New Roads) are projected to remain the largest population segments within 10 mi. of the site.

The population projections for the successive 10-mi. segments from the proposed RBS Unit 3 power block for 2017 (i.e., the projected first year of operation) and for each subsequent decade for five decades through the year 2067 (i.e., the projected end of the initial license period) are shown in Table 2.5-11. The projections were based on the average annual growth rate in census population from 1990 through 2005 (refer to Table 2.5-9) applied to the 2000 resident and transient population estimate for each segment.[e] Throughout the forecast period, the largest regional concentration of population is projected to remain in the Baton Rouge metropolitan area, 20 to 40 mi. southeast and south-southeast of the RBS site.

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d. ArcGIS software was used to find the percentage of each segment lying within a parish or county. A weighted average growth rate for each segment was calculated by combining the product of the parish/county growth rate and the segment tract area percentage associated with each parish/county. Figure 2.5-8 shows a graphical representation of this methodology.

e. ArcGIS software was used to find the percentage of each segment lying within a parish or county. A weighted average growth rate for each segment was calculated by combining the product of the parish/county growth rate and the segment tract area percentage associated with each parish/county. Figure 2.5-8 shows a graphical representation of this methodology.

2.5.1.1.4 LPZ, EPZ, and Regional Characteristics

Table 2.5-12 lists the 2000 population within 10 mi. and within 50 mi. of the proposed RBS Unit 3 power block location, sorted by age, and also lists the data for 2047, the expected midpoint of the station's preliminary operating license term. Note that to derive the detailed age estimates, the methodology requires a change from the previous population estimates made from LandView® 6. Previous population estimates in this subsection were based on census information organized and reported according to Census Block Points that, in the LandView® 6 software, allow a relatively precise estimate of population precisely 50 mi. (or other distance) from the proposed RBS Unit 3 location. Age distribution, however, is not available at the census point level in LandView® 6, and a larger census reporting area called the CBG must be used, because this reporting area does include age distribution data. According to the LandView® 6 supporting documentation, the average CBG contains about 39 Census Block Points. The consequence of using this CBG estimating approach, however, is that the block groups do not exactly coincide with the 50-mi. (or other distance) radius from the proposed RBS Unit 3 power block. Instead, and as shown in Figure 2.5-9, some of the CBGs near the 50-mi. radius extend beyond the 50-mi. concentric circle. This has the effect, in the instance of the 50-mi. radius, of increasing the regional population from 859,874 (refer to Table 2.5-12) using the census data point method, to 918,304. Likewise, at the 10-mi. radius, the CBG estimating approach produces a population of 37,746 rather than the 24,756 estimate under the more precise census data point approach. Figure 2.5-10 indicates the block groups lying wholly or partly within the 10-mi. radius, which is also called the EPZ.

Using the CBG estimating approach, the data in Table 2.5-12 indicate that in 2000, the 35 - 44 age group at the 10-mi. and 50-mi. distances was the largest age category. The projected 2047 age distribution was derived by applying the percentage distribution for each age group in 2000 to the total projected population in 2047. Consequently, the largest age group projected for the region in 2047 remains in the 35 - 44 year age group.

Age, sex, racial, and ethnic population characteristics for the LPZ, defined as the area within 2 mi. of the proposed RBS Unit 3 power block, the EPZ, and the region are listed in Tables 2.5-13 and 2.5-14. To derive the data in the tables, the CBG estimating approach was again used, meaning that CBGs wholly or partly within the selected areas were included in the estimates. Figure 2.5-11 indicates the CBGs in the LPZ.

The age and sex population distribution data in Table 2.5-13 indicate that the number of females is slightly above the number of males at the regional and LPZ level, and that the 35 - 44 age group is the largest age group in all three areas. Table 2.5-14 indicates that in all three areas, Caucasians comprised the largest ethnic group, followed by African Americans. Other races and ethnic groups compose a small percentage of the population in the LPZ, EPZ, and region.

Income distribution by household for the LPZ, EPZ, and region are listed in Table 2.5-15. Regional median household income data for Louisiana, Mississippi, and the regional parishes and counties are included in Table 2.5-16. The data in Table 2.5-15 indicate that the largest household income group for all three area designations in 2000 was in the $50,000 - $74,999 category. Table 2.5-16 indicates that West Feliciana was one of six parishes in the region having a median household income ($37,271) higher than the state level ($35,216) in 2004.

Putting the income data into a national perspective, Louisiana's median family income in 2004 can be compared with a national average of $44,334. From 2003 to 2005, Louisiana ranked 46 out of 50 states for the lowest median annual household income in comparison to the average for the United States (Reference 2.5-10).

2.5.2 COMMUNITY CHARACTERISTICS

This subsection describes the community characteristics in the vicinity of the proposed RBS Unit 3, with an emphasis on the regional parishes likely to incur the majority of impacts from the project. The high impact areas are those parishes in which the construction and operational workforce would reside and which would incur an increase in the demand for community services and facilities. Based on the proximity to the RBS site and the permanent residential locations of the RBS Unit 1 operational workforce, the primary impact area was defined to include the parishes of West Feliciana, East Baton Rouge, West Baton Rouge, Pointe Coupee, and East Feliciana. Characteristics include the primary impact area's economic base, political structure, housing information, education, recreational facilities, taxes, land use and zoning, social services, public facilities, transportation systems, and distinctive community characteristics.

2.5.2.1 Area Economic Base

2.5.2.1.1 Employment by Industry

Employment statistics for the major industry categories are presented in Table 2.5-17 for the primary impact area and the region as a whole. All data in the table are from the 2000 U.S. Census. As indicated in the table, the region had a total employment of 390,219 workers in 2000, and the primary employment industries in the region included educational, health, and social services (82,322 workers); manufacturing (45,627 workers); retail trade (45,510 workers); and construction (35,874 workers).

Within the primary impact area, West Feliciana Parish's largest employment industry is the educational, health, and social services industry (825 workers), followed by the public administration industry (710 workers), and manufacturing (682 workers). Regional employment is most heavily centered in the large Baton Rouge metropolitan area in East Baton Rouge Parish, approximately 24 mi. southeast of the RBS. According to 2000 census data, East Baton Rouge Parish had a total employment of 192,715. The educational, health, and social services industry employed 44,106 workers, the retail trade sector employed 21,749 workers, and the professional, scientific, management, administrative, and waste management services industry employed 19,511 workers.

West Baton Rouge, had a total employment of 9408; 1645 workers were employed in the educational, health, and social services industry, followed by 1510 workers employed in the construction industry, and 1031 workers employed in the retail trade industry. Pointe Coupee had a total employment of 8911, of which 1716 people worked in the educational, health and social services industry, 1189 people worked in the retail trade industry, and 1121 people were employed in the manufacturing industry. Lastly, in 2000, East Feliciana Parish had a total employment of 7601, with 2021 people employed in the educational, health, and social services industry, 1034 people employed in the manufacturing industry, and 815 people employed within the public administration industry.

The nearby centers of economic activity include the towns of St. Francisville in West Feliciana Parish, approximately 3 mi. northwest of the site; New Roads (Pointe Coupee) approximately 7 mi. west-southwest of the site; and Jackson (East Feliciana Parish), approximately 8 mi. northeast of the site.

In 2000, St. Francisville had a labor force of 881 workers, of which 837 were employed, constituting an unemployment rate of 5.0 percent. The leading industry of employment within the town was educational, health, and social services with 195 workers. This was followed by the transportation, warehousing, and utilities sector with 96 workers, and the public administration sector with 88 workers. The largest occupation category for St. Francisville was the management, professional, and related occupations category (38.1 percent), followed by the sales and office occupation (23.2 percent) (Reference 2.5-11).

2.5.2.1.2 Principal Employers

The largest employers in the primary impact area are listed in Table 2.5-18. In West Feliciana, the three largest employers (based on 2000 data) were the Louisiana State Corrections Penitentiary, Entergy Operations, Inc., and Tembec USA with 1100, 700, and 520 employees, respectively. The Tembec facility was closed in the summer of 2007, but there is the possibility that the facility will be sold and reopened (Reference 2.5-12). The next largest employers within the parish were The Bluffs and West Feliciana Hospital, each with approximately 100 employees.

West Feliciana Parish is aggressively pursuing the development of a business park southeast of the RBS site. With the West Feliciana Business Park, there is the potential for significant additional industrial growth near the RBS. The business park would be generally within the area bordered by U.S. Highway 61, the RBS site, the Mississippi River, and the East Feliciana Parish line (Thompson Creek) (refer to Figure 2.5-12). The park consists of approximately 2200 ac. The build-out employment associated with the park is uncertain at this time, but it has the potential to employ several hundred workers.

East Baton Rouge Parish has numerous employers with workforces greater than 1000. The largest employer in the parish was Turner Industries, an industrial contractor, with 8525 employees. This was followed by LSU with 5600 employees and ExxonMobil Chemical Company with 4275 employees.

The largest employers in West Baton Rouge, Pointe Coupee, and East Feliciana are smaller than in East Baton Rouge. The largest employers for West Baton Rouge Parish were Petrin Corporation (670 employees), Trinity Marine Port Allen (400 employees), and Wal-Mart (300 employees). For Pointe Coupee Parish, the largest three employers were Louisiana Generating (360 employees), Nan Ya Plastics Corporation (226 employees), and Wal-Mart (200 employees). For East Feliciana Parish, the top three employers were East Louisiana State Hospital (1500 employees), followed by Villa Feliciana Hospital (600 employees), and Dixon Correctional Institute (541 employees).

2.5.2.1.3 Employment, Labor Force, and Unemployment

The primary impact area and other parishes in the region have encountered moderate economic growth in recent years. Table 2.5-19 indicates that, from 2000 to 2006, the average annual growth rate for employment for primary impact area parishes was led by West Feliciana (0.86 percent), followed by West Baton Rouge (0.84 percent), East Baton Rouge (0.73 percent), Pointe Coupee (0.50 percent), and East Feliciana (0.34 percent). For the entire region, the average annual growth rate in employment was 1.45 percent.

Table 2.5-19 lists labor force and unemployment data for the region and the primary impact area in 2000 and 2006. Most parishes in the primary impact area experienced slight growth in the labor force; however, West Feliciana Parish had a slight decrease in the labor force during this period (4953 in 2006 compared to 4798 in 2000). There were 4732 people employed in the parish, and the unemployment rate was 4.5 percent in 2006, down from 6.3 percent in 2000.

The East Baton Rouge labor force increased from 206,885 in 2000 to 214,878 in 2006, and the unemployment rate fell from 4.3 percent to 3.8 percent. The West Baton Rouge labor force increased from 10,152 in 2000 to 10,537 in 2006, and its unemployment rate improved from 4.9 percent in 2000 to 3.7 percent in 2006. The Pointe Coupee labor force increased from 9732 in 2000 to 9852 in 2006, and the unemployment rate dropped from 5.9 percent in 2000 to 4.2 percent in 2006. In East Feliciana, the 2000 labor force was 8261 and increased to 8319 in 2006, while the 2006 parish unemployment rate of 4.1 percent decreased from the 5.4 percent mark in 2000.

In the larger 50-mi. RBS region, 20 of the 24 parishes and counties had 2006 unemployment rates below their 2000 figures, and 18 of the 24 parishes and counties had a larger labor force in 2006 than in 2000. The poorest performing locations in 2006, compared to the 2000 data in terms of employment growth, were generally the Mississippi counties.

2.5.2.1.4 Employment Projection

Table 2.5-20 lists employment projections for Louisiana and the Second Regional Market Labor Area (RMLA 2); the RMLA 2 includes the parishes of Ascension, Iberville, Livingston, St. Helena, Tangipahoa, and Washington, in addition to the parishes that constitute the primary impact area (refer to the Table 2.5-20 footnote for a list of all parishes in RMLA 2). The data compare historical 2004 occupational employment in all categories with projections for 2014, which would be the peak construction employment period at the RBS Unit 3 site. The information indicates that a 0.6 percent annual average growth rate is expected for all occupations statewide; a 1.8 percent average annual growth rate is projected for RMLA 2.

One of the more important employment categories, in terms of potential impacts from RBS Unit 3 construction, is the employment level projected for the RMLA 2 construction occupation. Table 2.5-20 indicates that the projected annual average growth rate from 2004 through 2014 is 1.16 percent at the state level, and is 1.58 percent for RMLA 2. While RMLA 2 does not perfectly coincide with the defined RBS Unit 3 primary impact area, it is reasonable to apply the RMLA 2 growth to the 2000 regional construction employment figure of 35,874 to arrive at the RBS Unit 3 regional construction employment estimate for 2014. Applying the 1.58 percent annual average growth rate results in a 2014 regional construction employment projection of 44,678 workers. This projection is utilized in Section 4.4.

2.5.2.2 Area Political Structure and Taxation

2.5.2.2.1 Political Structures

This subsection discusses the political infrastructure of the parishes within the primary impact area, beginning with West Feliciana Parish.

West Feliciana Parish is a political jurisdiction of Louisiana, and the parish government is led by the West Feliciana Parish Police Jury. The Parish Police Jury is composed of elected officials from seven districts. These seven jurors exercise functions and powers over local services and facilities, including road and bridge construction and maintenance, drainage, sewerage, solid waste disposal, fire protection, recreation and parks, parish prison construction and maintenance, road lighting and marking, water works, health, and hospitals.

Three of the remaining primary impact area parishes have similar political structures. West Baton Rouge Parish is governed by a parish council. The parish council is composed of a Parish President and nine District Council members (Reference 2.5-13). Pointe Coupee is governed by a police jury made up a 12 distinct districts, each represented by an elected official (Reference 2.5-14), and East Feliciana is governed by a police jury comprised of seven district officials (Reference 2.5-15).

East Baton Rouge Parish is organized under a different political structure, because the city of Baton Rouge is so closely tied to the parish. In 1949, the framework established in the "Plan of Government" (the Plan) document became effective, and thereby abolished the parish police jury and the city commission council. In their place, a single line of authority was established wherein the Mayor of the city of Baton Rouge was also designated as the President of the Parish Council (Reference 2.5-16).

The Plan also extended the city limits and substituted a consolidated system of a mayor and council for city and parish. The government established by the Plan has remained intact, but there have been a series of amendments over the years, including the addition of positions such as an assistant to the Mayor-President and a Council Budget Officer (Reference 2.5-16).

Today, the City-Parish Government consists of two branches: a Mayor-President and the Metropolitan Council. The Mayor-President sets the government's agenda, vision, and manages its day-to-day functions and does not directly set policy but influences it; the Metropolitan Council is in charge of passing new legislation and appropriating funds. The Metropolitan Council consists of 12 council district members (Reference 2.5-17).

2.5.2.2.2 Taxation

The primary impact area parishes depend on tax revenues to fund operations, and parish taxes are collected primarily through property taxes and local sales taxes. Tables 2.5-21 through 2.5-25 provide a breakdown of the sales and use taxes for each primary impact area parish. The state sales tax rate is 4 percent; the local sales tax rate for West Feliciana Parish is 4 percent. East and West Baton Rouge Parishes, and East Feliciana Parish each have a local sales tax rate of 5 percent (5.5 percent in Baker in East Baton Rouge). In Pointe Coupee, the sales tax is 4 percent or 5 percent, depending upon location within the parish.

Listed in Table 2.5-26 is a comparison of various tax collections for the primary impact area parishes. The West Feliciana sales and use tax revenues collected per capita in 2006 were $171, and this ranked 40th among the 64 parishes (Reference 2.5-18). The per capita property tax revenues collected for West Feliciana Parish were $1274 in 2005, considerably higher than the other parishes within the primary impact area. The East Baton Rouge property tax per capita was $643 in 2005, the West Baton Rouge per capita property tax was $807 and above that for Pointe Coupee ($617) and East Feliciana ($156).

Tables 2.5-27 through 2.5-31 show the operating budgets for the primary impact area parishes. (Note that the operating budget is not an all inclusive budget for the parish because schools, fire departments, and other entities have separate budgets that will not be reflected in the parish operating budget. In West Feliciana Parish, for example, the property taxes paid by the Applicant alone in 2007 were approximately two times the parish operating budget.) The West Feliciana Parish estimated revenue budget for 2007 is shown to be $7.04 million, with ad valorem taxes constituting the largest component of tax revenue. The budgeted parish expenses for 2007 equal $7.20 million, with the road fund the largest category, followed by culture and recreation expenditures. The projected total sources of funds for East Baton Rogue Parish are shown in Table 2.5-28 to have been $253.69 million for 2007, with the majority of the revenue derived from gross taxes. The projected use of funds matched the revenue intake, with the majority of funds used for personal services. The West Baton Rouge budget for 2007 was $8.18 million in revenues, and $10.67 million in expenditures.

Property taxes are assessed based on assessed value and the mill rate. In Louisiana, land is assessed at 10 percent of fair market value, and all other public service property is assessed at 25 percent of fair market value. The 2007 average millage rate for West Feliciana was 71 mills. New investment in industrial property often qualifies for a 10-year industrial property tax exemption (Reference 2.5-19).

Any new business or facility in the state is subject to applicable federal, state, and local taxes. In Louisiana, the major tax collection categories and amounts collected are shown in Table 2.5-32 for fiscal year 2005-2006. Table 2.5-33 lists the percent of tax collected by major category for Louisiana, Mississippi, and the U.S. average. In 2005 - 2006, the per capita individual income tax in Louisiana was $529, which ranked 38th largest among all states (Reference 2.5-20). The corporate income tax rate applicable on goods produced and sold in state begins at 4 percent on the first $25,000 of net income and then increases to 8 percent on net income over $200,000. Federal income taxes are deductible when computing Louisiana net taxable income.

The RBS Unit 1 is included in the assessment of Entergy Gulf States Louisiana LLC's (EGSL) public service property. In 2007, EGSL paid approximately $14 million in property taxes to West Feliciana Parish as shown, broken down by jurisdiction, in Table 2.5-34.

2.5.2.3 Demographic Information

Detailed demographic information for the region and segments at various distances from the plant site are provided in Subsection 2.5.1. This subsection includes only the demographics of West Feliciana Parish and selected cities within the region. St. Francisville, located approximately 3 mi. to the northwest, is the closest town to the RBS site, and has a population of 1712, based on the 2000 U.S. Census. Jackson, located approximately 8 mi. to the northeast, has a population of 4130, based on the 2000 U.S. Census. New Roads, located approximately 7 mi. to the southwest, has a population of 4966. The only major city within a 50-mi. radius of the RBS site is Baton Rouge, located approximately 24 mi. to the southeast, with a 2000 U.S. Census population of 228,000. (The metropolitan area population was 479,019.) Lafayette, Louisiana, a small portion of which lies within the 50-mi. radius to the southwest, is the only other regional city with a population over 25,000. Other towns with a population greater than 10,000 that are located within 50 mi. of the RBS facility include: Zachary, 18 mi. southeast, population 11,300 (2000 U.S. Census); Baker, 21 mi. southeast, 13,800 (2000 U.S. Census); and Opelousas, 48 mi. southwest, 22,900 (2000 U.S. Census). Projected population information for the area surrounding the RBS site is discussed in Subsection 2.5.1.

The cumulative resident population for the primary impact area was calculated using data from the 2000 and 2006 U.S. Censuses. The population densities for the primary impact area are shown in Table 2.5-35, which shows the contrast between the rural characteristics of West Feliciana, Pointe Coupee, West Baton Rouge, and East Feliciana parishes with the urban characteristics of East Baton Rouge Parish. West Feliciana Parish had a population density of 37.2 persons per sq. mi. in 2000; this figure increased to 38.3 by 2006. The West Baton Rouge 2006 population density was 117.5; this was higher than in Pointe Coupee (40.6) and East Feliciana (40.8). East Baton Rouge Parish had a 2000 population density of 907.4 people per sq. mi., which increased to 942.1 by 2006. Overall, the Louisiana population density decreased from 102.6 in 2000 to 98.4 in 2006; this decrease was primarily due to the effects of Hurricane Katrina.

2.5.2.4 Social Structure Information

Population data for the areas surrounding the RBS site indicate generally low population densities and a rural setting. Populations living in rural areas in the region are able to procure basic goods, services, and recreational opportunities in rural communities similar in size to St. Francisville. For specialized goods and services, the regional population is able to commute to Baton Rouge. Baton Rouge also provides regional employment opportunities in a wide range of industries and specialty positions not available elsewhere in the region. However, the presence of the RBS in West Feliciana Parish and the Big Cajun power plants in Pointe Coupee Parish provides important employment opportunities outside the primary regional city of Baton Rouge. The anticipated West Feliciana Business Park would add further regional employment diversity and is expected to be a source of relatively high-paying jobs.

2.5.2.5 Housing Information

2.5.2.5.1 Housing Base

Figure 2.5-13 indicates the housing distribution within 10 mi. of the proposed RBS Unit 3 power block. The proposed location of the Unit 3 power block is located at the center of the drawing, and concentric circles are drawn around the center at distances of 1, 2, 3, 4, 5, and 10 mi. The circles are divided into 22.5-degree segments, with each segment centered on one of the 16 cardinal compass points (e.g., north, north-northeast, etc.). Within each area defined by the concentric circles and radial lines, the 9455 housing units for 2000 are listed by segment, based on data from LandView® 6 using Census Block Point information.

Figure 2.5-14 indicates the housing distribution within 50 mi. of the proposed RBS Unit 3 power block. The proposed Unit 3 power block is centered, and concentric circles are drawn at distances of 10, 20, 30, 40, and 50 mi. The circles are divided into 22.5-degree segments, with each segment area centered on one of the 16 cardinal compass points (e.g., north, north-northeast, etc.). Within each area defined by the concentric circles and radial lines, the 346,909 regional housing units for 2000 are assigned, based on LandView® 6 using Census Block Point information. The same methodology used to determine the population for each 22.5-degree segment was also employed for the housing information.

In 2000, there were 333,001 occupied housing units reported for the region, based on data in LandView® 6 using the CBG estimating approach (refer to Table 2.5-36). This table also presents information on regional occupied housing unit stability. Approximately 63 percent of the 2000 population had lived in the same housing unit since 1994.

Table 2.5-37 provides additional regional housing information by parish and county for the year 2000. The table indicates that there were 840 (18.7 percent) vacant housing units located within West Feliciana Parish; 12,708 (7.5 percent) vacant housing units in East Baton Rouge; 707 (8.4 percent) vacant housing units in West Baton Rouge; 1900 (18.4 percent) vacant housing units in Pointe Coupee; and 1216 (15.4 percent) vacant housing units in East Feliciana Parish. In total, there were 17,371 (8.7 percent) housing units reported as vacant in the primary impact area, and there were 59,983 vacant housing units in the 50-mi. region, representing 10.2 percent of the total regional housing units.

Table 2.5-38 lists 2000 U.S. Census data for the adequacy of housing structures for each regional parish/county. The number and percent of occupied housing units that lack complete plumbing facilities, lack complete kitchen facilities, have no telephone service, and have more than one occupant per room is included. Of the parishes and counties wholly or partly in the region, St. Helena Parish has the highest percentage of occupied housing units that lack plumbing and kitchen facilities or that have no telephone service. West Feliciana Parish has the highest percent (8.04 percent) of housing units that have one or more persons living in a room. By way of comparison, the rate for the state of Louisiana is 5.22 percent.

In 2000, St. Francisville had a housing unit population of 796 units, of which 527 were detached units. Approximately 68 percent of the housing units were built before 1980, and the median number of rooms was 5.1. The median value of owner-occupied housing in St. Francisville was $100,500 in 2000 (Reference 2.5-21).

According to a member of the West Feliciana Parish Police Jury, West Feliciana has a sufficient number of higher priced homes. However, the parish currently does not have enough starter and lower priced homes. The parish is addressing this issue through a study being performed by Fregonese Associates, which will determine how to better zone for smaller lots of mixed category housing closer to the $125,000 to $175,000 range. This opinion regarding starter and worker housing was shared by a member of the West Feliciana Community Development Foundation; this individual also indicated that those seeking low- to moderate-priced housing are being pushed out of the parish (including many younger buyers) and the Fregonese study will address the need for an increased number of trailer parks and apartments.

2.5.2.5.2 Housing Projections

Housing unit projections for each parish or county that is wholly or partly within 50 mi. of the RBS Unit 3 power block for 2014 (peak construction) and 2017 (the assumed first year of operations) are shown in Table 2.5-39. The projections are based upon the average annual growth rate in census housing units from 1990 through 2000 for the regional parish and counties, applied to the 2000 housing units. Table 2.5-39 also shows the housing unit annual average growth rate for each parish and county within the region. Within the primary impact area, there are projected to be 226,398 housing units in 2014. At the beginning of RBS Unit 3 operation, there are projected to be 232,567 housing units in the primary impact area. If the vacancy rate of 8.7 percent (from 2000 census data) is assumed, there would be 19,697 vacant housing units in 2014 and 20,233 vacant housing units in 2017.

2.5.2.6 Educational System

Information on the public education systems in the primary impact area is presented in Table 2.5-40. Data are also compared to state averages for Louisiana and Mississippi, and to the U.S. average. Data include the number of school districts; the number of students; the number of classroom teachers on a full-time equivalent (FTE) basis; and the student/teacher ratio, which serves as a relative indicator of classroom capacity. Data are for the 2005 - 2006 school year and are from the U.S. Department of Education. Data indicate that the average student-to-teacher ratio for Louisiana is 14.7; this ratio is below the Mississippi and U.S. ratios. Compared to the other parishes within the primary impact area, West Feliciana Parish had the lowest ratio, with 13.5 pupils per FTE teacher, based on a total student population of 2508 and 186 FTE classroom teachers. The remaining parishes within the primary impact area had a higher student-to-teacher ratio. East Baton Rouge had a student-to-teacher ratio of 15.3 (49,994 students and 3269 FTE teachers); the ratio for West Baton Rouge was 14.5 (3643 students and 252 teachers); the ratio for Pointe Coupee was 15.7 (3028 teachers and 193 students); and the ratio for East Feliciana was 15.1 (2432 teachers and 161 FTE classroom teachers).

Tables 2.5-41 and 2.5-42 present revenue and expenditure data for the public education systems within the primary impact area. These data are compared to the state averages for Louisiana and Mississippi, as well as to the U.S. average. West Feliciana Parish had total revenues of $24.7 million for public education. This equated to $10,107 per student, according to the U.S. Department of Education. The largest source of revenue was local (48 percent), followed by state (40 percent), and federal (12 percent). Total current expenditures per pupil were $9205 in the parish. The revenue per student in West Feliciana Parish ranked highest of the seven parishes/counties listed in the table. The state of Louisiana average expenditure per student was $8487 in 2004 - 2005. In 2004 - 2005, the expenditures per student in Mississippi were $6554; the U.S. figure was $8645.

There are 15 educational facilities within the EPZ. The students and workers at these facilities have been included in the transient and special population estimates discussed in Subsection 2.5.1.1.

2.5.2.7 Recreational Facilities and Aesthetics

This subsection describes recreational facilities within the 10-mi. EPZ of the RBS site. The focus on facilities near the site is justified because of the expectation that impacts during construction and operation would be limited to the possible slowing of traffic during shift changes when travelers are en route to recreational facilities. Refer to Subsection 2.2.3.4 for a discussion of additional facilities beyond the 10-mi. EPZ.

The primary recreation areas within the 10-mi. EPZ include Hemingbough (formerly Audubon Lakes), approximately 2 mi. northeast of the site; Cat Island National Wildlife Refuge, approximately 3 mi. north-northwest of the site; the Audubon State Commemorative Area, nearly 4 mi. northeast of the site; and the Locust Grove State Commemorative Area, approximately 5 mi. northeast of St. Francisville. The area also includes the West Feliciana Parish Sports Park, approximately 5 mi. north-northwest of the site; the Port Hudson State Commemorative Area, approximately 9 mi. southeast of the site; the Marydale Girl Scout Camp (which is in operation during June and July), located approximately 9 mi. northwest of the site, False River, approximately 7 mi. southwest of the site; and the Nature Conservancy's Mary Ann Brown Preserve, located approximately 7 mi. north of the site. Approximately 5 mi. northeast of the RBS site is The Bluffs Country Club and Resort, which features a year-round golf course and associated facilities.

A member of the West Feliciana Community Development Foundation indicated that the tourism in the parish is primarily historical tourism. In recent years, historical tourism has declined nationally, and a similar trend has been noted locally, especially after the hurricanes in 2005. There is some momentum in the parish to increase the focus on recreational tourism. Examples of this include biking events within the parish and pursuit of a unique concept in Tunica State Park, where plexi-glass viewing areas would be located in trees and connected by walking bridges for the purpose of allowing bird viewing in a unique, natural environment.

From U.S. Highway 61, the power block or cooling towers are not visible, because of the presence of a significant tree buffer around the site. From the highway entrance, only the Applicant's Training Center Building is visible, and it has the appearance of an office building. The guard office is located farther down the entrance road; this office controls admission into the central power station. From other nearby public roads, the tree buffer and changes in elevation also conceal the central RBS Unit 1 power plant facilities, with the primary exception of high voltage transmission lines that extend from the site. Thus, the site is already aesthetically altered by RBS Unit 1; however, the station has minimal visual impact on neighboring properties.

2.5.2.8 Local Land Use Planning and Zoning

The discussion of local land use planning and zoning within this subsection is limited to West Feliciana Parish because of the location of the RBS site and the expectation that there would be no land use and zoning issues created by the construction and operation of RBS Unit 3 beyond West Feliciana Parish.

West Feliciana Parish has a Planning and Zoning Commission that is composed of five volunteer parish residents, who are appointed by the Parish Police Jury for a 4-year term. The commission has the responsibility of developing and recommending the overall land use and development policy to the Parish Police Jury. The commission's activities consist primarily of developing land use plans and capacity studies, as well as the drafting of land use policies and zoning regulations. The Planning and Zoning Commission has no direct regulatory authority and does not review development proposals or issue permits. Final action on any plans, policies, and regulations developed by the commission is taken by the Parish Police Jury (Reference 2.5-22).

In the document *Land Use and Growth Management Plan: Strategies, Policies, and Guidelines for West Feliciana Parish* (the Plan), the long-term land use objectives are set forth. The document explains, "Growth can be good for West Feliciana Parish. Communities die when they do not grow, but *how* our parish grows will determine whether we build or destroy our rural, historic character." The document establishes the following long-term goals related to parish growth (Reference 2.5-23):

- Maintain the natural beauty and rural nature of the parish.
- Preserve agricultural, wildlife habitat, and forestry use or property.
- Maintain the historic character of the parish.
- Respect the small town character of St. Francisville.
- Discourage suburban sprawl and conserve land.
- Encourage development of land where infrastructure is already available.
- Expand recreational and educational opportunities for the residents.
- Maintain "Greenbelts" and the rural character of roads in the parish.
- Encourage tourism development, "eco-tourism" development, and economic development.
- Encourage housing areas for all income groups.
- Limits signs and visual clutter.

To achieve these goals, the Plan establishes a number of guidelines; among the most important are the promotion of compact development patterns and the preservation of open space. Supporting policies include "land development in areas that are already served by infrastructure and discouraging growth in areas where expensive, publicly financed infrastructure must be built" and to "encourage future growth near existing development in order to promote compact growth" (Reference 2.5-24).

Prime areas targeted for residential growth include the town of St. Francisville and smaller but emerging rural communities in the parish, including Tunica, Weyanoke, Rosemound, Laurel Hill, Wakefield, and The Bluffs. The commission has strongly indicated (regarding commercial development) that it wishes to encourage growth in the existing towns, and that it would "resist strongly the spread of commercial development along Highways 61 and 10 outside the town of St. Francisville and emerging rural centers" (Reference 2.5-25). The Plan also designates a Greenbelt Overlay District, which extends 75 ft. from the ROW on Highways 10, 61, 66, and 965 and 50 ft. from ROWs on all other roads in the parish. Within these bounds, only a minimal amount of trees can be removed. Heavy commercial and industrial development are "encouraged in industrial and commercial park settings, especially in Growth Zone 1 (St. Francisville Region), which includes the RBS area and the area planned for the West Feliciana Business Park Development" (Reference 2.5-25).

The Plan includes a number of land use maps, dated to 1996, which are labeled "Feliciana Vision 2005." The Land Use Plan identifies the area that includes the RBS and the proposed West Feliciana Business Park as "Industrial M-1 base zoning." The Overlay District map also designates this entire area as Industrial Park (Reference 2.5-26).

In the years since the Plan maps were finalized, development in the RBS vicinity has been consistent with the long-term vision. Currently, the immediate vicinity near the RBS includes the former Tembec Pulp and Paper Mill and the Big Cajun 1 and Big Cajun 2 power plants, across the Mississippi River. The proposed West Feliciana Business Park between the RBS site and East Feliciana would further the industrial nature of the area. Figure 2.5-12 illustrates the proposed boundary of the business park. RBS Unit 3 would be consistent with the current and planned land use in the nearby area.

Currently, a comprehensive plan and land use study is being prepared for the parish by Fregonese Associates; the new plan will be completed at the end of 2008. Primary issues to be addressed include the need for affordable housing, the retention of young adults, and the balance of growth and the preservation of the parish's rural character.

The following subsection describes water, police, firefighting, and hospitals in the primary impact area, with an emphasis on West Feliciana Parish, where the largest impacts from RBS Unit 3 would occur.

2.5.2.9 Public Services and Facilities

2.5.2.9.1 Water

Table 2.5-43 lists the major water and sewer providers for the primary impact area parishes. Water District 13 provides potable water to the West Feliciana Parish population. The district is presently at 25 percent of its water supply capacity on an annual basis, and only operates at 35 percent of its capacity during the peak summer months. Table 2.5-44 lists the capacity and operational averages for the water services provided by Water District 13. Water District 13 has not historically supplied the RBS site with water. However, the district has begun providing potable water to this site. This supply would have a minor impact on the district's current capacity utilization. Even with this supply, RBS Unit 3 would provide the majority of its own water needs.

Residents in the parish utilize septic systems to process sewer wastes. The RBS site also provides for its own sanitary waste and processing needs.

2.5.2.9.2 Police Protection

Table 2.5-45 provides information for the primary impact area sheriffs' departments. In the area as a whole, there are 1249 regular deputy sheriffs, 152 part-time deputy sheriffs, and 127 reserve deputy sheriffs. The largest sheriff's department is East Baton Rouge, with 852 regular deputy sheriffs.

The West Feliciana Parish Sheriff's Office handles the present law enforcement duties within West Feliciana Parish. Specialized units include the Criminal Division, the Narcotics Unit, a K-9 Unit, Special Crisis Response Unit, a D.A.R.E. Program, Traffic Enforcement unit, and an Administrative Division. The Sheriff's Office also uses the RBS on-site heliport and hangar approximately once a week. The Sheriff's Office is involved in a number of crime prevention and information efforts, including Neighborhood Watch, Crime Solvers, its Electronic Watch program, the School Resource Officer program, and its Triad Program for senior citizens. The Sheriff's Website lists 31 department employees. The West Feliciana Parish Sheriff's Office is one of 63 members in the Louisiana Sheriffs' Association Task Force. Additional law enforcement resources from this task force and from the Louisiana State Highway Patrol are able to assist when needed. In the near future, the West Feliciana Parish Sheriff Department plans to hire an additional police officer per shift to accommodate the proposed expansion of U.S. Highway 61, the Audubon Bridge and Highway 10 projects, and general parish growth.

The town of St. Francisville has its own police department, consisting of eight full-time and nine reserve officers (Reference 2.5-27). The Applicant maintains its own security force to handle the security within the RBS property boundaries and coordinates with the Parish Sheriff's Office if additional resources are needed. The Louisiana National Guard could also be sent to the site by the Governor if the national threat level is elevated.

2.5.2.9.3 Fire Protection

Table 2.5-46 lists the fire departments for the primary impact area parishes, the populations these departments serve, and the number of firefighters, classified according to whether they are paid or volunteer. In all, there were 37 fire departments and 1714 total firefighters in 2007; the largest department is Baton Rouge, which has 575 firefighters protecting a population of 228,201 people.

Firefighting capabilities for West Feliciana Parish are maintained by the West Feliciana Parish Fire District No. 1, the Angola Volunteer Fire Department, and the St. Francisville Volunteer Fire Department. The West Feliciana Parish Fire District No. 1 total volunteer firefighting force of 50 serves the unincorporated portions of the parish. The Angola Volunteer Fire Department's 74 volunteers protect the area around the city of Angola. The St. Francisville Fire Department serves the area within St. Francisville city limits and is maintained by one full-time firefighter and 19 volunteers (Reference 2.5-27). The RBS maintains an emergency response team on-site at all times, ready to implement a fire response plan should a fire occur within the plant buildings and structures. A trained fire brigade consisting of at least five members is available at all times to respond to fires that may affect structures, systems, and components that are safety-related. The St. Francisville Volunteer Fire Department and West Feliciana Fire District No. 1 have agreed to provide firefighting support to the RBS, if needed. Other emergency planning responsibilities are assigned to a number of departments and agencies. Federal, state, and local officials would implement appropriate protective actions in case of an emergency at the site. RBS personnel have a cooperative relationship with local law enforcement personnel, as evidenced by the shared use of the firing range and the historical use of the heliport on the RBS site.

The West Baton Rouge Parish Office of Emergency Preparedness works closely with RBS personnel because the north end of the parish is within the 10-mi. EPZ. There are two exercises conducted each year with the five parishes within the EPZ (Pointe Coupee, East and West Feliciana, East Baton Rouge, and West Baton Rouge). One of these exercises is graded by the federal government. In the event of an actual emergency, efforts would also be coordinated with Mississippi State Emergency Preparedness, the Louisiana Office of Emergency Preparedness, the Louisiana Radiation Protection Division, the NRC, and the Federal Emergency Management Agency (Reference 2.5-28).

2.5.2.9.4 Hospitals

The primary impact area is served by 17 primary medical facilities. Table 2.5-47 provides the number of beds and patient statistics regarding length of stay for the major medical facilities in the area. The majority of facilities are located in the Baton Rouge area, which can be reached with an approximate 30-minute drive from the RBS site.

The hospital nearest the RBS site is West Feliciana Parish Hospital, located approximately 1/4 mi. off U.S. Highway 61 at 5266 South Commerce Street in St. Francisville. The West Feliciana Parish Hospital has 22 licensed beds, and includes a fully equipped emergency department, radiology department, full-service laboratory, endoscopy, and physical and respiratory therapy units. In 2006, West Feliciana Hospital had a total of 687 patient days and 215 hospital discharges. The average length of stay was 4.1 days, and the average daily census was 1.9.

West Feliciana Parish Hospital is accredited by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO). The hospital has three full-time physicians and 5.25 FTE registered nurses. The emergency room is staffed 24 hours a day, 7 days a week through the Schumacher Group, which is under contract with the hospital. The physicians manning the emergency room are approved by the local physicians and the hospital's Board of Commissioners (Reference 2.5-29).

West Feliciana Parish Hospital also has a fully-staffed emergency medical services (EMS) unit that covers 410 sq. mi. with its four advanced life support ambulance units. Two units are staffed 24 hours a day, 7 days a week. The units are equipped with laptop computers and are also available for nonemergency transport services. The EMS unit also provides first aid and CPR training for the parish. Additional information about West Feliciana Parish Hospital is provided in Table 2.5-47. Table 2.5-48 lists the vital statistics for the major medical centers within the primary impact area. Reported statistics include Medicare and Medicaid participation, accreditations, and staff information. Combined with West Feliciana, these hospitals have 2038 beds that serve the regional community. The nearest hospital with a burn unit is Baton Rouge General Hospital, approximately 30 mi. from the RBS.

2.5.2.10 Highway and Transportation System

Transportation in the region includes a well-developed highway network, rail transportation, airports, and barge transportation on the Mississippi River. The primary highway network and major industries in the area are shown in Figure 2.5-15 (refer also to Figures 2.2-4 and 2.2-5 for a regional perspective) and include U.S. Highway 61, which generally runs north to south, connecting Mississippi with St. Francisville and Baton Rouge. Other major routes in the region include U.S. Highway 10, which runs through Baton Rouge, and U.S. Highway 190, which extends from Baton Rouge to just south of New Roads.

U.S. Highway 61 is adjacent to the RBS, north and northeast of the property boundary. The highway has paved shoulders, and there is a stop light at the North Access Road. The speed limit is 55 mph near the RBS, and the area at the plant entrance is a no passing zone, marked by double yellow lines. The condition of the highway in this area is good, and there are no impediments related to roadway conditions that would prevent travel at the designated speed. U.S. Highway 61 is in the process of being expanded to four lanes in the vicinity of the RBS, and much of the land has been cleared for this expansion in the vicinity of the RBS.

At this time, a level of service (LOS) analysis was available; however, according to the LDOTD, the most recent traffic counts taken near the RBS on U.S. Highway 61 included a count taken just south of State Route 10, which had a 24-hour, two direction count of 9846 in 2004. The other count was taken between Louisiana Highway 964 and Louisiana Highway 954, which had a 24-hour, two direction count of 11,172 in 2006. The other nearby count was for LA 965 just south of U.S. Highway 61, which had an estimated annual average traffic count of 459 vehicles in 2004 (Reference 2.5-30).

The *Highway Capacity Manual (HCM)* issued by the Transportation Research Board is widely used to estimate highway capacity and was used to compare traffic levels on U.S. Highway 61 with the estimated capacity of the highway. While the capacity level of a two-lane rural highway is difficult to estimate because it depends on multiple factors, such as directional flow, vehicle mix, lighting conditions, physical dimensions of the highway, the weather, the posted speed limit, and other factors, a reasonable maximum capacity of 2800 passenger car equivalents per hour can be assumed under ideal conditions (Reference 2.5-31). If this figure is reduced to 2000 equivalents per hour to account for the fact that ideal conditions are seldom present on any road, this would imply a maximum daily volume of approximately 48,000 for U.S. Highway 61, meaning that on a 24-hour basis, there remains ample excess capacity. While such a measure can be misleading, because it does not capture short-term problems that could be present during peak traffic flow periods, the expansion of the highway to four lanes would significantly improve any short-term traffic flow issues that may currently be present. The *HCM*, for example, estimates that the capacity of a multi-lane highway is 2000 passenger car equivalents per hour, per lane (Reference 2.5-31).

There are two major transportation projects under way that would facilitate traffic flow around the RBS. First, as part of the Transportation Infrastructure Model for Economic Development (TIMED) Program, 20 mi. of U.S. Highway 61, from the Mississippi border to Baton Rouge in the south, are being widened from two to four lanes (Reference 2.5-32). This construction is under way and will continue through mid-2010. At the existing RBS entrance, the highway will be widened to four lanes, and a four-lane traffic light will be installed. Second, as part of the TIMED

Program, a new bridge is being constructed across the Mississippi River. This structure, the John James Audubon Bridge, will become the longest cable-stayed bridge in North America. It will be constructed approximately 1 mi. downstream of the RBS and is expected, by the DODT, to have an average daily traffic crossing of 6500 vehicles per day in 2020 (Reference 2.5-33).

In addition to the bridge, approximately 12 mi. of an extension of State Highway 10 will be constructed to connect the bridge with U.S. Highway 61 on the east side of the river and State Highway 1 near New Roads to the west. As shown in Figure 2.5-12, the extension would generally run along the western side of the planned West Feliciana Business Park, and the highway ROW would touch, but not cross, a very small portion of the RBS site near the easternmost boundary. The State Highway 10 extension and bridge would consist of two lanes in each direction with 8-ft. outside and 2-ft. inside shoulders. Construction is expected to be substantially complete by the summer of 2010 (Reference 2.5-34). According to discussions with personnel at the LDOTD in Baton Rouge, the design for the State Highway 10 and U.S. Highway 61 interchange has not yet been adopted, and will depend on the award of the contract in 2008. When complete, the bridge would result in increased traffic along U.S. Highway 61. The LDOTD's supplemental traffic study of the bridge projects that the average daily traffic count just north of the planned intersection of State Highway 10 with U.S. Highway 61 would be 22,520 with the bridge, compared to 17,970 without the bridge. Just south of this same intersection, the average daily traffic count in year 2020 is projected by the LDOTD to be 19,920 with the bridge, compared to 17,970 without the bridge (Reference 2.5-35).

Primary access to the RBS is from U.S. Highway 61 and the North Access Road. A plant security checkpoint lies within this entrance. The site can also be accessed via State Highway 965, which runs from U.S. Highway 61 west of the site, south and below the site where it meets the North Access Road. State Highway 965 ends at the intersection of the River Access Road and West Feliciana Parish 7 (WFP7) also signed as Powell Station Road, south of the RBS Unit 1 power block. WFP7 begins at the intersection of State Highway 965, exits the RBS property on the southeast, then turns north and completes the loop around the RBS, intersecting with U.S. Highway 61 east of the site. North Access Road and River Access Road were constructed when RBS Unit 1 was built. According to the 24-hour, two-direction vehicle counts taken in 2004, State Highway 965 just north of U.S. Highway 61 has a traffic count of 1941 cars per day. South of U.S. Highway 61 by the RBS, State Highway 965 has only 459 cars per day. State Highway 965 and WFP7 are considered to be in good physical condition so that posted speed limits are not impaired by roadway conditions. Both rural highways are well within their maximum vehicle-carrying capacity.

River Access Road begins at the intersection of State Highway 965 and WFP7 and heads south to the Mississippi River. River Access Road was built during RBS Unit 1 construction to haul barged equipment to the construction site. The North Access Road is the main entrance to RBS, and intersects with U.S. Highway 61 approximately a mile north of the power block. The final road currently crossing the plant site is River Road, an unpaved parish road that runs parallel to and lies near the Mississippi River bank near the edge of the RBS property.

The region contains a number of airports; the largest is the Baton Rouge Metropolitan Airport, which has a history dating to 1941 and, while an agency of the city-parish government, receives no money from the general funds. The airport currently has scheduled flights from five major airlines and has car rental and other services available for passengers. The airport is located

5 mi. north of downtown Baton Rouge, and occupies approximately 1800 ac. of land, which is sufficient for two primary runways with lengths of approximately 7000 ft. and 7500 ft. There are also shorter runways and taxiways. In addition to passenger service, the airport facilitates a significant amount of air cargo, especially following Hurricane Katrina and the leasing of air cargo facilities at the airport (References 2.5-36 and 2.5-37). In addition to the Baton Rouge Metropolitan Airport, there are several smaller airports in the region, including the False River Regional Airport, located in New Roads.

There is a significant amount of barge traffic on the Mississippi River near the project site, most of which is in transit to or from the ports in New Orleans or Baton Rouge. The ocean port in New Orleans has 108 mi. of deepwater frontage on both sides of the Mississippi River and more than 50 piers and docks. Vessels drafting 45 ft. to 47 ft. can be accommodated at the port; rarely is river commerce halted because of river depth or weather conditions. The port transfers cargo to and from ships and barges arriving in the LMR. The inland barge system, consisting of 19,262 mi. of waterway, moves more than 250 million tons of cargo annually upriver to major U.S. markets in the Midwest and Northeast (Reference 2.5-38).

Another important regional shipping port is the Port of Greater Baton Rouge. The port handles a diverse range of cargo and provides access to all types of intermodal transportation including ship, barge, truck, and rail. The port's location provides access to the Gulf of Mexico and beyond, as well as the nation's heartland via some 15,000 mi. of inland water transportation. The port is located adjacent to U.S. Interstate 10 and is in proximity to U.S. Interstates 12, 49, 55, and 59; U.S. Highways 61, 65, and 90, and State Highway 1.

During the construction of RBS Unit 1, the delivery of equipment and supplies was achieved, in part, using a barge slip created in an inlet off the Mississippi River. This slip can be accessed using the River Access Road, which is owned by the Applicant and lies on RBS property.

Primary railway lines in the state connect New Orleans with other locations within Louisiana and beyond. In 2005, approximately 38 million tons of rail freight originated in Louisiana, and approximately 31 million tons of rail freight terminated in the state, much of this in New Orleans. There is a 1.2-mi. abandoned rail line spur that traverses the RBS site; it was purchased by Entergy from the Illinois Central Gulf Railroad. There are no plans to reinstall the abandoned railway on the RBS site (Reference 2.5-39).

2.5.2.11 Distinctive Characteristics

The region surrounding the RBS site is well-known for its historic churches, plantation homes, Civil War history, and its association with the Mississippi River;Table 2.5-49 lists a number of these sites. In addition, there are a number of bed and breakfast locations in or around St. Francisville that cater to tourists interested in seeing local places of interest.

Part of the historical distinctiveness of the area is attributed to John James Audubon (1785 - 1851). Audubon became a world-renowned artist, famous for his numerous paintings of American birds. Approximately 80 of his paintings were created when he spent an extended amount of time in the region between 1821 and 1830. As a tribute to John James Audubon, the new bridge being constructed over the Mississippi River (connecting West Feliciana with New Roads) has been named in his honor (References 2.5-40 and 2.5-41).

Since 1972, the West Feliciana Historical Society has sponsored its Audubon Pilgrimage, through which visitors are provided tours of area historic private homes, gardens, and churches and are able to participate in a number of time period activities. The community also hosts the Audubon Country BirdFest, through which bird enthusiasts can observe the variety of migratory and resident birds in the area. Other festivals and events include the Christmas in the Country Festival, the Day the War Stopped, the Feliciana Hummingbird Celebration, and the Southern Garden Symposium. West Feliciana also offers golfing, hiking trails, and scenic cycling opportunities (Reference 2.5-42).

West Feliciana and the surrounding area have successfully integrated the development and preservation of the area's distinctive recreational and historical characteristics. Subsection 2.2.1 discusses the recreational areas within the EPZ, which include Hemingbough (formerly Audubon Lakes), approximately 2 mi. northeast of the site, Cat Island National Wildlife Refuge, approximately 3 mi. west-northwest of the site, the Audubon State Commemorative Area, approximately 3 mi. northeast of the site, the Locust Grove State Commemorative Area, approximately 5 mi. northeast of St. Francisville, the Port Hudson State Commemorative Area approximately 9 mi. southeast of the site, the Marydale Girl Scout Camp (operated during June and July) located approximately 9 mi. northwest of the site, False River located approximately 7 mi. southwest of the site, and the Nature Conservancy's Mary Ann Brown Preserve located approximately 8 mi. north of the site. The Clark Creek Nature Area is located 25 minutes north of St. Francisville in Mississippi and offers hiking bird watching, and other activities on 700 ac. that include some 20 waterfalls (Reference 2.5-42). The Bluffs Country Club and Resort is located 5 mi. to the northeast of the RBS and offers golfing and other related activities.

Baton Rouge is the largest city in the primary impact area; it has a long history that predates Colonization, was influenced by the Civil War, and became an important part of the development of commerce on the Mississippi River. Today Baton Rouge is a "major industrial, petrochemical, and port center of the American South and is the tenth largest in the United States in terms of weight."

Since the late 17th century, the Baton Rouge region has been ruled by three different European countries. It was first ruled by the French from 1699 - 1793, followed by the British (1763 - 1779), and finally the Spanish (1779 - 1810). In 1810, the Spanish were overthrown, and the new Republic of West Florida was created, only to exist for 74 days before President James Madison ordered troops to seize the republic and incorporated it into the Territory of Orleans. In 1812, Louisiana was admitted as a state, and Baton Rouge became a strategic military outpost to the west. During this period, Baton Rouge remained a relatively small city, with an 1840 population of about 2000, while the population of New Orleans was approximately 100,000.

At the outbreak of the Civil War, Louisiana seceded from the Union, and Baton Rouge raised volunteer armies to aid the Confederate cause. In 1862, Union troops took control of Baton Rouge, and it remained under Union control for the remainder of the war.

Lastly, near the fringe of the 50-mi. RBS region, the Tunica-Biloxi Tribe of Louisiana has a reservation near Marksville, Louisiana, which is two-thirds of the way between St. Francisville and Alexandria, Louisiana. The tribe has a long history and was encountered by the explorer De Soto in his 16th century explorations. The tribe achieved federal recognition in 1981 and has since built a museum that serves as a shrine to tribal ancestors and displays the recovered

Tunica Treasure, a collection of items buried with the Tunica ancestors. There is also a large gambling casino on the reservation (Reference 2.5-43).

2.5.3 HISTORIC PROPERTIES

This subsection provides an overview of the cultural resources investigations conducted in preparation for the proposed RBS expansion project (i.e., RBS Unit 3); for a more detailed report of this investigation, refer to *Phase I Cultural Resources Survey of the Proposed 2007 RBS Nuclear Station Expansion Project, West Feliciana Parish, Louisiana,* submitted to the Louisiana Division of Archaeology. The fieldwork was conducted in two field mobilizations during September and October of 2007. The first mobilization consisted of an intensive pedestrian survey augmented by systematic shovel testing of the RBS expansion footprint; the second field mobilization entailed a Phase I archaeological investigation of an associated proposed transmission line corridor. A substantial amount of the RBS property was disturbed during the construction of the original station unit (i.e., RBS Unit 1), which was built in the early 1980s. Because much of the area disturbed during Unit 1 construction coincides with the Unit 3 expansion footprint, consultation with the Louisiana Division of Archaeology (State Historic Preservation Office [SHPO]) was initiated to determine the necessity of surveying previously affected areas (refer to Appendix 2A). The SHPO concluded that additional surveying in these previously disturbed areas was not necessary; as a result, this investigation intensively examined only 312 ac. (126.3 ha) of the proposed 364-ac. (147-ha) project footprint.

This undertaking incorporated both in-depth historical research, which focused on the proposed project area and its surroundings, as well as a Phase I cultural resources survey and archaeological inventory of the approximately 312-ac. (126.3-ha) project area. The area of potential effect (APE) for construction includes eight separate areas (Figure 2.5-16), a single access road location, and a proposed on-site transmission line corridor. An additional APE for visual effects was also considered as a part of this project. Consultation with the Louisiana SHPO and the National Park Service (NPS) regarding the visual effects to historic properties of the RBS Unit 3 is ongoing.

This Phase I cultural resources investigation was designed to identify and evaluate all cultural resources (archaeological sites, isolated finds, standing structures, cemeteries, and traditional cultural properties) situated within or immediately adjacent to the APE. All work was performed in accordance with the procedures outlined in the National Historic Preservation Act of 1966, as amended; the Archaeological Resources Protection Act of 1979, as amended; the Advisory Council on Historic Preservation's handbook entitled *Treatment of Archaeological Properties*; and with *Louisiana's Comprehensive Archaeological Plan* (Reference 2.5-44).

The current project area is located on acreage that has supported various human occupations throughout both the prehistoric and historic periods. The prehistory of this part of Louisiana has been documented from circa (ca.) 12,000 to 300 B.P. (before present), a period that has been divided into four general archaeological stages. These four stages (Paleo-Indian [12,000 to 8000 B.P.], Archaic [8000 to 3000 B.P.], Woodland [3000 to 900 B.P.], and Mississippian [800 to 300 B.P.]) represent developmental segments characterized by dominant patterns of subsistence and technology.

Of the 14 prehistoric period archaeological sites identified within 1 mi. (1.6 km) of the RBS Unit 3 footprint, the majority (n = 10) dated from the Woodland Stage. The Woodland Stage in Louisiana is characterized by a combination of itinerant and possibly sedentary agriculture, the introduction of the bow and arrow, and the widespread use of ceramics. The Woodland Stage includes the Early, Middle, and Late Periods. The Early Woodland (ca. 2500 to 2000 B.P.) is represented by the Tchefuncte culture; the Middle Woodland (ca. 2000 to 1600 B.P.) is associated with the Marksville culture; and the Late Woodland (ca. 1600 to 800 B.P.) originated with the transitional Troyville culture but is dominated by Coles Creek culture.

Historically, the RBS property has been used for agriculture, primarily for growing cotton and sugar cane. The first confirmed landholders in the project area claimed land tracts along or just east of the Mississippi River between 1794 and 1810, a time period when the district that would become West Feliciana Parish was experiencing complicated political transitions associated with its position within colonial Spanish West Florida (1783 - 1810), the Independent State of West Florida (1810), and the Territory of Orleans (1810 - 1812). Magnolia Plantation appears to have been the primary property occupying the project acreage; however, the only substantial structural remains that exist today are those of its sugar house (i.e., Site 16WF36; refer to Subsection 2.5.3.4). Although no major Civil War battles or skirmishes occurred within the immediate vicinity of the current project area, the district figured prominently in scouting and foraging activities because of its proximity to Port Hudson, which fell to Union forces on July 9, 1863, following a siege of nearly 2 months - the longest siege on American soil in U.S. military history. In recent years, the cultivated fields of the current project area have been replaced by a nuclear energy production facility that is surrounded by timbered overgrowth.

2.5.3.1 Qualification of Surveyors

Mr. William P. Athens, M.A., R.P.A., and Mr. James Eberwine, M.S., R.P.A., served as co-principal investigators, and with Mr. Sean Coughlin, M.A., R.P.A., they supervised all aspects of this project. Each individual meets or exceeds the Secretary of the Interior's Standards and Guidelines for conducting archaeological surveys. In addition, they have conducted or supervised numerous Phase I cultural resources surveys throughout the southeastern United States.

2.5.3.2 Survey Methodology

The current investigation was designed to identify and to evaluate all cultural resources, i.e., archaeological sites, cultural resources loci, cemeteries, and traditional cultural properties, situated within and immediately adjacent to the APE that may be adversely affected by the proposed undertaking. Fieldwork for the project was comprehensive in nature and followed all requirements of *Louisiana's Comprehensive Archaeological Plan* (Reference 2.5-44). It included cartographic, archival, and archaeological review of data pertaining to the cultural resources that had been recorded previously within, or immediately adjacent to, the proposed project area. Subsequent to this research, pedestrian survey and systematic subsurface testing was undertaken to identify any unrecorded cultural resources that might lie within the limits of the proposed project area. Typically, this investigation also would have included procedures designed to evaluate, on a preliminary level, all standing structures 50 years in age or older located within, or immediately adjacent to, the proposed project area. However, no such structures were located.

Before the initiation of fieldwork, aerial photographs were provided by the Applicant that illustrated the amount of land disturbance that occurred during the original construction of the RBS in the early 1980s (refer to Appendix 2A). By overlaying the currently proposed RBS expansion footprint on top of these aerial photographs, it appears that significant portions of the current footprint were disturbed during the original construction. During consultation with the Louisiana Division of Archaeology, it was decided that a survey was not required in those areas that had been affected by prior construction. All correspondence relating to this consultation is contained in Appendix 2A. As a result of this decision, only 312 ac. (126.3 ha) of the proposed 364-ac. (147-ha) parcel were investigated for cultural resources.

Pedestrian Survey and Shovel Testing

Following the completion of this consultation, a Phase I cultural resources survey and archaeological inventory was completed throughout the remainder of the proposed project area. The purpose of this investigation was to identify those cultural resources located within, or immediately adjacent to, the remainder of the proposed RBS expansion footprint and to assess the eligibility of any newly recorded cultural resources by applying the National Register of Historic Places (NRHP) Criteria for Evaluation (36 CFR 60.4 [a-d]) (Reference 2.5-45). Where possible, fieldwork for this investigation consisted of an intensive pedestrian survey augmented by systematic shovel testing within the APE. The pedestrian survey within the APE included the visual inspection of the exposed ground surface along survey transects positioned approximately 98.4 or 164.0 ft. (30 or 50 m) apart. Ground surface visibility throughout the area was low to moderate, depending on the level of ground surface disturbance noted. Shovel tests were excavated at 98.4 or 164.0 ft. (30 or 50 m) intervals, depending on the perceived probability of the area to contain cultural materials. Based on the presence of a treefall, prior disturbance, or standing water, shovel tests often were offset as much as 49.2 ft. (15 m) to provide adequate coverage throughout the project parcel.

All shovel tests were excavated in 3.9 in. (10 cm) arbitrary levels within natural strata, and each shovel test measured 11.8 in. (30 cm) in width. Every shovel test was excavated to a minimum depth of 19.7 inbs (inches below surface) (50 cmbs [cm below surface]) or until impenetrable soils hindered the archaeological excavation process. All excavated levels then were screened separately through 0.25 in. (0.64 cm) hardware cloth. Munsell Soil Color Charts were used to record soil color; soil texture and other identifiable characteristics also were recorded using standard soils nomenclature. Finally, each shovel test was backfilled immediately upon completion of the archaeological recordation process.

Site Delineation

The cultural resources identified during the survey were examined to ascertain the nature, size, depth, integrity, age, and affiliation of the cultural deposits through additional site delineation shovel testing. The additional shovel tests also were used to assess the stratigraphic placement, density, and research potential of the identified site. These data were gathered to assist in the determination of whether the site was considered not significant, potentially significant, or significant according to the NRHP Criteria for Evaluation (36 CFR 60.4 [a-d]). Archaeological recordation included a combination of the following: (1) establishment of a site datum; (2) intensive surface reconnaissance of the site area; (3) excavation of tightly spaced shovel tests (49.2 ft. [15 m] apart) along rays emanating from datum in each of the cardinal directions to delineate both site size and configuration; and (4) mapping and photographing of the site. Both color print and color digital photographs of the site area were taken.

Architectural Recordation Procedures

Survey crews were instructed to record all historic standing structures identified during the cultural resources survey and archaeological inventory of the APE. This architectural investigation followed guidelines established in *National Register Bulletin 24: Guidelines for Local Surveys: A Basis for Preservation Planning* (National Park Service 1995). No historic standing structures were encountered within or immediately adjacent to the APE.

2.5.3.3 Consultation

Consultation with the Louisiana SHPO was initiated prior to the beginning of the fieldwork portion of this project, and this consultation continues; all correspondence is contained in Appendix 2A. Additionally, consultation has been initiated with the NPS regarding any viewshed concerns. A draft report of the results of the 2007 survey of the RBS expansion project was submitted to the SHPO's office in January of 2008. Commentary on this report was received on February 20, 2008 (Appendix 2A).

Additional consultation was initiated with potentially interested Native American tribes as a part of the fieldwork portion of this project; all correspondence with these Native American groups is contained in Appendix 2B. No commentary from the interested tribes has been received.

2.5.3.4 Results of the Field Investigations

As part of the current Phase I cultural resources survey of the proposed APE, the footprint of the RBS expansion was divided into areas that had been disturbed during the construction of the facility in the early 1980s and those areas that were characterized as "undisturbed." Only those portions of the RBS property that were not affected during the construction of the initial facility were surveyed as part of the current investigation. This methodology led to the examination of 10 individual project items: seven area surveys (i.e., Areas 1 through 7), a spoil location (Area 8), a proposed transmission line corridor, and an access road.

A total of five cultural resources were identified as a result of this investigation, i.e., non-site cultural resources Locus Tran-Line 1-01, and archaeological Sites 16WF36, 16WF180, 16WF181, and 16WF182. These resources are discussed in more detail below.

Locus Tran-Line 1-01

Locus Tran-Line 1-01 was situated at an elevation of 88.6 ft. (27 m) National Geodetic Vertical Datum (NGVD) within a mixed environment of hardwood trees, secondary growth vegetation, and coniferous trees. This locus measured approximately 23.8 ft. (10 m) in diameter, was circular in shape, and was characterized by the field investigations as a low-density surface scatter of historic period artifacts. This locus was positioned on a small hilltop, approximately 984.3 ft. (300 m) northeast of Alligator Bayou.

Materials recovered from Locus Tran-Line 1-01 were limited to a complete manganese solarized glass bottle (ca. 1890 to 1920), a complete dark green colored, turn-paste molded glass bottle (ca. 1892 to 1915), and two brick fragments that were discarded in the field. The excavation of 10 shovel tests and seven delineation shovel tests failed to produce any additional cultural material. The absence of associated subsurface cultural deposits, as well as the minimal artifact assemblage, demonstrates that Locus Tran-Line 1-01 lacks research potential. Locus Tran-Line 1-01 does not possess the qualities of significance as defined by the NRHP Criteria of Evaluation (36 CFR 60.4 [a-d]). The Louisiana SHPO concurred with this finding in a letter dated February 19, 2008 (refer to Appendix 2A).

Site 16WF36

First recorded by Smith in 1982, Site 16WF36 represents the remains of a sugar mill, which is located at the northern end of the site area. An additional brick scatter was identified near the southern boundary of the site. Located within a forest of hardwood and deciduous trees, the site is situated at an approximate elevation of 110 ft. (33.5 m) NGVD, i.e., located within an upland plain setting. Ground surface visibility throughout the area was low. The sugar mill ruin is the remnants of the sugar mill associated with Magnolia Plantation and measures approximately 32.8 by 32.8 ft. (10 by 10 m) in size. Only a portion of the mill structure has survived, with no signs of equipment readily visible. The ruins currently are in an active state of deterioration.

The excavation of 204 shovel tests throughout the site area led to the recovery of eight non-brick artifacts. These artifacts included a single blue shell-edge pearlware sherd (i.e., a ceramic fragment; ca. 1780 to 1820), a single underglaze hand-painted whiteware sherd (ca. 1820 to 1890), a single plain white ironstone sherd (ca. 1842 to 1930), a single amber glass shard (i.e., a glass fragment), and a single hand-wrought screw/bolt from Stratum I; a single plain whiteware sherd (ca. 1820 to present) from Stratum II; and a single plain pearlware sherd (ca. 1780 to 1840) and a single plain whiteware sherd (ca. 1820 to present) from Stratum III. In addition, in the vicinity of the standing ruins, not only was brick and mortar debris identified on the surface and in a number of shovel tests, additional shovel tests produced evidence of mortar flooring and the presence of intact brick walls. Brick debris, although not as numerous, also was observed on the surface around the heavy concentration of brick located at the southern end of the site. It is likely that this southern concentration represents the remains of a former structure, although its relationship to the former sugar mill is unclear at this time. On top of the identified construction debris, a number of topographic features were identified at the site area that may pertain to the sugar mill operation: a series of parallel depressions located to the east of the standing ruin; what appeared to be the remains of a road; a number of round depressions; and a man-made pond situated to the southeast of the ruin. This pond may likely represent a water source for the operation of the associated steam machinery.

Although shovel testing throughout Site 16WF36 failed to produce a sizable number of artifacts, the identification of intact mortar floors and brick walls indicate that Site 16WF36 possesses research potential. Site 16WF36 possesses the qualities of significance as defined by the NRHP Criteria for Evaluation (36 CFR 60.4 [a-d]). Specifically, the site is eligible under Criterion D, because further investigations into this industrial complex may greatly improve knowledge of industrial sugar production during the Antebellum Louisiana 1803 to 1860 period described in *Louisiana's Comprehensive Archaeological Plan* (Reference 2.5-44). The Louisiana SHPO concurred with this finding in a letter dated February 19, 2008 (refer to Appendix 2A).

<u>Site 16WF180</u>

Located approximately 4921.3 ft. (1500 m) southwest of a tributary of Alligator Bayou, this historic period site contains the remains of a ruined brick chimney and a set of concrete stairs; no other structural remains were encountered. The excavation of 11 shovel tests within the vicinity of the site area failed to produce any subsurface cultural material or evidence of intact cultural deposits. The site was located within an upland setting, and plants observed throughout the area included both hardwoods and secondary growth vegetation. Situated at an elevation of approximately 125 ft. (38.1 m) NGVD, the site likely has been affected by the construction of Louisiana Highway 965; surface visibility throughout the area was poor.

Site 16WF180 likely represents the remains of an historic structure that at one time fronted Louisiana Highway 965 and is shown on the U.S. Geological Survey (USGS) Elm Park Quadrangle dating from 1965. The likely removal of the main structure and the absence of any associated artifacts demonstrate that Site 16WF180 exhibits little, if any, research potential. The site does not possess the qualities of significance as defined by the NRHP Criteria for Evaluation (36 CFR 60.4 [a-d]). The Louisiana SHPO concurred with this finding in a letter dated February 19, 2008 (refer to Appendix 2A).

<u>Site 16WF181</u>

Site 16WF181 was characterized as a medium-density surface and subsurface scatter of historic period artifacts. Situated on a hilltop at an approximate elevation of 101.7 ft. (31 m) above mean sea level (amsl), the irregularly shaped site measured approximately 98.4 ft. (30 m) along its north-south axis and 590.6 ft. (180 m) along its east-west axis. Identified within a primarily hardwood forest, the site is located approximately 1509.2 ft. (460 m) east of an unnamed creek. A total of 99 shovel tests were excavated in the vicinity of Site 16WF181, and 17 produced cultural material. This material included a single whiteware sherd recovered from the surface; 8 ceramic sherds, 3 glass shards, and 2 metal artifacts that originated from Stratum I; and 19 ceramic sherds, 12 metal artifacts, 6 glass shards, 4 brick fragments, and a single unidentified vertebrate element collected from Stratum II. Temporally diagnostic artifacts recovered from the site included various types of decorated pearlware sherds (ca. 1780 to 1840), decorated whiteware sherds (ca. 1820 to present), and cut and square nails (common to ca. 1890).

Site 16WF181 likely represents the remains of an early-to-middle nineteenth century domestic dwelling. The high percentage of artifacts recovered from the potentially intact soil horizons (i.e., Stratum II, 75 percent) suggests that intact cultural deposits are still present at Site 16WF181. The presence of potentially intact cultural deposits coupled with the tight temporal distribution of the recovered artifacts suggests that Site 16WF181 may possess research potential, particularly with regard to small, non-plantation settlements within the Antebellum Louisiana 1803 to 1860 cultural unit identified in *Louisiana's Comprehensive Archaeological Plan* (Reference 2.5-44). These data support the conclusion that 16WF181 may contain subsurface cultural deposits that may possess the qualities of significance defined by the NRHP Criteria for Evaluation (36 CFR 60.4 [a-d]). The Louisiana SHPO concurred with this finding in a letter dated February 19, 2008 (refer to Appendix 2A).

Site 16WF182

Located south of Locus Tran-Line 1-01, Site 16WF182 is situated along a small finger ridge 2641.1 ft. (805 m) east of Alligator Bayou. This low-density subsurface scatter of historic artifacts and a single prehistoric ceramic sherd was identified at an approximate elevation of 116.5 ft. (35.5 m) amsl and in an area covered with hardwood trees. The locus measured approximately 98.4 ft. (30 m) in diameter, and ground visibility throughout the site area was poor.

The excavation of 33 shovel tests within the vicinity of Site 16WF182 led to the recovery of a single, nondiagnostic, prehistoric Baytown plain ceramic sherd, a single milk glass shard (ca. 1869 to 1945), a single shard of clear glass, a single white ironstone sherd (ca. 1842 to 1930), and a single wire nail (common after 1890). In addition, brick artifacts were observed across the surface of the site, but they were not collected. Finally, a pile of scrap metal and what appeared to be a pump or well head were also identified within the site area.

Site 16WF182 likely represents the remains of a former domestic occupation that dated from the late nineteenth to early twentieth centuries; in addition, a single prehistoric period ceramic artifact was recovered. The lack of substantial structural remains in addition to an absence of potentially intact soil horizons (i.e., Stratum II), coupled with the limited artifact assemblage, demonstrate that Site 16WF182 lacks research potential. Site 16WF182 does not possess the qualities of significance as defined by the NRHP Criteria for Evaluation (36 CFR 60.4 [a-d]). The Louisiana SHPO concurred with this finding in a letter dated February 19, 2008 (refer to Appendix 2A).

2.5.3.5 Previously Recorded Cultural Resources Located within 10 mi. (16.1 km) of the Currently Proposed Project Area

To ensure that all potential effects to known historic or prehistoric properties were addressed prior to the initiation of fieldwork, a review of previously conducted cultural resources surveys completed within 10 mi. (16.1 km) of the proposed project area, as well as those previously recorded archaeological sites, historic standing structures, and NRHP properties situated within 10 mi. (16.1 km) of the proposed project area was undertaken. This research involved an examination of the archaeological site forms and historic maps currently on file with the Louisiana Division of Archaeology and the Louisiana State Library, and a search of the online NRHP database.

The state of Louisiana is in the process of digitizing the cultural resource database to create an online geographical information system. As a result, certain maps pertaining to the built resources in the vicinity of the proposed project area have been removed from the Louisiana State Library and are not accessible to researchers. Some of the removed maps pertained directly to the currently proposed project area, resulting in a lack of available data for a number of the built resources located within 10 mi. (16.1 km) of the proposed project area.

A total of five cultural resources were identified either within, or in proximity to, the currently proposed project area, i.e., Sites 16WF36, 16WF19, 16WF54, 16WF55, and 16WF56. A total of four sites (i.e., Sites 16WF19, 16WF54, 16WF55, and 16WF56) have not been assessed for their NRHP significance according to Section 106 of the National Historic Preservation Act of 1966 (as referenced in 36 CFR 60.4 [a-d]). While no explanation was given as to why these sites were not assessed, it is likely that they were identified during a non-Section 106 undertaking; therefore, no eligibility assessments were necessary.

Of the five previously identified sites, only Site 16WF36 was re-identified during the current investigation. This site, the Magnolia Plantation Sugar Mill, was recorded originally by Smith in 1982. Listed as measuring 131.2 by 131.2 ft. (40 by 40 m) in size, the site consisted of a standing brick ruin and a surface scatter of bricks and brick rubble. Random shovel testing conducted within the boundary of Site 16WF36 failed to reveal the presence of any subsurface cultural materials. At the time of its identification, the site was assessed as potentially eligible for inclusion on the NRHP and avoidance or preservation in place of the structure was recommended.

Further archaeological investigations of Site 16WF36 were conducted by Shuman and Orser in 1984. Additional shovel testing conducted at the site recovered four historic period artifacts from subsurface contexts: a square nail, a flat glass shard, a chicken bone, and a single glass bottle neck. Two articulated brick features were identified below the ground surface as well as large amounts of brick rubble. Although Shuman and Orser identified additional artifacts, they differed from Smith by assessing the site as not eligible for inclusion on the NRHP. However, they did point out that the site still should be preserved so that a more thorough investigation can be conducted in the future. The Applicant intends to take the Smith recommendation of avoiding Site 16WF36.

Site 16WF19, which was located in proximity to Area 7 of the current investigation, was recorded by Neuman in 1972 on a hilltop overlooking the western fork of Grants Bayou. The site consisted of a low-density surface scatter of prehistoric period artifacts. Neuman identified seven ceramic sherds dating from the Plaquemine Period (ca. 800 to 550 B.P.). The site measured 2 by 3 ft (0.6 by 0.9 m) in size. Archaeological investigations at the site were limited to pedestrian survey. However, the NRHP status of Site 16WF19 was not assessed.

The first of three sites identified in proximity to the proposed transmission line corridor, Site 16WF54, was also recorded by Neuman in 1972. This medium-density surface scatter of prehistoric period artifacts was situated on a small hilltop. Recovered artifacts included 66 ceramic sherds, a single lithic artifact, and a single mammal tooth. Of the recovered ceramics, 16 were characterized as rim sherds, 7 as decorated body sherds, and the remaining 43 as plain body sherds. Neuman characterized the cultural affiliation of the site as dating from the Marksville and Troyville-Coles Creek Periods. Measuring 100 by 20 ft. (30.5 by 6.1 m) in size, Site 16WF54 was not assessed in regard to its NRHP eligibility.

Site 16WF55, located to the north of Site 16WF54, was also recorded by Neuman in 1972. Characterized as a low-density surface scatter that produced six nondiagnostic prehistoric period ceramic sherds, the site was identified on a small hilltop that overlooks the Mississippi River. The site measured approximately 2 by 3 ft. (0.6 by 0.9 m). No subsurface testing was conducted within the boundaries of the site. The NRHP eligibility of the site was not assessed.

Site 16WF56, located to the northwest of Site 16WF55 and between the proposed project access road and the proposed transmission line corridor, was again recorded by Neuman in 1972. Measuring approximately 200 ft. (61 m) north-south, the site consisted of a surface scatter that produced 29 prehistoric ceramic sherds, 3 of which were decorated, and 3 lithic artifacts. This

Coles Creek Period artifact scatter (ca. 1600 to 800 B.P.) was identified along a high bluff edge near the Mississippi River. The NRHP eligibility of Site 16WF56 was not assessed.

In total, 1,232 cultural resources were identified within 10 mi. (16.1 km) of the currently proposed project area. This number included 178 archaeological sites (Table 2.5-50), 1028 built resources greater than 50 years in age (Table 2.5-51), and 26 properties listed on the NRHP; in all, 50 cultural resources listed on the NRHP were identified within 10 mi. (16.1 km) of the proposed project area (Table 2.5-52).

Resources identified included both historic and prehistoric archaeological sites, individual structures, historic districts, historic gardens, cemeteries, and battlefields. The resources were identified within East Baton Rouge, East Feliciana, Pointe Coupee, and West Feliciana Parishes.

In addition, an examination of the online version of the National Registry of National Landmarks database maintained by the NPS indicated that no properties located within Louisiana are listed on this registry.

2.5.4 ENVIRONMENTAL JUSTICE

2.5.4.1 Background

The NRC performs environmental justice analyses utilizing a 50-mi. radius around the plant as the environmental "impact area." The two states, Louisiana and Mississippi, included within the 50-mi. radius comprise the "geographic area."

NRC guidance suggests using the most recent U.S. Census Bureau decennial census data. The characteristics of 2000 census population data within the region were determined through the use of the LandView®6 software (refer to Subsections 2.5.1 and 2.5.2). Census population data were used to identify the minority and low-income populations within a 50-mi. radius of the site. Minority and low-income populations in the geographic area were analyzed based on 2000 census block information. The results were compiled and maps were produced showing the geographic location of minority and low-income populations in relation to the site. Information for both groups was then reviewed with respect to the Nuclear Reactor Regulation criteria for minority and low-income populations (Reference 2.5-46).

2.5.4.2 Minority Populations

The NRC Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues defines a "minority" population as American Indian or Alaskan Native, Asian, Native Hawaiian or Pacific Islander, Black, other, two or more races, the aggregate of all minority races, Hispanic ethnicity, and the aggregate of all minority races and Hispanic ethnicity (Reference 2.5-46). The guidance indicates that a minority population is considered to be present if either of the two following conditions exists:

1. The minority population in the census block exceeds 50 percent.

2. The minority population percentage is more than 20 percentage points greater in the census block than the minority percentage of the geographic area chosen for the comparative analysis.

As indicated in Table 2.5-53, 37.4 percent of the Louisiana population is minority and 39.3 percent of the Mississippi population is minority. Based on the NRC guidance for determining whether a minority population is present for which the possibility of disproportionate environmental impacts should be gauged, five regional Louisiana parishes (Iberville, St. Helena, and West Feliciana) and Mississippi counties (Adams and Wilkerson) within a 50-mi. radius qualify as minority population areas. These areas are identified in Figure 2.5-17 at the parish and county level, and in Figure 2.5-18 at the CBG level. In West Feliciana Parish, 51.9 percent of the population is minority, according to U.S. Census data, which qualifies the parish as a minority area. The regional minority population is further broken down in Figure 2.5-20. This figure shows the racial classifications that qualified the individual CBGs as minority.

A special group of interest in the environmental justice category consists of migrant populations. Historically, migrant population data have been difficult to capture. For the first time, the 2002 Census of Agriculture collected data on migrant farm laborers at the state and parish/county level. Table 2.5-54 lists the number and percentage of total farms at the parish/county level that hired or contracted migrant farm laborers. As indicated in the table, only a small percentage of regional farms hired or contracted migrant farm laborers in 2002. Fourteen of the 24 regional parishes/counties reported that less than 1 percent of farms hired or contracted migrant farm labor.

2.5.4.3 Low-Income Populations

NRC guidance defines "low-income" using U.S. Census Bureau statistical poverty thresholds (Reference 2.5-46). As addressed above with minority populations, areas in Louisiana and Mississippi were evaluated in this analysis.

The guidance indicates that a low-income population is considered to be present if either of the two following conditions exists:

1. The low-income population in the CBG exceeds 50 percent.

2. The percentage of households below the poverty level in a CBG is significantly greater (typically at least 20 percentage points) than the low-income population percentage of the geographic area chosen for the comparative analysis (i.e., individual state and four-state combined average).

As indicated in Table 2.5-53, 19.64 percent of the Louisiana population is low income, and 19.93 percent of the Mississippi population is low income. Based on the NRC guidance, no regional Louisiana parishes and Mississippi counties within a 50-mi. radius qualify as low-income population areas. In West Feliciana Parish, 19.88 percent of the population is low income. Figure 2.5-19 shows the low-income CBGs in the region. No CBGs in West Feliciana Parish qualify as low-income areas.

2.5.4.4 Other Considerations

While the overall population figures reveal important information regarding the potential for population-level environmental justice issues, it is possible that there are relatively small populations or communities that would be negatively affected by plant construction and operation but would not be reflected in the parish or block group data. To ascertain this possibility, a number of knowledgeable personnel were interviewed while this section was being compiled to discuss, within a smaller community scope, whether the project would likely cause a disproportionate environmental impact on these communities. These individuals consisted of members of the West Feliciana Community Development Foundation, the West Feliciana Police Jury, and the West Feliciana Sheriff's Department. These three individuals each indicated that they were not aware of any small populations that would trigger environmental justice issues, by likely being disproportionately impacted by the project, and they each expected support among parish residents for the project because of the tax, employment, and income opportunities that would be created. The West Feliciana Community Development representative also indicated that he did not know of any populations that subsist principally on fish or wildlife that would be affected by the project.

2.5.5 NOISE

A description of the site and vicinity is included in Subsection 2.2.1.

According to the RBS Unit 1 Environmental Report for the Operating License Stage (Reference 2.5-47) and the RBS Unit 1 Final Environmental Impact Statement (Reference 2.5-48), at least two ambient sound level surveys were conducted in support of licensing for RBS Unit 1. The first survey was conducted June 15-16, 1972, prior to the construction of Unit 1. A follow-up survey was conducted January 9-10, 1980, during construction of Unit 1 (but specifically during periods of the day when there was little construction activity occurring). The results of these surveys were summarized in Section 2.9 and Subsection 6.7.1 of Reference 2.5-47. Gulf States Utilities (GSU) predictions of Unit 1 noise emissions were also discussed and summarized with a contour plot in Figure 5.8-1 of Reference 2.5-47.

Subsequent analysis of the 1972 and 1980 survey data was performed by the NRC; this was summarized in Section 5.12 of Reference 2.5-48. This analysis provided a summary of the 1972 and 1980 surveys, along with NRC predictions of the expected noise effects at the nearest noise-sensitive receptors (i.e., the nearest residences) to Unit 1.

Figure 2.5-21 shows the locations of Unit 1 and the eight noise-sensitive receptors identified in Figure 5.22 of Reference 2.5-48. The ambient sound levels at these eight receptors during the 1972 and 1980 surveys are summarized in Table 2.5-55. Most of the differences in ambient sound levels between the two surveys appear to have resulted from seasonal variations; the ambient sound levels in June 1972 were heavily influenced by insect noise, which is not uncommon in the region during the summer months. It should be noted that Location R3 was approximately 100 ft. from a 69 kV on-site transmission line. This was the only location that would have been affected by transmission line noise. It should also be noted that there are no state regulations regarding noise.

Subsequent to the completion of Unit 1, there have been no ambient sound level surveys conducted in the vicinity specifically to establish the ambient sound level conditions with Unit 1 in operation. Thus, predictions of Unit 1 noise emissions from References 2.5-47 and 2.5-48 were evaluated to establish representative ambient sound levels. The ranges of predicted ambient sound levels at the same eight receptors are summarized in Table 2.5-56. The apparently wide ranges of present-day sound levels are the result of seasonal variations in the initial conditions (refer to Table 2.5-55), as well as different methods of sound level prediction used by GSU and the NRC. According to Reference 2.5-49, GSU utilized a "COMSOL computer model" for the prediction of plant operation sound pressure levels, whereas the NRC utilized a "staff model."

Discussions on the effects of construction and operation of the existing RBS plant on the noise levels surrounding the site are presented in Sections 3.7, 4.6, 5.6, and 5.8 of this report. New facility construction and operation effects with regard to noise are discussed in Sections 4.4, 4.6, 5.3, 5.6, 5.8, and 5.10.

2.5.6 REFERENCES

2.5-1 KLD Associates, Inc., River Bend Station Development of Evacuation Time Estimates, May 2008.

2.5-2 U.S. Census 2000, "County-To-County Worker Flow Files," Website, http://www.census.gov/population/www/cen2000/commuting.html, accessed November 19, 2007.

2.5-3 U.S. Census Bureau and U.S. Geological Survey, Website, http://landview.census.gov, data and maps, "Census Block Groups," Land View® 6 on DVD with MARPLOTS® , a Viewer for EPA, Excel Spreadsheet, December 2003.

2.5-4 Travel Industry Association of America, "2003 TravelScope® Profile of U.S. Travelers to Louisiana," Website, http://www.latour.lsu.edu/pdfs/travelscope_2003.pdf, accessed August 8, 2007.

2.5-5 State of Louisiana Department of Public Safety and Corrections, "Time In Prison: The Adult Institutions," Website, http://www.corrections.state.la.us/Whats%20NEw/PDFs/TimeInPrison.pdf, accessed August 8, 2007.

2.5-6 The Road Home, "Policies and Resources," Website, http://www.road2la.org/homeowner/resources.htm#hurricane, accessed October 26, 2007.

2.5-7 State of Louisiana, Press Release: "Governor Blanco, Mayor Nagin and LRA wrap up successful meetings with White House officials and Congressional Leaders; Group optimistic federal officials will act quickly to finish the job and fully fund the Road Home," October 18, 2007, Website, http://gov.louisiana.gov/index.cfm?md=newsroom&tmp=detail&articleID=3282, accessed October 26, 2007.

2.5-8 The Road Home, "Application Status," Website, http://www.road2la.org/homeowner/status.htm, accessed October 26, 2007.

2.5-9 The Road Home, "Overview of the Homeowner program," Website, http://www.road2la.org/homeowner/overview.htm, accessed October 26, 2007.

2.5-10 The Henry J. Kaiser Family Foundation, "Median Annual Household Income, 2003 - 2005," Website, http://www.statehealthfacts.org/comparemaptable.jsp?ind=15&cat=1&yr=1&typ=4&o=d&sort=n, accessed July 30, 2007.

2.5-11 U.S. Census Bureau "St. Francisville Profile of Selected Economic Characteristics, 2000," Website, http://factfinder.census.gov/servlet/QTTable?_bm=y&-geo_id=16000US2267215&-qr_name=DEC_2000_SF3_U_DP3&-ds_name=DEC_2000_SF3_U&-_lang=en&-_sse=o, accessed March 18, 2008.

2.5-12 Tembec Press Room, "Tembec to idle its coated paper mill located in St. Francisville, Louisiana," Website, http://www.tembec.com/public/Salle-de-presse/2007-06-01.html?Count=5&isRecent=true&search=all, accessed August 3. 2007.

2.5-13 West Baton Rouge "West Baton Rouge Parish Council," Website, http://www.wbrcouncil.org/contacts/bios.asp, accessed March 5, 2008.

2.5-14 Pointe Coupee Parish, "Pointe Coupee Police Jury," Website, http://www.pcpolicejury.org/government/policejury/index.html, accessed March 5, 2008.

2.5-15 National Association of Counties, "East Feliciana Parish, LA," Website, http://www.naco.org/Template.cfm?Section=Find_a_County&Template=/cffiles/counties/county.cfm&id=22037, accessed March 5, 2008.

2.5-16 Baton Rouge Government, "About the City-Parish Government," Website, http://brgov.com/aboutus.htm, accessed March 5, 2008.

2.5-17 Baton Rouge Government, "City of Baton Rouge, Parish of East Baton Rouge Consolidated Government," Website, http://brgov.com/govt/, accessed March 26, 2008.

2.5-18 Louisiana Department of Revenue, "2005 - 2006 Tax Collection Report," p. 50, Website, http://www.revenue.louisiana.gov/forms/publications/ar(05-06)tc.pdf, accessed July 27, 2007.

2.5-19 Community Development Foundation, Economic Development for West Feliciana Parish, "Taxes," Website, http://www.stfrancisville.org/index.php?option=com_content&task=view&id=28&Itemid=66, accessed July 31, 2007.

2.5-20 Louisiana Department of Revenue, "2005 - 2006 Tax Collection Report," p. 32, Website, http://www.revenue.louisiana.gov/forms/publications/ar(05-06)tc.pdf, accessed July 27, 2007.

2.5-21 U.S. Census Bureau, "St. Francisville Selected Housing Characteristics, 2000," Website, http://factfinder.census.gov/servlet/QTTable?_bm=y&-geo_id=16000US2267215&-qr_name=DEC_2000_SF3_U_DP4&-ds_name=DEC_2000_SF3_U&-_lang=en&-redoLo, accessed March 18, 2007.

2.5-22 West Feliciana Parish, "Police Jury Functions and Responsibilities," Website, http://westfelicianaparish.org/content/view/16/, accessed August 3, 2007.

2.5-23 West Feliciana Parish, "Land Use and Growth Management Plan: Strategies, Policies, and Guidelines," p. 7, January 1998.

2.5-24 West Feliciana Parish, "Land Use and Growth Management Plan: Strategies, Policies, and Guidelines," p. 9, January 1998.

2.5-25 West Feliciana Parish, "Land Use and Growth Management Plan: Strategies, Policies, and Guidelines," p. 14, January 1998.

2.5-26 West Feliciana Parish, "Land Use and Growth Management Plan: Strategies, Policies, and Guidelines," (Land Use Maps, Appendix to the Plan), January 1998.

2.5-27 St. Francisville, Louisiana, "A Main Street Community," Website, http://www.stfrancisville.net/town_new/index.html, accessed July 30, 2007.

2.5-28 West Baton Rouge Parish, "Office of Emergency Preparedness/Homeland Security/911," Website, http://www.wbrparish.org/index.php?display=emergencyprep, accessed July 30, 2007.

2.5-29 West Feliciana Parish Hospital, "Medical Services," Website, http://www.wfph.org/, accessed July 30, 2007.

2.5-30 Louisiana Department of Transportation and Development, "LADOT Estimated Annual Average Daily Traffic Sites," Website, http://www.dotd.la.gov/highways/tatv/default.asp, accessed December 11, 2007.

2.5-31 Transportation Research Board National Research Council, "Highway Capacity Manual Special Report 209," Washington, D.C., 1985.

2.5-32 West Feliciana Community Development Foundation, "Conceptual Plan of the West Feliciana Business Park," p. 6, Website, http://www.stfrancisville.org/downloads/conceptualplan.pdf, accessed August 3, 2007.

2.5-33 U.S. Coast Guard, Louisiana Department of Transportation and Development, "Mississippi River Bridge Environmental Assessment, Route LA 10 Mississippi River Bridge St. Francisville-New Roads West Feliciana-Pointe Coupee Parishes," State Project 700-28-0022, March 2003.

2.5-34 Louisiana Department of Transportation, "John James Audubon Bridge public outreach office set to open in New Roads," Website, http://www.dotd.louisiana.gov/press/pressrelease.asp?nRelease=645, accessed August 3, 2007.

2.5-35 Louisiana Department of Transportation and Development, "New Roads-St. Francisville Mississippi River Bridge Supplemental Traffic Study Alignment F," as a part of S.P. No. 700-28-0022, Figure 3, November 2003.

2.5-36 Baton Rouge Metropolitan Airport, "Air Cargo," Website, http://www.flybtr.com/PracticeAreas/PracticeAreas.asp, accessed August 2, 2007.

2.5-37 Baton Rouge Metropolitan Airport, "Airport Information-Airfield Layout and Characteristics," Website, http://www.flybtr.com/CatSubCat/CatSubCatDisplay.asp?p1=409&p2=Y&p7=0&p8=7448&p9=CSC1, accessed August 2, 2007.

2.5-38 Port of South Louisiana Transportation of the Americas, "Transportation," Website, http://www.portsl.com/pages/15_transportation.html, accessed August 3, 2007.

2.5-39 Association of American Railroads, "Railroad Service in Louisiana 2005," Website, http://www.aar.org/PubCommon/Documents/AboutTheIndustry/RRState_LA.pdf?states=RRState_LA.pdf, accessed August 3, 2007.

2.5-40 Audubon, "John James Audubon 1785-1851," Website, http://www.audubon.org/nas/jja.html, accessed August 3, 2007.

2.5-41 St. Francisville, Louisiana Audubon Pilgrimage, "J J Audubon," Website, http://www.audubonpilgrimage.info/audubon.htm, accessed August 3, 2007.

2.5-42 West Feliciana Parish Tourist Commission, St. Francisville, "Simple Pleasures, Unique Treasures," Website, http://www.stfrancisville.us/, accessed July 30, 2007.

2.5-43 Tunica-Biloxi Tribe of Louisiana, Website, http://www.tunicabiloxi.org/, accessed December 12, 2007.

2.5-44 Smith, S. D., P. G. Rivet, K. M. Byrd, and N. W. Hawkins, *Louisiana's Comprehensive Archaeological Plan*, Louisiana Department of Culture, Recreation, & Tourism, Office of Cultural Development, Division of Archaeology, Baton Rouge, 1983.

2.5-45 36 CFR 60.4 (a-d), "Criteria for Evaluation."

2.5-46 U.S. Nuclear Regulatory Commission, Office Instruction LIC-203, "Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues," May 2004.

2.5-47 Gulf States Utilities Company, "River Bend Station Environmental Report, Operating License Stage," Volumes 1-4, Supplements 1-9, November 1984.

2.5-48 U.S. Nuclear Regulatory Commission, *Final Environmental Statement Related to the Operation of River Bend Station*, NUREG-1073, Docket No 50-458, pp. 5-56 through 5-59, Figures 5.21 and 5.22, and Tables 5.15 through 5.18, January 1985.

2.5-49 LandView® 6 on DVD with MARPLOTS® , a Viewer for EPA, U.S. Census Bureau and U.S. Geological Survey, data and maps, Excel Spreadsheet, Website, http://landview.census.gov, County Information, December 2003.

2.5-50 U.S. Census Bureau and U.S. Geological Survey, Website, http://landview.census.gov, data and maps, "Census Block Point Information," Land View® 6 on DVD with MARPLOTS® , a Viewer for EPA, Excel Spreadsheet, December 2003.

2.5-51 City-Data.com, "County and Parish Information," Website, http://www.city-data.com/countyDir.html, accessed August 1, 2007.

2.5-52 Black & Veatch Hurricane Impacted Gulf Coast Area Analysis referencing, U.S. Census Bureau, Special Population Estimates for Impacted Counties in the Gulf Coast Area, Excel Spreadsheet, Website, http://www.census.gov/Press-Release/www/emergencies/impacted_gulf_methodology.html, accessed October 26, 2007.

2.5-53 U.S. Census Bureau, "State & County QuickFacts," Website, http://quickfacts.census.gov/qfd/, accessed July 26, 2007.

2.5-54 Baton Rouge Area Chamber, "West Feliciana Parish," Website, http://www.brac.org/site20.php, accessed March 6, 2008.

2.5-55 Baton Rouge Area Chamber, "East Baton Rouge Parish, Website, http://www.brac.org/site13.php, accessed March 6, 2008.

2.5-56 Baton Rouge Area Chamber, "West Baton Rouge Parish," Website, http://www.brac.org/site19.php, accessed March 6, 2008.

2.5-57 Baton Rouge Area Chamber, "Pointe Coupee Parish," Website, http://www.brac.org/site17.php, accessed March 25, 2008.

2.5-58 Baton Rouge Area Chamber, "East Feliciana Parish," Website, http://www.brac.org/site14.php, accessed March 6, 2008.

2.5-59 U.S. Department of Labor, Bureau of Labor Statistics, "Local Area Unemployment Statistics," Website, http://www.bls.gov/lau/home.htm, accessed July 26, 2007.

2.5-60 Louisiana Works Department of Labor, Labor Market Statistics, "Industry Employment and Projections," Industry tab, Website, https://www.voshost.com/analyzer/searchAnalyzer.asp?cat=IND&session=INDPROJ&subsession=99&time=&geo=&currsubsessavail=&incsource=&blnStart=True, accessed July 26, 2007.

2.5-61 Louisiana Association of Tax Administrators, "West Feliciana Parish Tax Collection Agencies," Website, http://www.laota.com/parish2/West_Feliciana_Parish.html, accessed March 9, 2008.

2.5-62 Louisiana Association of Tax Administrators, "East Baton Rouge Parish Tax Collection Agencies," Website, http://www.laota.com/parish2/East_Baton_Rouge_Parish.html, accessed March 9, 2008.

2.5-63 Louisiana Association of Tax Administrators, "West Baton Rouge Parish Tax Collection Agencies," Website, http://www.laota.com/parish2/WBR.html, accessed March 9, 2008.

2.5-64 Louisiana Association of Tax Administrators, "Pointe Coupee Parish Tax Collection Agencies," Website, http://www.laota.com/parish2/Point_Coupee_Parish.html, accessed March 9, 2008.

2.5-65 Louisiana Association of Tax Administrators, "East Feliciana Parish Agencies," Website, http://www.laota.com/parish2/Point_Coupee_Parish.html, accessed March 9, 2008.

2.5-66 Louisiana Department of Revenue, "2005-2006 Tax Collection Report," p. 12, Website, http://www.revenue.louisiana.gov/forms/publications/ar(05-06)tc.pdf, accessed July 27 2007.

2.5-67 West Feliciana Parish Police Jury Secretary, S. Smith, "West Feliciana Parish Police Jury Revenues and Expenses for Year Ending December 31, 2007," November 29, 2007.

2.5-68 Baton Rouge Government, "2008 Annual Operating Budget," Website, http://brgov.com/dept/finance/pdf/2008%20Budget/08Summary%20of%20Gen%20Fund%20Est%20Revs%20and%20Appro.pdf, accessed March 25, 2005.

2.5-69 Louisiana Department of Revenue, "2005-2006 Tax Collection Report," p. 5, Website, http://www.revenue.louisiana.gov/forms/publications/ar(05-06)tc.pdf, accessed July 27, 2007.

2.5-70 Louisiana Department of Revenue, "2005-2006 Tax Collection Report," p. 9, Website, http://www.revenue.louisiana.gov/forms/publications/ar(05-06)tc.pdf, accessed July 27, 2007.

2.5-71 U.S. Census Bureau, "West Feliciana Parish Quickfacts," Website, http://quickfacts.census.gov/qfd/states/22/22125.html, accessed March 7, 2008.

2.5-72 U.S. Census Bureau, "East Baton Rouge Parish Quickfacts," Website, http://quickfacts.census.gov/qfd/states/22/22033.html, accessed March 7, 2008.

2.5-73 U.S. Census Bureau, "West Baton Rouge Parish Quickfacts," Website, http://quickfacts.census.gov/qfd/states/22/22121.html, accessed March 7, 2008.

2.5-74 U.S. Census Bureau, "Pointe Coupee Parish Quickfacts," Website, http://quickfacts.census.gov/qfd/states/22/22077.html, accessed March 7, 2008.

2.5-75 U.S. Census Bureau, "East Feliciana Parish Quickfacts," Website, http://quickfacts.census.gov/qfd/states/22/22077.html, accessed March 7, 2008.

2.5-76 Institute of Education Sciences, U.S. Department of Education, National Center for Education Statistics, "District Details," Website, http://nces.ed.gov/ccd/districtsearch/, accessed July 30, 2007.

2.5-77 Institute of Education Sciences, U.S. Department of Education, National Center for Education Statistics, "State Education Data Profiles," Website, http://nces.ed.gov/programs/stateprofiles/, accessed August 1, 2007.

2.5-78 Baton Rouge Area Chamber, "Telephone and Utilities," Website, http://www.brac.org/site91.php, accessed March 10, 2008.

2.5-79 Louisiana Sheriff's Association, "West Feliciana Parish," Website, http://www.lsa.org/Louisiana_Sheriffs__Associatio/Sheriffs__Directory/West_Feliciana/west_feliciana.html, accessed March 17,2008.

2.5-80 Louisiana Sheriff's Association, "East Baton Rouge Parish," Website, http://www.lsa.org/Louisiana_Sheriffs__Associatio/Sheriffs__Directory/East_Baton_Rouge/east_baton_rouge.html, accessed March 17, 2008.

2.5-81 Louisiana Sheriff's Association, "West Baton Rouge Parish," Website, http://www.lsa.org/louisiana_sheriffs__associatio/sheriffs__directory/west_baton_rouge/west_baton_rouge.html, accessed March 5, 2008.

2.5-82 Louisiana Sheriff's Association, "Pointe Coupee Parish," Website, http://www.lsa.org/Louisiana_Sheriffs__Associatio/Sheriffs__Directory/Pointe_Coupee/pointe_coupee.html, accessed March 6, 2008.

2.5-83 Louisiana Sheriff's Association, "East Feliciana Parish," Website, http://www.lsa.org/Louisiana_Sheriffs__Associatio/Sheriffs__Directory/East_Feliciana/east_feliciana.html, accessed March 5, 2008.

2.5-84 Louisiana Interagency Coordination Center, "West Feliciana Parish Fire Departments," Website, http://www.fs.fed.us/r8/kisatchie/licc/site/parish/west_feliciana_parish.htm, accessed March 19, 2008.

2.5-85 Louisiana Interagency Coordination Center, "East Baton Rouge Parish Fire Departments," Website, http://www.fs.fed.us/r8/kisatchie/licc/site/parish/east_baton_rouge_parish.htm, accessed on March 19, 2008.

2.5-86 Louisiana Interagency Coordination Center, "West Baton Rouge Parish Fire Departments," Website, http://www.fs.fed.us/r8/kisatchie/licc/site/parish/west_baton_rouge_parish.htm, accessed on March 6, 2008.

2.5-87 Louisiana Interagency Coordination Center, "Pointe Coupee Parish Fire Departments," Website, http://www.fs.fed.us/r8/kisatchie/licc/site/parish/pointe_coupee_parish.htm, accessed March 6, 2008.

2.5-88 Louisiana Interagency Coordination Center, "East Feliciana Parish Fire Departments," Website, http://www.fs.fed.us/r8/kisatchie/licc/site/parish/east_feliciana_parish.htm, accessed March 19, 2008.

2.5-89 Louisiana Hospital Inform, "West Feliciana Parish Hospital," Website, http://www.lahealthinform.org/profile.html?provid=191306, accessed March 7, 2008.

2.5-90 Louisiana Hospital Inform, "Baton Rouge General Medical Center," Website, http://www.lahealthinform.org/profile.html?provid=190065, accessed March 7, 2008.

2.5-91 Louisiana Hospital Inform, "Benton Rehabilitation Hospital," Website, http://www.lahealthinform.org/profile.html?provid=193070, accessed March 7, 2008.

2.5-92 Louisiana Hospital Inform, "Cypress Psychiatric Hospital," Website, http://www.lahealthinform.org/profile.html?provid=194071, accessed March 7, 2008.

2.5-93 Louisiana Hospital Inform, "Earl K. Long Medical Center," Website, http://www.lahealthinform.org/profile.html?provid=190122, accessed March 7, 2008.

2.5-94 Louisiana Hospital Inform, "Lane Regional Medical Center," Website, http://www.lahealthinform.org/profile.html?provid=190020, accessed March 7, 2007.

2.5-95 Louisiana Hospital Inform, "Ochsner Medical Center Baton Rouge," Website, http://www.lahealthinform.org/profile.html?provid=190202, accessed March 7, 2008.

2.5-96 Louisiana Hospital Inform, "Our Lady of the Lake Regional Medical Center," Website, http://www.lahealthinform.org/profile.html?provid=190064, accessed March 7, 2007.

2.5-97 Louisiana Hospital Inform, "Promise Hospital of Baton Rouge (Mid-City Campus)," Website, http://www.lahealthinform.org/profile.html?provid=192049, accessed March 7, 2008.

2.5-98 Louisiana Hospital Inform, "Sage Rehabilitation Institute," Website, http://www.lahealthinform.org/profile.html?provid=193078, accessed March 22, 2008.

2.5-99 Louisiana Hospital Inform, "Surgical Specialty Centre," Website, http://www.lahealthinform.org/profile.html?provid=190251, accessed March 7, 2008.

2.5-100 Louisiana Hospital Inform, "Vista Surgical Hospital of Baton Rouge," Website, http://www.lahealthinform.org/profile.html?provid=190249, accessed March 7, 2008.

2.5-101 Louisiana Hospital Inform, "Woman's Hospital," Website, http://www.lahealthinform.org/profile.html?provid=190128, accessed March 7, 2008.

2.5-102 Louisiana Hospital Inform, "Pointe Coupee General Hospital," Website, http://www.lahealthinform.org/profile.html?provid=190059, accessed March 7, 2008.

2.5-103 Louisiana Hospital Inform, "Gulf States LTAC of Feliciana," Website, http://www.lahealthinform.org/profile.html?provid=192041, accessed March 7, 2008.

2.5-104 Louisiana Hospital Inform, "Villa Feliciana Medical Complex," Website, http://www.lahealthinform.org/profile.html?provid=190199, accessed March 7, 2008.

2.5-105 UCompare Healthcare, "West Feliciana Hospital," Website, http://www.ucomparehealthcare.com/hospital/Louisiana/West_Feliciana_Hospital.html, accessed March 22, 2008.

2.5-106 UCompare Healthcare, "Baton Rouge General Medical Center," Website, http://www.ucomparehealthcare.com/hospital/Louisiana/Baton_Rouge_General_Medical_Center.html, accessed March 11, 2008.

2.5-107 UCompare Healthcare, "Benton Rehabilitation Hospital," Website, http://www.ucomparehealthcare.com/hospital/Louisiana/Benton_Rehabilitation_Hospital.html, accessed March 7, 2008.

2.5-108 UCompare Healthcare, "Cypress Rehabilitation Hospital," Website, http://www.ucomparehealthcare.com/hospital/Louisiana/Cypress_Rehabilitaion_Hospital.html, accessed March 11, 2008.

2.5-109 UCompare Healthcare, "Earl K. Long Medical Center ," Website, http://www.ucomparehealthcare.com/hospital/Louisiana/Earl_K_Long_Medical_Center.html,, accessed March 22, 2008.

2.5-110 UCompare Healthcare, "Lane Regional Medical Center," Website, http://www.ucomparehealthcare.com/hospital/Louisiana/Lane_Regional_Medical_Center.html, accessed March 11, 2008.

2.5-111 UCompare Healthcare, "Ochsner Medical Center Baton Rouge," Website, http://www.ucomparehealthcare.com/hospital/Louisiana/Ochsner_Medical_Center-baton_Rouge.html, accessed March 11, 2008.

2.5-112 UCompare Healthcare, "Our Lady of the Lake Regional Medical Center," Website, http://www.ucomparehealthcare.com/hospital/Louisiana/Our_Lady_Of_The_Lake_Reg_Med_Center.html, accessed March 11, 2008.

2.5-113 UCompare Healthcare, "Promise Hospital of Baton Rouge (Mid-City Campus)," Website, http://www.ucomparehealthcare.com/hospital/Louisiana/Promise_Specialty_Hospital_Baton_Ro.htmlm, accessed March 11, 2008.

2.5-114 UCompare Healthcare, "Sage Rehabilitation Institute," Website, http://www.ucomparehealthcare.com/hospital/Louisiana/Sage_Rehab_Institute.html, accessed March 11, 2008.

2.5-115 UCompare Healthcare, "Surgical Specialty Hospital," Website, http://www.ucomparehealthcare.com/hospital/Louisiana/Surgical_Specialty_Hospital.html, accessed March 11, 2008.

2.5-116 UCompare Healthcare, "Vista Surgical Hospital of Baton Rouge," Website, http://www.ucomparehealthcare.com/hospital/Louisiana/Vista_Surgical_Hospital.html, accessedline at March 11, 2008.

2.5-117 UCompare Healthcare, "Woman's Hospital," Website, http://www.ucomparehealthcare.com/hospital/Louisiana/Womans_Hospital.html, accessed March 11, 2008.

2.5-118 UCompare Healthcare, "Pointe Coupee General Hospital," Website, http://www.ucomparehealthcare.com/hospital/Louisiana/Pointe_Coupee_General_Hospital.html, accessed March 11, 2008.

2.5-119 UCompare Healthcare, "Gulf States LTAC of Feliciana," Website, http://www.ucomparehealthcare.com/hospital/Louisiana/Gulf_States_Ltac_Of_Feliciana.html, accessed March 11, 2008.

2.5-120 UCompare Healthcare, "Villa Feliciana Medical Complex," Website, http://www.ucomparehealthcare.com/hospital/Louisiana/Villa_Feliciana_Medical_Complex.html, accessed March 11, 2008.

2.5-121 National Park Service, "A National Register of Historic Place Travel Itinerary, Southeastern Louisiana," Website, http://www.nps.gov/history/nr/travel/louisiana/sitelist.htm, accessed March 19, 2008.

2.5-122 U.S. Department of Agriculture, "Table 1. Parish Summary Highlights: 2002," and "Table 7. Hired Farm Labor - Workers and Payroll: 2002," U.S. National Agricultural Statistics Service, Louisiana.

2.5-123 U.S. Department of Agriculture, "Table 1. County Summary Highlights: 2002," and "Table 7. Hired Farm Labor - Workers and Payroll: 2002," U.S. National Agricultural Statistics Service, Mississippi.

2.5-124 Community Development Foundation, Economic Development for West Feliciana Parish, "Business Park Maps," Website, http://www.stfrancisville.org/index.php?option=com_content&task=view&id=49&Itemid=37, accessed July 30, 2007.

Table 2.5-1
Parishes and Counties within a 50-Mi. Radius of the Proposed RBS Unit 3 Power Block

Louisiana Parishes		Mississippi Counties
Ascension	Lafayette	Adams
Assumption	Livingston	Amite
Avoyelles	Pointe Coupee	Franklin
Catahoula	St. Helena	Pike
Concordia	St. Landry	Wilkinson
East Baton Rouge	St. Martin	
East Feliciana	Tangipahoa	
Evangeline	West Baton Rouge	
Iberia	West Feliciana	
Iberville		

Source: Reference 2.5-49.

Table 2.5-2
Segment Population Distribution 0 to 10 Mi. from the Proposed RBS Unit 3 Power Block, 2000

Cardinal Compass Direction	Population in Mile Range from the Proposed RBS Unit 3 Power Block					
	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10
NORTH	41	100	126	0	43	773
N-NE		106	83	59	0	511
NE		0	35	2	22	4265
E-NE		17	16	72	0	220
EAST		0	8	24	0	289
E-SE		0	16	8	38	720
SE		0	45	0	9	1953
S-SE		4	44	0	0	202
SOUTH		2	0	0	0	844
S-SW		0	0	0	208	920
SW		0	0	0	0	3404
W-SW		0	0	0	150	4635
WEST		0	0	0	0	0
W-NW		4	409	398	0	17
NW		134	507	712	805	805
N-NW		75	0	0	244	632
Total Population per Circle	41	442	1289	1275	1519	20,190
Total Population: All Segments	24,756					

Note: the value 41 in the 0 - 1 column spans all sixteen directions.

Source: Reference 2.5-50.

Table 2.5-3
Segment Population Distribution 0 to 50 Mi. from the Proposed RBS Unit 3 Power Block, 2000

Cardinal Compass Direction	Population in Mile Range from the Proposed RBS Unit 3 Power Block				
	0-10	10-20	20-30	30-40	40-50
NORTH	24,756	975	4575	869	3130
N-NE		391	1478	2895	1275
NE		2184	2800	2258	3276
E-NE		4500	3826	1827	4605
EAST		2559	2940	3797	16,750
E-SE		11,422	24,019	18,035	16,133
SE		34,042	131,618	68,166	38,114
S-SE		21,352	170,275	42,308	23,852
SOUTH		2676	5498	13,085	2304
S-SW		4005	4060	175	3278
SW		4396	1076	1965	33,354
W-SW		606	2822	3990	47,241
WEST		1114	1476	1818	2863
W-NW		168	1978	4892	15,259
NW		370	5543	215	828
N-NW		855	763	53	146
Total Population per Circle	24,756	91,615	364,747	166,348	212,408
Total Population: All Segments	859,874				

Source: Reference 2.5-50.

Table 2.5-4
Resident and Transient Population Density at 10-Mi. Concentric Circles

Concentric Circle	Population			Land Area (Sq. Mi.)	Population Density (Persons per Sq. Mi.)
	Resident	Transient	Total		
0 – 1 Mi.	41	650	691	3.1	220
1 – 2 Mi.	442	544	986	9.4	105
2 – 3 Mi.	1289	245	1534	15.7	98
3 – 4 Mi.	1275	2119	3394	22.0	154
4 – 5 Mi.	1519	49	1568	28.3	55
5 - 10 Mi.	20,190	1884	22,074	235.6	94
0 - 10 Mi.	24,756	5491	30,247	314.2	96
Louisiana			4,468,976	43,562	103

Source: References 2.5-1 and 2.5-50.

Table 2.5-5
Resident and Transient Population and Density by Concentric Circle

Concentric Circle	Population			Land Area (Sq. Mi.)	Population Density (Persons per Sq. Mi.)
	Resident	Transient	Total		
0 - 10 Mi.	24,756	5491	30,247	314	96
10 - 20 Mi.	91,615	12,619	104,234	942	111
20 - 30 Mi.	364,747	23,303	388,050	1571	247
30 - 40 Mi.	166,348	6824	173,172	2199	79
40 - 50 Mi.	212,408	10,330	222,738	2827	79
0 - 50 Mi.	859,874	58,567	918,441	7854	117
Louisiana			4,468,976	43,562	103

Source: References 2.5-1, 2.5-2, 2.5-3, 2.5-4, 2.5-5, 2.5-50, and 2.5-51.

Table 2.5-6
Special Facilities Transient Population Data for the Regional Parishes and Counties

	Number of People Living in:					
Parish/County	State Prisons/ Local Jails[(a)]	College Dormitories[(b)]	Nursing Homes	Hospitals or Wards[(c)]	Religious Group Quarters[(d)]	Other Non-household Living Situations[(e)]
Ascension	234	0	314	65	21	12
Assumption	57	0	106	3	25	0
Avoyelles	2337	0	728	38	9	0
Catahoula	392	0	116	0	0	0
Concordia	457	0	155	77	0	0
East Baton Rouge	2706	7713	2412	771	232	842
East Feliciana	1720	0	527	5	0	18
Evangeline	1220	0	331	170	24	27
Iberia	390	0	562	253	19	446
Iberville	3,100	0	233	6	12	3
Lafayette	986	1803	1220	174	119	474
Livingston	142	0	316	79	39	7
Pointe Coupee	106	0	224	0	7	0
St. Helena	0	0	66	6	0	0
St. Landry	355	0	814	220	57	107
St. Martin	420	0	296	71	18	0
Tangipahoa	541	1292	647	293	109	35
West Baton Rouge	436	0	116	13	4	0
West Feliciana	5022	0	116	0	6	2
Adams (MS)	165	14	259	9	9	31
Amite (MS)	24	0	0	0	0	0
Franklin (MS)	2	0	67	10	0	14
Pike (MS)	174	256	404	6	0	22
Wilkinson (MS)	947	0	91	0	0	0
Total:	21,933	11,078	10,120	2269	710	2040

a) Includes local jails (including police lockups), halfway houses, state prisons, juvenile institutions (including short-term care, detention, or diagnostic centers), other correctional institutions, federal prisons, and military disciplinary barracks.

b) Includes college quarters off campus.

c) Includes homes for the mentally/physically handicapped/ill, hospitals/wards and hospices for chronically ill, orthopedic wards, institutions for the deaf or blind, patients who have no usual home elsewhere.

d) Includes workers' dormitories, agriculture workers' dormitories on farms, and other group homes.

e) Includes other noninstitutional group quarters, job corps, and vocational training facilities.

Source: Reference 2.5-51.

Table 2.5-7
U.S. Census Commuter Information

Parish or County (State)	Inflow	Outflow	Net Flow
Ascension Parish (LA)	1851	2601	-750
Assumption Parish (LA)	456	3096	-2640
Avoyelles Parish (LA)	718	2793	-2075
Catahoula Parish (LA)	286	801	-515
Concordia Parish (LA)	223	712	-489
East Baton Rouge Parish (LA)	4392	4417	-25
East Feliciana Parish (LA)	66	133	-67
Evangeline Parish (LA)	481	2017	-1536
Iberia Parish (LA)	3079	2439	640
Iberville Parish (LA)	290	289	1
Lafayette Parish (LA)	12,610	5074	7536
Livingston Parish (LA)	160	2241	-2081
Pointe Coupee Parish (LA)	137	177	-40
St. Helena Parish (LA)	31	206	-175
St. Landry Parish (LA)	1538	2665	-1127
St. Martin Parish (LA)	412	1712	-1300
Tangipahoa Parish (LA)	2248	8482	-6234
West Baton Rouge Parish (LA)	175	189	-14
West Feliciana Parish (LA)	230	101	129
Adams Co. (MS)	856	1008	-152
Amite Co. (MS)	63	482	-419
Franklin Co. (MS)	200	670	-470
Pike Co. (MS)	2359	2129	230
Wilkinson Co. (MS)	109	131	-22
Total 50-Mi. Area	32,970	44,565	11,595

Source: Reference 2.5-2.

Table 2.5-8 (Sheet 1 of 2)
Special Population Estimates for Affected Counties in the Gulf Coast Area

County Name	Household Population Estimates: Official Series July 1, 2004	Official Series July 1, 2005	Special Estimate January 1, 2006	Growth Rate: July 1, 2004 - July 1, 2005	July 1, 2005 - January 1, 2006
Louisiana	**3,315,075**	**3,330,600**	**2,985,819**	**0.47%**	**-10.35%**
Acadia	58,182	58,570	58,697	0.67%	0.22%
Allen	21,245	21,252	21,435	0.03%	0.86%
Ascension	***86,373***	***89,855***	***94,128***	***4.03%***	***4.76%***
Assumption	***23,006***	***22,996***	***23,361***	***-0.04%***	***1.59%***
Beauregard	32,822	33,372	33,009	1.68%	-1.09%
Calcasieu	179,925	180,709	174,639	0.44%	-3.36%
Cameron	9561	9493	7532	-0.71%	-20.66%
East Baton Rouge	***396,882***	***396,735***	***413,700***	***-0.04%***	***4.28%***
East Feliciana	***18,284***	***18,237***	***18,503***	***-0.26%***	***1.46%***
Evangeline	***33,486***	***33,768***	***33,778***	***0.84%***	***0.03%***
Iberia	***72,551***	***72,773***	***72,804***	***0.31%***	***0.04%***
Iberville	***29,204***	***29,107***	***29,729***	***-0.33%***	***2.14%***
Jefferson	448,843	448,578	411,305	-0.06%	-8.31%
Jefferson Davis	30,764	30,857	30,624	0.30%	-0.76%
Lafayette	***190,459***	***192,448***	***194,938***	***1.04%***	***1.29%***
Lafourche	90,319	90,543	91,153	0.25%	0.67%
Livingston	***105,174***	***108,622***	***111,863***	***3.28%***	***2.98%***
Orleans	443,430	437,186	158,353	-1.41%	-63.78%
Plaquemines	28,258	28,282	20,164	0.08%	-28.70%
Pointe Coupee	***22,107***	***22,040***	***22,649***	***-0.30%***	***2.76%***
Sabine	23,160	23,369	23,809	0.90%	1.88%
St. Bernard	64,848	64,576	3361	-0.42%	-94.80%
St. Charles	49,525	50,203	52,269	1.37%	4.12%
St. Helena	***10,237***	***10,187***	***10,920***	***-0.49%***	***7.20%***
St. James	20,801	20,885	21,773	0.40%	4.25%
St. John the Baptist	45,087	45,950	48,642	1.91%	5.86%

Table 2.5-8 (Sheet 2 of 2)
Special Population Estimates for Affected Counties in the Gulf Coast Area

	Household Population Estimates			Growth Rate	
County Name	**Official Series July 1, 2004**	**Official Series July 1, 2005**	**Special Estimate January 1, 2006**	**July 1, 2004 - July 1, 2005**	**July 1, 2005 - January 1, 2006**
St. Landry	***87,794***	***88,409***	***89,555***	***0.70%***	***1.30%***
St. Martin	***49,526***	***49,642***	***49,993***	***0.23%***	***0.71%***
St. Mary	51,379	50,787	50,744	-1.15%	-0.08%
St. Tammany	211,398	217,999	220,651	3.12%	1.22%
Tangipahoa	***101,761***	***103,261***	***109,501***	***1.47%***	***6.04%***
Terrebonne	105,041	106,078	107,291	0.99%	1.14%
Vermilion	53,857	54,428	54,463	1.06%	0.06%
Vernon	46,100	45,323	45,828	-1.69%	1.11%
Washington	42,439	42,966	43,523	1.24%	1.30%
West Baton Rouge	***21,285***	***21,064***	***20,836***	***-1.04%***	***-1.08%***
West Feliciana	***9962***	***10,050***	***10,296***	***0.88%***	***2.45%***
Mississippi	**1,868,716**	**1,882,198**	**1,839,808**	**0.72%**	**-2.25%**
Adams	***31,988***	***31,640***	***31,506***	***-1.09%***	***-0.42%***
Amite	***13,322***	***13,337***	***13,702***	***0.11%***	***2.74%***
Franklin	***8322***	***8318***	***8329***	***-0.05%***	***0.13%***
Pike	***38,219***	***38,548***	***39,297***	***0.86%***	***1.94%***
Wilkinson	***9052***	***9069***	***9444***	***0.19%***	***4.13%***
Primary Impact Area	***468,520***	***468,126***	***485,984***	***-0.08%***	***3.81%***

Notes:
Counties in gray comprise the primary impact area.
Counties **bold** and *italized are within 50 mi. of the RBS.*

Source: Reference 2.5-52.

Table 2.5-9
Population and Average Annual Growth Rates

	Historical and Estimated Population			Average Annual Growth Rate		
County	1990	2000	July 1, 2005	'90 - '00	'00 - '05	'90 - '05
Louisiana	4,221,826	4,468,976	4,507,331	0.57%	0.17%	0.42%
Ascension	58,214	76,627	90,447	2.79%	3.37%	2.88%
Assumption	22,753	23,388	23,108	0.28%	-0.24%	0.10%
Avoyelles	39,159	41,481	41,789	0.58%	0.15%	0.43%
Catahoula	11,065	10,920	10,472	-0.13%	-0.83%	-0.37%
Concordia	20,828	20,247	19,298	-0.28%	-0.96%	-0.51%
East Baton Rouge	380,105	412,852	409,809	0.83%	-0.15%	0.50%
East Feliciana	19,211	21,360	20,703	1.07%	-0.62%	0.50%
Evangeline	33,274	35,434	35,462	0.63%	0.02%	0.43%
Iberia	68,297	73,266	74,212	0.70%	0.26%	0.56%
Iberville	31,049	33,320	32,160	0.71%	-0.71%	0.23%
Lafayette	164,762	190,503	196,627	1.46%	0.63%	1.19%
Livingston	70,523	91,814	108,958	2.67%	3.48%	2.94%
Pointe Coupee	22,540	22,763	22,288	0.10%	-0.42%	-0.07%
St. Helena	9874	10,525	10,138	0.64%	-0.75%	0.18%
St. Landry	80,312	87,700	89,640	0.88%	0.44%	0.74%
St. Martin	44,097	48,583	50,228	0.97%	0.67%	0.87%
Tangipahoa	85,709	100,588	106,152	1.61%	1.08%	1.44%
West Baton Rouge	19,419	21,601	21,634	1.07%	0.03%	0.72%
West Feliciana	12,915	15,111	15,185	1.58%	0.10%	1.09%
Mississippi	2,575,475	2,844,658	2,908,496	1.00%	0.44%	0.81%
Adams	35,356	34,340	32,059	-0.29%	-1.37%	-0.65%
Amite	13,328	13,599	13,395	0.20%	-0.30%	0.03%
Franklin	8377	8448	8293	0.08%	-0.37%	-0.07%
Pike	36,882	38,940	39,204	0.54%	0.14%	0.41%
Wilkinson	9678	10,312	10,134	0.64%	-0.35%	0.31%
Primary Impact Area	454,190	493,687	489,619	0.84%	-0.17%	0.50%

Note: Counties in gray comprise the primary impact area.

Source: Reference 2.5-49.

Table 2.5-10 (Sheet 1 of 4)
0- to 10-Mi. Resident and Transient Population Projections

Year	0-1 Miles
2000	691
2012	786
2017	830
2027	924
2037	1030
2047	1147
2057	1278

Cardinal Compass Direction	Year	Mile Range 1-2	2-3	3-4	4-5	5-10	Total
	2000	100	126	0	43	773	1042
	2012	113	143	0	48	879	1183
	2017	120	151	0	51	928	1250
NORTH	2027	133	168	0	57	1034	1392
	2037	149	187	0	64	1152	1552
	2047	166	209	0	71	1283	1729
	2057	185	233	0	79	1430	1927
	2000	106	83	1059	0	511	1759
	2012	120	94	1205	0	581	2000
	2017	127	100	1272	0	613	2112
N-NE	2027	141	111	1417	0	683	2352
	2037	158	124	1578	0	761	2621
	2047	176	138	1758	0	848	2920
	2057	196	154	1959	0	945	3254
	2000	0	35	2	22	4503	4562
	2012	0	39	2	25	5025	5091
	2017	0	41	2	26	5260	5329
NE	2027	0	46	2	29	5764	5841
	2037	0	51	2	32	6317	6402
	2047	0	57	3	36	6922	7018
	2057	0	64	3	40	7585	7692

Table 2.5-10 (Sheet 2 of 4)
0- to 10-Mi. Resident and Transient Population Projections

Cardinal Compass Direction	Year	Mile Range 1-2	2-3	3-4	4-5	5-10	Total
E-NE	2000	17	16	72	0	220	325
	2012	19	18	81	0	235	353
	2017	20	19	86	0	242	367
	2027	22	21	96	0	256	395
	2037	25	23	107	0	271	426
	2047	28	26	119	0	286	459
	2057	31	29	133	0	303	496
EAST	2000	0	8	24	19	289	340
	2012	0	9	26	20	306	361
	2017	0	9	27	20	314	370
	2027	0	10	30	22	330	392
	2037	0	11	32	23	347	413
	2047	0	13	35	24	365	437
	2057	0	14	38	26	384	462
E-SE	2000	0	16	8	38	720	782
	2012	0	18	8	40	764	830
	2017	0	19	8	41	783	851
	2027	0	21	9	43	823	896
	2037	0	23	9	45	866	943
	2047	0	26	10	48	910	994
	2057	0	29	10	50	957	1046
SE	2000	0	45	0	39	2267	2351
	2012	0	51	0	41	2407	2499
	2017	0	54	0	42	2468	2564
	2027	0	60	0	44	2595	2699
	2037	0	67	0	46	2728	2841
	2047	0	74	0	49	2869	2992
	2057	0	83	0	51	3016	3150
S-SE	2000	4	44	0	0	772	820
	2012	4	50	0	0	825	879
	2017	4	52	0	0	848	904
	2027	5	58	0	0	897	960
	2037	5	65	0	0	949	1019
	2047	6	73	0	0	1003	1082
	2057	7	81	0	0	1061	1149

Table 2.5-10 (Sheet 3 of 4)
0- to 10-Mi. Resident and Transient Population Projections

Cardinal Compass Direction	Year	Mile Range 1-2	2-3	3-4	4-5	5-10	Total
SOUTH	2000	2	0	100	0	844	946
	2012	2	0	113	0	878	993
	2017	2	0	120	0	893	1015
	2027	2	0	133	0	924	1059
	2037	2	0	149	0	955	1106
	2047	3	0	166	0	988	1157
	2057	3	0	185	0	1022	1210
S-SW	2000	0	0	0	208	936	1144
	2012	0	0	0	206	927	1133
	2017	0	0	0	205	924	1129
	2027	0	0	0	204	917	1121
	2037	0	0	0	203	910	1113
	2047	0	0	0	201	903	1104
	2057	0	0	0	200	896	1096
SW	2000	0	245	0	0	3439	3684
	2012	0	251	0	0	3408	3659
	2017	0	254	0	0	3395	3649
	2027	0	259	0	0	3370	3629
	2037	0	265	0	0	3344	3609
	2047	0	271	0	0	3319	3590
	2057	0	277	0	0	3295	3572
W-SW	2000	0	0	0	150	4850	5000
	2012	0	0	0	148	4819	4967
	2017	0	0	0	148	4806	4954
	2027	0	0	0	146	4780	4926
	2037	0	0	0	145	4755	4900
	2047	0	0	0	144	4730	4874
	2057	0	0	0	143	4705	4848
WEST	2000	0	0	400	0	80	480
	2012	0	0	427	0	90	517
	2017	0	0	439	0	94	533
	2027	0	0	464	0	105	569
	2037	0	0	491	0	116	607
	2047	0	0	519	0	128	647
	2057	0	0	549	0	142	691

Table 2.5-10 (Sheet 4 of 4)
0- to 10-Mi. Resident and Transient Population Projections

Cardinal Compass Direction	Year	Mile Range 1-2	2-3	3-4	4-5	5-10	Total
W-NW	2000	4	409	598	0	17	1028
	2012	4	465	680	0	19	1168
	2017	4	491	718	0	20	1233
	2027	5	547	800	0	22	1374
	2037	5	609	891	0	25	1530
	2047	6	679	993	0	28	1706
	2057	7	756	1106	0	31	1900
NW	2000	678	507	1131	805	905	4026
	2012	771	577	1287	916	1030	4581
	2017	814	609	1358	967	1087	4835
	2027	907	678	1513	1077	1211	5386
	2037	1010	755	1686	1200	1349	6000
	2047	1126	842	1878	1337	1503	6686
	2057	1254	938	2092	1489	1674	7447
N-NW	2000	75	0	0	244	948	1267
	2012	85	0	0	277	1079	1441
	2017	90	0	0	293	1138	1521
	2027	100	0	0	326	1268	1694
	2037	111	0	0	363	1413	1887
	2047	124	0	0	405	1574	2103
	2057	138	0	0	451	1753	2342

Source: References 2.5-1 and 2.5-50.

Table 2.5-11 (Sheet 1 of 4)
10- to 50-Mi. Resident and Transient Population Projection

Cardinal Compass Direction	Year	Mile Range 10 - 20	20 - 30	30 - 40	40 - 50	Total
NORTH	2000	1116	4916	1154	3452	10,638
	2012	1223	5100	1193	3256	10,772
	2017	1271	5179	1210	3178	10,838
	2027	1372	5340	1244	3028	10,984
	2037	1482	5507	1279	2884	11,152
	2047	1600	5678	1315	2748	11,341
	2057	1728	5855	1352	2617	11,552
N-NE	2000	462	1690	3149	1406	6707
	2012	511	1753	3234	1399	6897
	2017	533	1780	3270	1396	6979
	2027	581	1835	3344	1390	7150
	2037	632	1892	3419	1384	7327
	2047	688	1950	3496	1379	7513
	2057	750	2011	3575	1373	7709
NE	2000	2351	2994	2377	3415	11,137
	2012	2502	3090	2386	3428	11,406
	2017	2568	3130	2390	3434	11,522
	2027	2705	3214	2398	3445	11,762
	2037	2850	3300	2406	3457	12,013
	2047	3002	3388	2414	3468	12,272
	2057	3162	3478	2423	3480	12,543
E-NE	2000	4726	4145	2011	4891	15,773
	2012	5017	4397	2053	5047	16,514
	2017	5144	4507	2072	5114	16,837
	2027	5407	4735	2108	5250	17,500
	2037	5683	4975	2146	5389	18,193
	2047	5974	5227	2184	5533	18,918
	2057	6279	5491	2222	5680	19,672

Table 2.5-11 (Sheet 2 of 4)
10- to 50-Mi. Resident and Transient Population Projection

Cardinal Compass Direction	Year	Mile Range				Total
		10 - 20	20 - 30	30 - 40	40 - 50	
EAST	2000	2750	3421	3997	17,538	27,706
	2012	2919	3615	4098	19,494	30,126
	2017	2993	3700	4142	20,372	31,207
	2027	3146	3875	4230	22,250	33,501
	2037	3307	4058	4319	24,300	35,984
	2047	3476	4250	4411	26,539	38,676
	2057	3654	4451	4505	28,984	41,594
E-SE	2000	12,557	25,415	18,626	16,794	73,392
	2012	13,335	30,670	26,135	23,335	93,475
	2017	13,674	33,169	30,097	26,763	103,703
	2027	14,377	38,793	39,914	35,204	128,288
	2037	15,116	45,372	52,933	46,307	159,728
	2047	15,893	53,066	70,199	60,911	200,069
	2057	16,711	62,064	93,095	80,121	251,991
SE	2000	35,819	136,295	70,550	39,564	282,228
	2012	38,041	150,275	93,123	55,847	337,286
	2017	39,007	156,515	104,542	64,472	364,536
	2027	41,014	169,783	131,752	85,926	428,475
	2037	43,123	184,176	166,045	114,518	507,862
	2047	45,342	199,790	209,263	152,625	607,020
	2057	47,674	216,727	263,730	203,412	731,543
S-SE	2000	22,586	182,560	47,038	24,759	276,943
	2012	24,175	195,334	50,599	30,851	300,959
	2017	24,870	200,917	52,161	33,813	311,761
	2027	26,320	212,566	55432,	40,618	334,936
	2037	27,855	224,891	58,907	48,791	360,444
	2047	29,479	237,930	62,601	58,609	388,619
	2057	31,198	251,726	66,526	70,403	419,853

Table 2.5-11 (Sheet 3 of 4)
10- to 50-Mi. Resident and Transient Population Projection

Cardinal Compass Direction	Year	Mile Range				Total
		10 - 20	20 - 30	30 - 40	40 - 50	
SOUTH	2000	2961	5883	13,523	2606	24,973
	2012	3208	6312	13,914	2724	26,158
	2017	3317	6500	14,081	2775	26,673
	2027	3547	6894	14,420	2880	27,741
	2037	3792	7311	14,	2988	28,859
	2047	4055	7753	15,124	3101	30,033
	2057	4335	8222	15,488	3218	31,263
S-SW	2000	4226	4252	308	3805	12,591
	2012	4292	4388	325	4219	13,224
	2017	4319	4446	333	4404	13,502
	2027	4376	4565	349	4800	14,090
	2037	4433	4686	366	5232	14,717
	2047	4490	4811	384	5702	15,387
	2057	4549	4939	402	6215	16,105
SW	2000	4658	1166	2358	34,775	42,957
	2012	4616	1184	2597	38,697	47,094
	2017	4599	1192	2703	40,459	48,953
	2027	4564	1208	2930	44,228	52,930
	2037	4530	1225	3176	48,348	57,279
	2047	4496	1241	3442	52,851	62,030
	2057	4463	1258	3731	57,774	67,226
W-SW	2000	659	3043	4434	48,824	56,960
	2012	653	3121	4841	53,317	61,932
	2017	650	3155	5022	55,310	64,137
	2027	645	3223	5403	59,521	68,792
	2037	640	3292	5814	64,053	73,799
	2047	636	3363	6256	68,929	79,184
	2057	631	3436	6731	74,177	84,975

Table 2.5-11 (Sheet 4 of 4)
10- to 50-Mi. Resident and Transient Population Projection

Cardinal Compass Direction	Year	Mile Range 10 - 20	20 - 30	30 - 40	40 - 50	Total
WEST	2000	1180	1667	2115	3260	8222
	2012	1220	1725	2303	3538	8786
	2017	1237	1750	2387	3661	9035
	2027	1272	1801	2563	3921	9557
	2037	1308	1854	2753	4198	10,113
	2047	1345	1908	2956	4495	10,704
	2057	1384	1963	3174	4814	11,335
W-NW	2000	261	2174	5330	17,582	25,347
	2012	277	2187	5597	18,520	26,581
	2017	284	2192	5713	18,926	27,115
	2027	299	2203	5951	19,764	28,217
	2037	315	2215	6199	20,639	29,368
	2047	331	2226	6458	21,553	30,568
	2057	349	2237	6727	22,508	31,821
NW	2000	414	5770	483	1202	7869
	2012	463	5915	492	1219	8089
	2017	485	5977	496	1226	8184
	2027	533	6102	504	1241	8380
	2037	586	6230	512	1256	8584
	2047	644	6361	520	1271	8796
	2057	708	6495	528	1286	9017
N-NW	2000	5981	1132	286	375	7774
	2012	6617	1174	278	351	8420
	2017	6901	1192	275	342	8710
	2027	7508	1229	269	324	9330
	2037	8168	1267	264	307	10,006
	2047	8886	1307	258	292	10,743
	2057	9667	1347	253	276	11,543

Source: References 2.5-2, 2.5-3, 2.5-4, 2.5-5, 2.5-50, and 2.5-51.

Table 2.5-12
Historical and Projected Population by Age Distribution, at 10 and 50 Mi. from the RBS Unit 3 Power Block, 2000 and 2047

	Mile Radius from the Unit 3 Power Block			
	0 - 10 Mi.		0 - 50 Mi.	
Age	2000[a]	Projected 2047[b]	2000	Projected 2047
Under 5	1610	2106	61,788	106,699
Age 5 to 9	1825	2386	65,146	112,498
Age 10 to 14	1943	2540	66,604	115,017
Age 15 to 19	2021	2,643	74,244	128,210
Age 20 to 24	1482	1937	68,936	119,043
Age 25 to 34	3035	3969	119,284	205,988
Age 35 to 44	4196	5487	134,828	232,831
Age 45 to 54	3650	4773	113,103	195,314
Age 55 to 59	1208	1580	39,151	67,608
Age 60 to 64	981	1282	30,757	53,114
Age 65 to 74	1611	2106	48,762	84,206
Age 75 to 84	862	1127	29,731	51,342
Age 85 and up	333	436	9540	16,475
Total	24,756	32,373	859,874	1,488,347

a) Methodology: CBG estimating approach.

b) 2047 Corresponds to the projected midpoint of RBS Unit 3 station operating life.

Source: Reference 2.5-3.

Table 2.5-13
Age and Sex Distribution in the LPZ, EPZ, and Region

Population Parameter	LPZ[a]	Emergency Planning Zone[a]	Region[a]
Sex			
Male	2125	19,272	449,470
Female	2238	18,474	468,834
Age			
Less than 5 Years	285	2455	65,833
5 - 9 Years	340	2782	69,411
10 - 14 Years	372	2962	70,965
15 - 19 Years	362	3082	79,105
20 - 24 Years	234	2259	73,449
25 - 34 Years	501	4628	127,094
35 - 44 Years	699	6398	143,656
45 - 54 Years	675	5565	120,508
55 - 59 Years	227	1842	41,714
60 - 64 Years	164	1495	32,771
65 - 74 Years	297	2456	51,955
75 - 84 Years	146	1314	31,678
85 Years and Up	61	508	10,165
Total	4363	37,746	918,304

a) Methodology: CBG estimating approach.

Notes:

1. The LPZ is defined as the area located within a 2-mi. radius of the RBS reactor containment.
2. The plume exposure EPZ is a 10-mi. radius area surrounding the RBS site.
3. The region is defined as the area located within a 50-mi. radius of the RBS site.

Source: Reference 2.5-3.

Table 2.5-14
Racial and Ethnic Distribution within the LPZ, EPZ, and Region

	LPZ[(a)]	EPZ[(a)]	Region[(a)]
Ethnicity			
African-American	1182	15,497	324,016
Asian	12	106	9976
Hawaiian	0	4	187
Native American	15	82	2269
Caucasian	3111	21,550	562,832
Hispanic	29	327	13,506
Other	180	154	5518

a) Methodology: CBG estimating approach.Notes:

Notes:

1. The LPZ is defined as the area located within a 2-mi. radius of the RBS reactor containment.
2. The plume exposure EPZ is a 10-mi. radius area surrounding the RBS site.
3. The region is defined as the area located within a 50-mi. radius of the RBS site.

Source: Reference 2.5-3.

Table 2.5-15
Household Income Distribution in the LPZ, EPZ, and Region

Income Category	Households in the LPZ[(a)]	Households in the EPZ[(a)]	Households in the Region[(a)]
Less than $10,000	136	1970	50,582
$10,000 to $14,999	114	1011	27,054
$15,000 to $24,999	178	1703	47,532
$25,000 to $34,999	152	1507	42,933
$35,000 to $49,999	258	2066	51,945
$50,000 to $74,999	323	2390	58,055
$75,000 to $99,999	148	1129	28,524
$100,000 to $149,999	166	786	18,452
$150,000 to $199,999	57	165	3990
$200,000 or More	62	173	4438

a) Methodology: CBG estimating approach.

Notes:

1. The LPZ is defined as the area located within a 2-mi. radius of the RBS Unit 1 reactor containment.
2. The plume exposure EPZ is a 10-mi. radius area surrounding the RBS site.
3. The region is defined as the area located within a 50-mi. radius of the RBS site.

Source: Reference 2.5-3.

Table 2.5-16
Regional and State Median Household Income Data

LA Parish or MS County	Households (2000)	Persons per Household (2000)	Median Household Income (2004)	Per Capita Money Income (1999)	Persons Below Poverty, Percent (2004)
Ascension	26,691	2.85	$48,789	$17,858	12.00
Assumption	8239	2.81	$34,781	$14,008	19.30
Avoyelles	14,736	2.6	$25,915	$12,146	24.80
Catahoula	4082	2.55	$24,201	$12,607	24.50
Concordia	7521	2.6	$25,033	$11,966	25.60
East Baton Rouge	156,365	2.55	$37,262	$19,790	18.00
East Feliciana	6699	2.76	$31,995	$15,428	19.30
Evangeline	12,736	2.64	$24,220	$11,432	26.00
Iberia	25,381	2.82	$33,358	$14,145	21.10
Iberville	10,674	2.81	$30,738	$13,272	22.50
Lafayette	72,372	2.57	$39,367	$19,371	16.50
Livingston	32,630	2.8	$42,474	$16,282	13.20
Pointe Coupee	8397	2.67	$32,256	$15,387	19.90
St. Helena	3873	2.7	$29,545	$12,318	22.00
St. Landry	32,328	2.67	$26,290	$12,042	23.90
St. Martin	17,164	2.78	$31,977	$13,619	20.40
Tangipahoa	36,558	2.66	$30,785	$14,461	22.20
West Baton Rouge	7663	2.74	$37,120	$15,773	16.80
West Feliciana	3645	2.73	$37,271	$16,201	20.40
Adams (MS)	13,677	2.48	$25,143	$15,778	24.30
Amite (MS)	5271	2.58	$27,769	$14,048	19.80
Franklin (MS)	3211	2.6	$27,883	$13,643	20.10
Pike (MS)	14,792	2.57	$26,173	$14,040	23.90
Wilkinson (MS)	3578	2.59	$21,771	$10,868	30.80
State					
Louisiana	1,656,053	2.62	$35,216	$16,912	19.20
Mississippi	1,046,434	2.63	$34,278	$15,853	19.30

Source: Reference 2.5-53.

Table 2.5-17
Employment by Industry in the Region and in the Primary Impact Area, 2000

		Primary Impact Area Employment				
Industry	**Regional Industry Employment**	**West Feliciana Parish**	**East Baton Rouge Parish**	**West Baton Rouge Parish**	**Pointe Coupee Parish**	**East Feliciana Parish**
Agriculture, Forestry, Fishing, Hunting, and Mining	9930	204	1451	109	615	266
Construction	35,874	290	13,089	924	852	763
Manufacturing	45,627	682	18,640	1510	1121	1034
Wholesale Trade	13,690	67	6507	415	282	203
Retail Trade	45,510	323	21,749	1031	1189	638
Transportation and Warehousing and Utilities	18,464	379	8,024	612	628	475
Information	7212	43	4284	91	100	54
Finance Insurance, Real Estate, and Rental Leasing	23,443	177	13,773	448	400	278
Professional, Scientific, Management, Administrative, and Waste Management Services	31,165	252	19,511	711	408	386
Educational, Health, and Social Services	82,322	825	44,106	1645	1716	2021
Arts, Entertainment, Recreation, Accommodation, and Food Services	29,343	292	16,936	696	577	324
Other Services (except public administration)	19,510	125	9624	467	380	344
Public Administration	28,129	710	15,021	749	643	815
Total:	390,219	4369	192,715	9408	8911	7601

Source: Reference 2.5-3.

Table 2.5-18 (Sheet 1 of 2)
Primary Impact Area's Largest Employers

West Feliciana Parish	
Louisiana State Corrections Penitentiary	1100
Entergy Operations, Inc.	700
Tembec USA	520
The Bluffs	100
West Feliciana Hospital	100
East Baton Rouge Parish	
Turner Industries	8525
Louisiana State University	5600
ExxonMobil Chemical Co.	4275
The Shaw Group	4243
Our Lady of the Lake Medical Center	4009
Baton Rouge General Medical Center	3000
Oshner Clinic Foundations	2000
Woman's Hospital	1982
Southern University	1800
H & E Equipment Services, Inc.	1620
BCBS of LA	1525
Cajun Contractors	1500
Aegis Lending Corp.	1400
Newtron Group, Inc.	1342
West Baton Rouge Parish	
Petrin Corp.	670
Trinity Marine Port Allen	400
Wal-Mart	300
Shaw SSS Fabricators	140
West Baton Rouge Council	125
ExxonMobil	120
Alcoa, Inc.	115
Martin-Brower Co.	100

Table 2.5-18 (Sheet 2 of 2)
Primary Impact Area's Largest Employers

Pointe Coupee	
Louisiana Generating	360
Nan Ya Plastics Corp.	226
Wal-Mart	200
Pointe Coupee General Hospital	175
Louisiana National Guard	136
Town of New Roads	120
Lakeview Manor Nursing Home	120
Pointe Coupee Nursing Home	100
Pointe Coupee Parish Sheriff	75
East Feliciana	
East Louisiana State Hospital	1500
Villa Feliciana Hospital	600
Dixon Correctional Institute	541
Veterans Affairs Department	161
Grace Health & Rehab Center	140
Feliciana Home Health	120
Anvil Attachments	90

Source: References 2.5-54, 2.5-55, 2.5-56, 2.5-57, and 2.5-58.

Table 2.5-19 (Sheet 1 of 2)
Employment, Labor Force Data, and Trends for the Primary Impact Area and Regional Parishes and Counties

LA Parish / MS County	2000				2006				Employment Average Annual Growth Rate
	Labor Force	Employment	Unemployment	Unemployment Rate	Labor Force	Employment	Unemployment	Unemployment Rate	
West Feliciana	4798	4496	302	6.30%	4953	4732	221	4.50%	0.86%
East Baton Rouge	206,885	197,954	8,931	4.30%	214,878	206,815	8063	3.80%	0.73%
West Baton Rouge	10,152	9650	502	4.90%	10,537	10,147	390	3.70%	0.84%
Pointe Coupee	9732	9157	575	5.90%	9852	9434	418	4.20%	0.50%
East Feliciana	8261	7818	443	5.40%	8319	7980	339	4.10%	0.34%
Concordia	7737	7124	613	7.90%	7239	6814	425	5.90%	-0.74%
Ascension	38,356	36,461	1895	4.90%	46,359	44,708	1651	3.60%	3.46%
Assumption	9978	9378	600	6.00%	10,109	9619	490	4.80%	0.42%
Avoyelles	15,681	14,744	937	6.00%	16,061	15,356	705	4.40%	0.68%
Catahoula	4127	3763	364	8.80%	4175	3967	208	5.00%	0.88%
Evangeline	12,116	11,441	675	5.60%	12,116	11,624	492	4.10%	0.26%
Iberia	30,433	28,783	1650	5.40%	34,099	32,967	1132	3.30%	2.29%
Iberville	12,585	11,754	831	6.60%	12,650	11,977	673	5.30%	0.31%
Lafayette	97,296	93,576	3720	3.80%	107,747	104,829	2918	2.70%	1.91%
Livingston	44,722	42,362	2360	5.30%	54,262	52,376	1886	3.50%	3.60%
St. Helena	4052	3833	219	5.40%	4213	3921	292	6.90%	0.38%

Table 2.5-19 (Sheet 2 of 2)
Employment, Labor Force Data, and Trends for the Primary Impact Area and Regional Parishes and Counties

LA Parish / MS County	2000				2006				Employment Average Annual Growth Rate
	Labor Force	Employment	Unemployment	Unemployment Rate	Labor Force	Employment	Unemployment	Unemployment Rate	
St. Landry	32,670	30,683	1987	6.10%	37,475	36,007	1468	3.90%	2.70%
St. Martin	21,316	20,209	1107	5.20%	23,421	22,653	768	3.30%	1.92%
Tangipahoa	45,087	42,361	2726	6.00%	50,389	48,156	2233	4.40%	2.16%
Wilkinson (MS)	3530	3218	312	8.80%	3541	3250	291	8.20%	0.17%
Adams (MS)	14,526	13,571	955	6.60%	13,204	12,277	927	7.00%	-1.66%
Amite (MS)	5547	5238	309	5.60%	5337	5008	329	6.20%	-0.75%
Franklin (MS)	3447	3212	235	6.80%	3222	3002	220	6.80%	-1.12%
Pike (MS)	16,088	15,026	1062	6.60%	15,727	14,688	1039	6.60%	-0.38%
Region	659,122	625,812	33,310	5.05%	709,885	682,307	27,578	3.88%	1.45%

Source: Reference 2.5-59.

Table 2.5-20 (Sheet 1 of 2)
Projected Employment by Industry for Louisiana and the Second Regional Labor Market Area (RMLA 2)

	2004 Annual Average Employment		2014 Projected Employment		Employment Change 2004 - 2014		AAGR[a] 2004 - 2014	
Industry Title	RMLA 2[b]	Louisiana	RMLA 2[b]	Louisiana	RMLA 2[b]	Louisiana	RMLA 2[b]	Louisiana
Agriculture, Fishing, Forestry, and Hunting	2415	23,642	2391	21,278	-24	-2364	-0.10%	-1.05%
Mining	1688	41,891	2129	44,427	441	2536	2.35%	0.59%
Utilities	2,829	9,707	2721	8,890	-108	-817	-0.39%	-0.88%
Construction	34,287	116,988	40,122	131,227	5835	14,239	1.58%	1.16%
Manufacturing	30,590	152,120	30,201	142,574	-389	-9,546	-0.13%	-0.65%
Wholesale Trade	15,491	75,669	16,575	76,733	1084	1064	0.68%	0.14%
Retail Trade	44,781	224,256	48,773	225,440	3,992	1184	0.86%	0.05%
Transportation and Warehousing	12,322	70,660	16,485	77,729	4163	7,069	2.95%	0.96%
Information	6,198	29,829	7350	31,854	1152	2025	1.72%	0.66%
Finance and Insurance	13,488	63,843	15,356	61,151	1868	-2692	1.31%	-0.43%
Real Estate and Rental and Leasing	5473	34,234	7064	36,472	1591	2238	2.58%	0.64%
Professional, Scientific, and Technical Services	16,665	72,610	23,996	84,742	7331	12,132	3.71%	1.56%
Management of Companies and Enterprises	4343	21,975	5075	24,288	732	2313	1.57%	1.01%

Table 2.5-20 (Sheet 2 of 2)
Projected Employment by Industry for Louisiana and the Second Regional Labor Market Area (RMLA 2)

Industry Title	2004 Annual Average Employment		2014 Projected Employment		Employment Change 2004 - 2014		AAGR[a] 2004 - 2014	
	RMLA 2[b]	Louisiana	RMLA 2[b]	Louisiana	RMLA 2[b]	Louisiana	RMLA 2[b]	Louisiana
Administrative and Waste Services	19,263	90,067	25,357	96,014	6094	5947	2.79%	0.64%
Educational Services	41,048	180,573	46,483	190,988	5435	10,415	1.25%	0.56%
Health Care and Social Assistance	44,508	251,823	61,459	297,535	16,951	45,712	3.28%	1.68%
Arts, Entertainment, and Recreation	4797	37,441	6366	36,290	1569	-1151	2.87%	-0.31%
Accommodation and Food Services	30,094	166,539	39,663	195,003	9569	28,464	2.80%	1.59%
Other Services, Except Public Administration	42,258	194,638	49,619	192,561	7361	-2077	1.62%	-0.11%
Government	40,924	164,439	45,033	170,971	4109	6532	0.96%	0.39%
Total, All Industries	413,462	2,022,944	492,218	2,146,167	78,756	123,223	1.76%	0.59%

a) Average Annual Growth Rate.

b) Second RLHA, Baton Rouge Region (RLMA 2). This area includes: Ascension, East Baton Rouge, East Feliciana, Iberville, Livingston, Pointe Coupee, St. Helena, Tangipahoa, Washington, West Baton Rouge, and West Feliciana.

Source: Reference 2.5-60.

Table 2.5-21
West Feliciana Parish Sales and Use Tax Rates

Jurisdiction	Total Rate	State Rate	Parish Rate
St. Francisville	8%	4%	4%
Balance of Parish	8%	4%	4%

Source: Reference 2.5-61.

Table 2.5-22
East Baton Rouge Parish (EBRP) Sales and Use Tax Rates

Jurisdiction	Total Rate	State Rate	Parish Rate
Baton Rouge	9%	4%	5%
Baker	9.5%	4%	5.5%
Zachary	9%	4%	5%
Central	9%	4%	5%
Balance of Parish	9%	4%	5%

Parish Rate Breakdown of Sales and Use Tax Rates

Jurisdiction	School Board	Sewer and Street Improvement	Police Jury	City/Town	Educational Facilities Improvement District
Baton Rouge	1%	1%	N/A	2%	1%
Baker and Baker School District	2%	1%	N/A	2.5%	N/A
Baker and EBRP School District	1%	1%	N/A	2.5%	1%
Zachary and Zachary School District	1%	1%	N/A	2%	1%
Central and Central School District	1%	1%	N/A	2%	1%
Parish of EBR and EBR School District	1%	1%	2%	N/A	1%
Parish of EBR Zachary School District	1%	1%	2%	N/A	1%
Parish of EBR Central School District	1%	1%	2%	N/A	1%

Source: Reference 2.5-62.

Table 2.5-23
West Baton Rouge Parish Sales and Use Tax Rates

Tax Recipient	Rate	Affected Region
School Board	1%	Parish wide
Educational Facilities Improvements	1%	Parish wide
Parish	1%	Parish wide and municipalities
Sales Tax District No. 1	1%	Parish wide and municipalities (Port Allen, Addis, Brusly) excluding certain industrial districts
Fire Protection District No. 1	0.5%	
Correctional Facilities	0.5%	Parish wide and municipalities (Port Allen, Addis, Brusly)

Source: Reference 2.5-63.

Table 2.5-24
Pointe Coupee Sales and Use Tax Rates

Jurisdiction	Total Rate	State Rate	Parish Rate
New Roads	9%	4%	5%
Livonia	9%	4%	5%
Morganza	9%	4%	5%
Fordoche	9%	4%	5%
Balance of Parish	8%	4%	4%
Parish Rate Breakdown of Sales and Use Tax Rates			
Jurisdiction	School Board	Police Jury	City/Town
New Roads	2%	2%	1%
Livonia	2%	2%	1%
Morganza	2%	2%	1%
Fordoche	2%	2%	1%
Balance of Parish	2%	2%	N/A

Source: Reference 2.5-64.

Table 2.5-25
East Feliciana Sales and Use Tax Rates

Jurisdiction	Total Rate	State Rate	Parish Rate
East Feliciana Parish	9%	4%	5%
Parish Rate Breakdown of Sales and Use Tax Rates			
Jurisdiction	School Board	Police Jury	
East Feliciana Parish	2%	3%	

Source: Reference 2.5-65.

Table 2.5-26
Various and Per Capita Tax Collections for West Feliciana and Adjacent Parishes

Parish	Gross Sales Tax Due FYE 06[a]	Sale Tax (Per Capita) FYE '06	Distribution of Local Property Taxes 2005	Property Taxes (per Cap) 2005	LA Adjusted Individual Income Tax FYE '06	LA Adjusted Income Tax (per Cap) FYE '06
West Feliciana	$2,597,906	$171	$19,363,433	$1274	$5,443,690	$358
East Baton Rouge	$254,382,344	$618	$264,529,268	$643	$214,347,584	$521
West Baton Rouge	$13,521,038	$625	$17,366,123	$807	$9,880,896	$457
Pointe Coupee	$3,360,816	$150	$13,801,777	$617	$9,097,778	$407
East Feliciana	$168,114	$82	$3,243,062	$156	$7,593,477	$365

a) FYE '06 = Fiscal Year Ending 2006.

Source: Reference 2.5-66.

Table 2.5-27 (Sheet 1 of 2)
West Feliciana Parish Police Jury Adopted Budget - Revenues and Expenses, Year Ending December 31, 2007

	2005 Actual	2006 Estimated	2007 Budget
Revenues			
Taxes			
Ad Valorem			
Constitutional	$1,010,989	$960,557	$971,597
Buildings/Grounds	$795,197	$813,272	$822,620
Recreation - Regular	$419,592	$406,636	$411,310
Recreation - Facilities			$90,719
Social Services	$28,320	$26,908	$27,216
Economic Development	$283,191	$269,080	$272,159
Sales Tax			
Recreation	$405,911	$359,595	$315,000
Social Services	$71,580	$71,735	$63,000
Contingency		$48,660	$42,000
Hotel/Motel Tax	$27,837	$35,073	$35,100
Other	$129,713	$142,893	$138,800
Total Taxes	$3,172,330	$3,134,409	$3,189,521
Licenses and Permits	$111,157	$127,950	$127,950
Intergovernmental			
Federal funds	$1,333	$151,356	$1360
State Funds	$251,942	$264,461	$200,311
Local Funds	$87,095	$88,885	$121,000
Total Intergovernmental	$340,370	$504,702	$322,671
Fees and Charges for Services	$136,611	$205,918	$176,725
Use of Money and Property	$164,625	$216,625	$146,225
Other Financial Sources			$241,666
Road Fund	$1,715,452	$1,759,264	$2,077,683
Health Unit	$209,430	$228,997	$234,675
Solid Waste	$562,249	$598,000	$651,410
Total Revenues	$6,301,067	$6,647,915	$7,040,576

Table 2.5-27 (Sheet 2 of 2)
West Feliciana Parish Police Jury Adopted Budget - Revenues and Expenses, Year Ending December 31, 2007

	2005 Actual	2006 Estimated	2007 Budget
Expenses			
Legislative	$140,041	$135,293	$137,400
Judicial	$281,865	$328,105	$298,500
Elections	$33,771	$34,550	$45,000
Finance and Administrative	$269,943	$330,346	$347,500
Other	$2,472,963	$1,187,577	$343,850
Developmental Services	$112,988	$133,555	$247,550
Public Safety	$252,686	$317,612	$226,612
Public Works	$25,420	$121,758	$222,893
Health and Welfare	$83,002	$101,191	$90,216
Culture and Recreation	$1,100,964	$1,141,111	$1,265,110
Economic Development and Assistance	$268,236	$307,417	$472,539
Other Financial uses			$250,000
Road Fund	$1,594,686	$1,599,154	$2,312,998
Health Unit	$233,928	$162,895	$294,535
Solid Waste	$564,064	$598,000	$650,000
Total Expenses	$7,434,557	$6,498,564	$7,204,703

Source: Reference 2.5-67.

Table 2.5-28 (Sheet 1 of 2)
East Baton Rouge Parish 2008 Annual Operating Budget

	2006 Actual	2007 Budget	2007 Projection	2008 Budget	2008 to 2007 Variance	
					$ Amount	%
Source of Funds						
Estimated Revenues						
Taxes:						
General Property Taxes	20,575,360	20,147,420	20,993,100	21,756,390	1,608,970	7.99
Gross Receipts Business Taxes	27,442,170	23,119,020	25,122,000	23,974,550	855,530	3.70
General Sales and Use Taxes						
Gross Taxes	146,383,800	152,239,160	156,630,680	162,895,940	10,656,780	7.00
Gross Taxes Extraordinary	22,159,950	0	10,157,400	0	0	N/A
Less Enterprise Zone Adjustments	198,180	(950,000)	(950,000)	(1,050,000)	(100,000)	10.53
Less City of Central	(5,017,620)	(4,125,300)	(5,106,000)	(4,331,570)	(206,270)	5.00
Less Sales and Use Tax Dedications	(14,275,550)	12,927,140	(12,743,420)	(10,950,470)	1,976,670	15.29
Total Net Sales and Use Taxes	149,448,760	134,236,720	147,988,660	146,563,900	12,327,180	9.18
Sales and Use Tax Audit Collections	2,040,470	800,000	950,000	950,000	150,000	18.75
Occupancy Tax	1,341,770	850,000	1,000,000	850,000	0	0.00
Occupational License Tax	8,915,740	8,550,000	9,700,000	9,600,000	1,050,000	12.28
Insurance Premiums Tax	3,180,180	3,400,000	3,430,000	3,430,000	30,000	0.88
Gaming Admissions Tax (Riverboats)	7,005,780	2,000,000	2,000,000	2,000,000	0	0.00
Interest and Penalties - Taxes	1,982,490	1,560,000	1,752,240	1,747,000	187,000	11.99

Table 2.5-28 (Sheet 2 of 2)
East Baton Rouge Parish 2008 Annual Operating Budget

	2006 Actual	2007 Budget	2007 Projection	2008 Budget	2008 to 2007 Variance	
					$ Amount	%
Total Taxes	221,932,720	194,663,160	212,936,000	210,871,840	16,208,680	8.33
Licenses and Permits	4,515,190	4,312,400	4,530,740	4,507,500	195,100	4.52
Intergovernmental Revenues	12,438,170	10,234,840	10,491,300	12,477,370	2,242,530	21.91
Charges for Services	21,316,300	17,865,350	19,213,650	18,104,190	238,840	1.34
Fines and Forfeits	2,507,570	1,591,000	2,139,000	2,181,000	590,000	37.08
Miscellaneous Revenues	11,664,720	10,346,170	11,953,770	10,825,270	479,100	4.63
Total Estimated Revenues	274,374,670	239,012,920	261,264,460	258,967,170	19,954,250	8.35
Fund Balance Used In Budget	0	11,120,100	11,120,100	16,168,180	5,048,080	45.40
Other Financing Sources	6,084,130	3,552,610	3,552,610	2,822,380	(730,230)	20.55
Total Source of Funds	280,458,800	253,685,630	275,937,170	277,957,730	24,272,100	9.57
Use of Funds						
Personal Services	119,450,100	130,925,200	128,582,000	142,009,970	11,084,770	8.47
Employee Benefits	40,761,090	46,922,210	45,004,070	48,788,170	1,865,960	3.98
Supplies	12,191,620	10,749,970	12,207,280	13,426,060	2,676,090	24.89
Contractual Services	44,722,430	44,065,220	35,550,100	52,176,840	8,111,620	18.41
Interfund Transfers	34,167,660	21,023,030	34,016,710	21,556,690	533,660	2.54
Carryforward Expenditures	3,259,030	0	3,877,620	0	0	N/A
Total Use of Funds	254,551,930	253,685,630	259,237,780	277,957,730	24,272,100	0
Excess Sources Over (Under) Uses	25,906,870	0	16,699,390	0	0	

Source: Reference 2.5-68.

Table 2.5-29 (Sheet 1 of 2)
West Baton Rouge Operating Budget 2006, 2007, and Requested 2008

Description	Prior Year Actual 2006	Current Year Budget 2007	Current Year Estimate 2007	Requested 2008
Revenue				
Taxes				
Ad Valorem Tax	$713,545	$774,400	$790,000	$844,800
Sales and Use Tax	$2,685,101	$2,635,700	$2,714,003	$2,613,669
Sales Tax District 1	$2,354,078	$2,297,900	$2,369,872	$2,282,270
Alcoholic Beverages	$33,868	$32,000	$31,200	$32,000
Federal Grants	$54,824			
Total Taxes	$5,841,416	$5,740,000	$5,905,075	$5,772,739
License and Permits	$650,221	$667,875	$680,635	$597,425
Intergovernmental	$104,196	$68,000	$61,128	$58,000
Local Shared Revenue	$259,740	$48,000	$48,000	$-
Fees, Charges, and Commissions for Service	$147,947	$142,000	$186,005	$146,500
Public Works Fees	$950,606	$970,000	$1,030,000	$1,100,000
Health and Welfare Fees and Charges	$6012	$5500	$11,200	$8800
Culture and Recreation Charges and Fees	$125	$-	$6265	$-
Use of Money and Property	$503,791	$543,177	$663,429	$453,104
Total Revenue	$8,464,055	$8,184,552	$8,591,737	$8,136,568

Table 2.5-29 (Sheet 2 of 2)
West Baton Rouge Operating Budget 2006, 2007, and Requested 2008

Description	Prior Year Actual 2006	Current Year Budget 2007	Current Year Estimate 2007	Requested 2008
Expenses				
Legislature	$305,604	$349,000	$325,000	$358,525
Judicial	$479,566	$792,148	$750,015	$807,811
Elections and Registered Voters	$155,248	$183,472	$182,510	$194,720
General Government	$1,899,554	$2,112,663	$2,027,443	$2,302,979
Public Safety	$320,607	$334,652	$307,283	$682,220
Public Works	$1,018,998	$1,100,000	$1,130,000	$1,220,000
Health and Welfare	$242,932	$302,435	$205,333	$333,595
Economic Development and Promotion	$61,272	$68,500	$81,300	$84,200
Total General Fund Operating Expense	$4,483,781	$5,242,869	$5,008,884	$5,984,050
Total Operating Expenses and Transfers	$5,514,752	$6,449,542	$6,002,923	$7,264,115
Total Fund Transfers	$2,338,830	$5,423,673	$4,032,564	$3,478,065
Grand Total – Disbursements	$6,822,610	$10,666,542	$9,041,448	$9,462,115
Beginning Fund Balance	$4,174,732	$5,816,177	$5,816,177	$5,366,465
Plus: Revenue	$8,464,055	$8,184,552	$8,591,737	$8,136,568
Less: Disbursements	$6,822,610	$10,666,542	$9,041,448	$9,462,115
Estimated Ending Fund Balance	$5,816,177	$3,334,187	$5,366,465	$4,040,918

Table 2.5-30 (Sheet 1 of 2)
Pointe Coupee Parish Police Jury
The Operating Budgets for the Years Ending December 31, 2007 and 2008

	2007			2008
	Projected	Adjusted	Budget	Budget
Revenues				
Taxes	$5,583,050	$(40,000)	$5,543,050	$5,576,200
Licenses and Permits	299,500	29,700	329,200	333,700
Intergovernmental	2,883,983	(164,400)	2,719,583	2,402,300
Charges for Services	4,076,656	(88,570)	3,988,086	3,936,186
Fines and Forfeitures	85,500	7500	93,000	90,500
Interest	0	-	0	0
Rentals	0	-	0	0
Miscellaneous	888,834	485,810	1,374,944	1,149,119
Transfers	1,536,400	1,465,542	2,959,642	1,174,450
Total Revenues and Other Financing Sources	$15,353,923	$1,695,582	$17,007,505	$14,662,455
Expenditures/Expenses				
Legislative	$388,850	$37,500	$426,350	$384,250
Judicial	324,246	9000	333,246	349,496
Elections	62,750	(1750)	61,000	69,500
Financial Administrative	331,509	25,000	356,509	376,480
General Government	973,830	45,900	955,730	865,430

Table 2.5-30 (Sheet 2 of 2)
Pointe Coupee Parish Police Jury
The Operating Budgets for the Years Ending December 31, 2007 and 2008

	2007			2008
	Projected	**Adjusted**	**Budget**	**Budget**
Employee Benefits	58,000	-	58,000	59,000
Public Safety	470,950	49,700	520,650	438,045
Corrections	404,200	(5500)	398,700	321,490
Fire Protection	324,535	419,150	743,685	1,233,240
Other Protection	328,000	51,250	379,250	170,500
Highways and Streets	693,730	138,030	831,760	832,880
Cultural and Recreation	1,411,643	(216,150)	1,195,493	1,408,808
Conservation	1,441,316	84,950	1,526,266	963,340
Economic Development	116,165	80,550	196,715	136,175
Natural Gas Service	2,472,200	54,950	2,527,150	2,423,100
Water Service	213,510	(213,510)	0	0
Waste Disposal	1,556,015	32,300	1,588,315	1,506,805
Utility Maintenance Service Total Expenditures	110,180	(31,900)	78,280	76,280
Capital Outlays	-	1,304,500	1,304,500	-
Debt Service	1,084,746	(122,381)	962,365	1,047,500
Transfers	1,536,400	1,424,642	2,959,642	1,174,450
Total Expenditures and Other Financing Uses	14,302,775	$3,166,231	$17,403,606	$13,836,769

Table 2.5-31
East Feliciana Parish Police Jury Operating Budget
Year End December 31, 2006

Functions/Programs	Expenses	Program Revenues: Charges for Services	Program Revenues: Operating Grants and Contributions	Program Revenues: Capital Grants and Contributions	Net (Expenses) Revenue and Increase (Decreases) in Net Assets Governmental Activites
Primary Government					
Governmental Activities					
General Government	$604,697	$144,691	$716,089	$0	($256,083)
Public Safety	1,232,937	141,680	22,564	0	1,068,693
Highways and Streets	3,361,817	5150	716,469	0	2,640,198
Health and Welfare	*238,400*	8860	38,677	0	190,863
Culture and Recreation	11,010	0	0	0	11,010
Sanitation	1,344,551	0	0	0	1,344,551
Economic Development	13,500	0	0	0	13,500
Interest on Long-Term Debt	2699	0	0	0	2699
Total Governmental Activites	6,809,611	300,381	1,493,799	0	5,015,431
	General Revenues				
	Property Taxes				462,448
	Franchise Taxes				6,662
	Other Taxes				3,310,556
	Investment Earnings				165,406
	Rental Income				19,650
	Other General Revenues				140,013
	Total General Revenues and Transfers				4,104,735
	Change in Net Assets				(910,696)
	Net Assets - Beginning				9,454,661
	Net Assets - Ending				8,543,965

Table 2.5-32
Louisiana Tax Collections Revenue, 2005 - 2006

Major State Taxes	
Corporate Franchise Tax	$261166,429
Income Tax	$504,849,972
Individual Income Tax	$2,453,612,365
Petroleum Products	
Gasoline Tax	$459,700,612
Inspection Fee	$3,044,406
Special Fuels Tax	$142,740,534
Sales Tax	$2,731163,312
Severance Tax	$719,258,708
Miscellaneous State Taxes and Fees	$243,729,107
Other Taxes	$67,943,875
Total	$7,587,209,321

Source: Reference 2.5-69.

Table 2.5-33
Percent of State Tax Collected by Major Category, Fiscal Year 2005

	General Sales and Use	Individual Income	Corporate Income	Motor Fuels	Licenses	All Other
Louisiana	31.7%	24.2%	3.6%	7.6%	7.0%	25.9%
Mississippi	49.5%	20.8%	4.1%	8.7%	6.4%	10.5%
U.S. Average	33.5%	34.7%	4.9%	6.0%	6.6%	14.3%

Source: Reference 2.5-70.

Table 2.5-34
2007 Ad Valorem Taxes Paid by Entergy to West Feliciana Parish

	Mills	Taxes ($)
Community Distribution	2.00	397,913.40
Subtotal	**2.00**	**397,913.40**
Economic Development	1.00	198,956.70
General Fund	3.57	710,275.43
Health Unit	1.00	198,956.70
Hospital	1.94	385,976.00
Improvement Fund	8.89	1,768,725.10
Library	1.00	198,956.70
Social Services	0.10	19,895.68
Sports and Recreation	1.00	198,956.70
Subtotal	**18.50**	**3,680,699.01**
School Property	14.75	2,934,611.37
School Bonds	3.00	596,870.10
School Constitution	4.46	887,346.91
Subtotal School	**22.21**	**4,418,828.38**
School/Parishwide	3.75	746,087.65
School Bonds	2.00	397,913.40
Subtotal School	**5.75**	**1,144,001.05**
Law Enforcement No. 1	8.43	1,677,205.00
Law Enforcement No. 2	5.77	1,147,980.17
Subtotal Law	**14.20**	**2,825,185.17**
Fire Maintenance	6.00	1,191,032.96
Subtotal Fire	**6.00**	**1,191,032.96**
Assessment District	2.23	447,652.59
Water District	0.40	67,491.86
Forestry	0.08	
LTC No. 1	0.10	19,894.07
LTD No. 2	0.15	
Subtotal	**2.92**	**535,038.52**
Grand Totals	**69.62**	**14,192,698.49**

Table 2.5-35
People per Sq. Mi. within the Primary Impact Area and the State of Louisiana, 2000 and 2006

Parish/State	2000 Population	2006 Population	Land Area (sq. mi.)	People per Sq. Mi., 2000	People per Sq. Mi., 2006
West Feliciana	15,111	15,535	406	37.2	38.3
East Baton Rouge	412,852	429,073	455	907.4	942.1
West Baton Rouge	21,601	22,463	191	113.1	117.5
Pointe Coupee	22,763	22,648	557	40.9	40.6
East Feliciana	22,648	22,763	557	40.9	40.8
Louisiana	4,468,976	4,287,768	43,562	102.6	98.4

Source: References 2.5-71, 2.5-72, 2.5-73, 2.5-74, 2.5-75.

Table 2.5-36
Regional Occupied Housing Stability Characteristics, 2000[a]

Year Moved in	Units	Percentage
1999 - 2000	64,160	19.3
1995 - 1998	92,998	27.9
1990 - 1994	50,859	15.3
1980 - 1989	49,782	14.9
1970 - 1979	39,702	11.9
1969 or Earlier	35,500	10.7
Occupied Housing Units	333,001	

a) Methodology: CBG estimating approach.

Source: Reference 2.5-3.

Table 2.5-37
Regional Housing Information by Parish and County, 2000

		Occupied Housing			Vacant Housing	
Parish / County	Total Housing Units	Total Occupied Units	Owner-Occupied	Renter Occupied	Total Vacant Units	Seasonal, Recreational, Occasional Use
West Feliciana	4485	3645	2716	929	840	416
East Baton Rouge	169,073	156,365	96,332	60,033	12,708	518
West Baton Rouge	8370	7663	6037	1626	707	92
Pointe Coupee	10,297	8397	6526	1871	1900	1054
East Feliciana	7915	6699	5521	1178	1216	383
Ascension	29,172	26,691	21,955	4736	2481	197
Assumption	9635	8239	6921	1318	1396	727
Avoyelles	16,576	14,736	10,969	3767	1840	590
Catahoula	5351	4082	3393	689	1269	822
Concordia	9148	7521	5723	1798	1627	963
Evangeline	14,258	12,736	8834	3902	1522	472
Iberia	27,844	25,381	18,635	6746	2463	318
Iberville	11,953	10,674	8258	2416	1279	422
Lafayette	78,122	72,372	47,798	24,574	5750	385
Livingston	36,212	32,630	27,320	5310	3582	821
St. Helena	5034	3873	3287	586	1161	525
St. Landry	36,216	32,328	22,865	9463	3888	867
St. Martin	20,245	17,164	14,024	3140	3081	1604
Tangipahoa	40,794	36,558	26,800	9,758	4236	632
Adams (MS)	15,175	13,677	9615	4062	1498	176
Amite (MS)	6446	5271	4535	736	1175	490
Franklin (MS)	4119	3211	2764	447	908	434
Pike (MS)	16,720	14,792	11,002	3790	1928	284
Wilkinson (MS)	5106	3578	2979	599	1528	941
Total	588,266	528,283	374,809	153,474	59,983	14,133
State						
Louisiana	1,847,181	1,656,053	1,125,135	530,918	191,128	39,578
Mississippi	1,161,953	1,046,434	756,967	289,467	115,519	21,845
Total	3,009,134	2,702,487	1,882,102	820,385	306,647	61,423

Source: Reference 2.5-49.

Table 2.5-38 (Sheet 1 of 2)
Adequacy of Housing Structures

Parish/County	Occupied Housing Units	Lacking Complete Plumbing Facilities		Lacking Complete Kitchen Facilities		No Telephone Service		Greater than 1 Occupant per Room	
		Housing Units	%	Housing Units	%	Housing Units	%	Housing Units	%
Louisiana	1,656,053	10,717	0.65	10,726	0.65	69,488	4.20	86,426	5.22
West Feliciana Parish	3645	26	0.71	32	0.88	153	4.20	293	8.04
East Baton Rouge Parish	156,365	768	0.49	881	0.56	3846	2.46	7442	4.76
West Baton Rouge Parish	7663	35	0.46	19	0.25	300	3.91	362	4.72
Pointe Coupee Parish	8397	88	1.05	28	0.33	568	6.76	454	5.41
East Feliciana Parish	6699	103	1.54	68	1.02	517	7.72	466	6.96
Ascension Parish	26,691	146	0.55	113	0.42	1045	3.92	1525	5.71
Assumption Parish	8239	84	1.02	44	0.53	422	5.12	482	5.85
Avoyelles Parish	14,736	97	0.66	48	0.33	1079	7.32	721	4.89
Catahoula Parish	4082	43	1.05	35	0.86	336	8.23	193	4.73
Concordia Parish	7521	43	0.57	40	0.53	508	6.75	336	4.47
Evangeline Parish	12,736	118	0.93	101	0.79	1105	8.68	927	7.28
Iberia Parish	25,381	169	0.67	149	0.59	1301	5.13	1880	7.41
Iberville Parish	10,674	148	1.39	140	1.31	835	7.82	644	6.03
Lafayette Parish	72,372	251	0.35	384	0.53	1751	2.42	3447	4.76
Livingston Parish	32,630	194	0.59	201	0.62	1029	3.15	1347	4.13
St. Helena Parish	3873	97	2.50	82	2.12	544	14.05	259	6.69

Table 2.5-38 (Sheet 2 of 2)
Adequacy of Housing Structures

Parish/County	Occupied Housing Units	Lacking Complete Plumbing Facilities		Lacking Complete Kitchen Facilities		No Telephone Service		Greater than 1 Occupant per Room	
		Housing Units	%	Housing Units	%	Housing Units	%	Housing Units	%
St. Landry Parish	32,328	285	0.88	276	0.85	2224	6.88	2075	6.42
St. Martin Parish	17,164	127	0.74	96	0.56	1,090	6.35	1119	6.52
Tangipahoa Parish	36,558	276	0.75	230	0.63	2474	6.77	1745	4.77
Mississippi	1,046,434	9015	0.86	7470	0.71	68,532	6.55	51,617	4.93
Adams County	13,677	91	0.67	68	0.50	772	5.64	470	3.44
Amite County	5271	73	1.38	43	0.82	521	9.88	284	5.39
Franklin County	3211	55	1.71	44	1.37	306	9.53	177	5.51
Pike County	14,792	154	1.04	109	0.74	1041	7.04	581	3.93
Wilkinson County	3578	55	1.54	21	0.59	374	10.45	170	4.75

Source: Reference 2.5-49.

Table 2.5-39
Housing Units Forecast for the 50-Mi. Region

Parish or County	Housing Units		Annual Average GrowthRate (1990 - 2000)	Projected Housing Units	
	1990	2000		2014	2017
West Feliciana[(a)]	3392	4485	2.83%	6631	7211
East Baton Rouge[(a)]	156,767	169,073	0.76%	187,941	192,251
West Baton Rouge[(a)]	7298	8370	1.38%	10,140	10,566
Pointe Coupee[(a)]	9,695	10,297	0.60%	11,203	11,407
East Feliciana[(a)]	6,476	7915	2.03%	10,482	11,133
Ascension	21,165	29,172	3.26%	45,714	50,334
Assumption	8,644	9635	1.09%	11,216	11,587
Avoyelles	15,428	16,576	0.72%	18,328	18,727
Catahoula	5138	5351	0.41%	5664	5734
Concordia	9043	9148	0.12%	9297	9329
Evangeline	13,311	14,258	0.69%	15,698	16,025
Iberia	25,472	27,844	0.89%	31,540	32,394
Iberville	11,352	11,953	0.52%	12,848	13,049
Lafayette	67,431	78,122	1.48%	95,996	100,329
Livingston	26,848	36,212	3.04%	55,052	60,221
St. Helena	3840	5034	2.74%	7354	7976
St. Landry	31,137	36,216	1.52%	44,748	46,823
St. Martin	17,592	20,245	1.41%	24,645	25,705
Tangipahoa	33,640	40,794	1.95%	53,436	56,618
Adams (MS)	14,715	15,175	0.31%	15,843	15,990
Amite (MS)	5695	6446	1.25%	7667	7957
Franklin (MS)	3555	4119	1.48%	5062	5291
Pike (MS)	14,995	16,720	1.09%	19,473	20,120
Wilkinson (MS)	4242	5106	1.87%	6619	6998
Primary Impact Area	183,628	200,140	0.86%	226,398	232,567

Source: Reference 2.5-10.

a) Counties that make up the primary impact area.

Table 2.5-40
Number of Primary and Secondary Schools and Students in the Primary Impact Area, Louisiana, Mississippi, and the United States, 2005 - 2006

LA Parish/MS County	Number of District Schools	Total Student	Classroom Teachers (FTE)	Student/Teacher Ratio
West Feliciana	5	2508	186	13.5
East Baton Rouge	97	49,945	3269	15.3
West Baton Rouge	10	3643	252	14.5
Pointe Coupee	6	3028	193	15.7
East Feliciana	8	2432	161	15.1
State				
Louisiana	1527	654,526	44,660	14.7
Mississippi	1051	494,954	31,433	15.7
U.S. (average)	1932	963,009	61,508	15.7

Source: References 2.5-76 and 2.5-77.

Table 2.5-41
Total Revenue and Expenditure Data for the Primary Impact Area's School Districts, 2004 - 2005

LA Parish/MS County	Total Revenue	Revenue by Source			Total Expenditures	Total Current Expenditures
		Federal	Local	State		
West Feliciana	$24,741,000	$3,027,000	$11,817,000	$9,897,000	$24,368,000	$22,534,000
East Baton Rouge	$429,756,000	$59,840,000	$233,943,000	$135,973,000	$416,924,000	$388,058,000
West Baton Rouge	$29,093,000	$4,428,000	$13,806,000	$10,859,000	$28,219,000	$27,428,000
Pointe Coupee	$29,839,000	$6,846,000	$11,149,000	$11,844,000	$28,918,000	$27,988,000
East Feliciana	$18,898,000	$3,206,000	$3,740,000	$11,952,000	$19,407,000	$18,022,000

Source: Reference 2.5-77.

Table 2.5-42
Revenue Expenditure Data per Student for the Primary Impact Area, Louisiana, Mississippi, and the United States, 2004 - 2005

LA Parish/MS County	Total Revenue	Revenue by Source			Total Expenditures	Total Current Expenditures
		Federal	Local	State		
West Feliciana	$10,107	$1237	$4827	$4043	$9954	$9205
East Baton Rouge	$9260	$1289	$5041	$2930	$8984	$8362
West Baton Rouge	$8544	$1300	$4,055	$3189	$8288	$8055
Pointe Coupee	$9917	$2275	$3705	$3936	$9611	$9301
East Feliciana	$8066	$1368	$1596	$5101	$8283	$7692
State						
Louisiana (Median)						$8487
Mississippi (Median)						$6554
U.S. (average)						$8645

Source: References 2.5-76 and 2.5-77.

Table 2.5-43
Primary Impact Area Water and Sewer Providers by Parish

Parish	Water Providers	Sewer Providers
West Feliciana	Town of St. Francisville, Water District 13	Town of St. Francisville, Solitude Waste System, Hardwood Waste System, Turner Waste System
East Baton Rouge	Baton Rouge Water Company, City of Baker, City of Zachary	City of Baker, City of Zachary, East Baton Rouge Parish
West Baton Rouge	City of Port Allen, Water Districts 1, 2, 4, West Baton Rouge Parish Utilities	Allied Waste, Special Waste Disposal, Incorporated
Pointe Coupee	City of New Roads, Town of Fordoche, Town of Livonia, Town of Morganza	City of New Roads, Town of Morganza
East Feliciana	East Feliciana Water System, Town of Clinton, Town of Jackson	Town of Clinton, Town of Jackson

Source: Reference 2.5-78.

Table 2.5-44
Water District 13 Capacities and Utilization

Water Source	Maximum Capacity (gpd)	Average Consumption (gpd)	Peak Consumption (gpd)	Storage Capacity (gal)
Ground Aquifers	4,560,000	1,100,000	1,266,667	750,000

Table 2.5-45
Sheriff's Department Statistics, Primary Impact Area

Parish	Regular Deputy Sheriffs	Part-Time Deputy Sheriffs	Reserve Deputy Sheriffs
West Feliciana	70	15	-
East Baton Rouge	852	19	127
West Baton Rouge	175	75	-
Pointe Coupee	109	16	-
East Feliciana	43	27	-

Source: References 2.5-79, 2.5-80, 2.5-81, 2.5-82, and 2.5-83.

Table 2.5-46 (Sheet 1 of 2)
Primary Impact Area Fire Department Statistics

Parish	Department Name	Population Protected	Volunteer Firefighters	Paid Firefighters	Total Firefighters
West Feliciana	Angola Volunteer Fire Department	8000	74	2	76
	St. Francisville Volunteer Fire Department	1702	19	1	20
	West Feliciana Fire District 1	13,000	50	17	67
East Baton Rouge	Baker Volunteer Fire Department	13,500	15	17	32
	Baton Rouge Fire Department	228,201	3	572	575
	Brownsfield Volunteer Fire Department	12,000	55	15	70
	Central Fire Protection District 4	35,000	40	17	57
	Chaneyville Volunteer Fire Department	3819	N/A	N/A	N/A
	East Side Volunteer Fire Department	18,000	28	3	31
	East Baton Rouge Fire District 6	20,000	0	15	15
	Pride Volunteer Fire Department	1300	29	1	30
	St. George Fire Protection District	80,000	5	96	101
	Zachary Fire Department	13,148	17	50	67
	Alsen-St. Irma Lee Volunteer Fire Department	2000	4	8	12
West Baton Rouge	Addis Volunteer Fire Department	1900	40	0	40
	Brusly Volunteer Fire Department	6200	28	1	29
	Erwinville Volunteer Fire Department	2421	20	0	20
	Lobdell Volunteer Fire Department	2297	16	0	16
	Port Allen Fire Department	8500	32	8	40
	Rosehill Volunteer Fire Department	856	20	0	20

**Table 2.5-46 (Sheet 2 of 2)
Primary Impact Area Fire Department Statistics**

Parish	Department Name	Population Protected	Volunteer Firefighters	Paid Firefighters	Total Firefighters
Pointe Coupee	Fordoche Volunteer Fire Department	4207	N/A	N/A	N/A
	Innis Volunteer Fire Department	2889	17	0	17
	Livonia Volunteer Fire Department	4207	N/A	N/A	N/A
	Morganza Volunteer Fire Department	1710	35	0	35
	New Roads Volunteer Fire Department	8449	52	0	52
	Pointe Coupee Fire District 3	5285	38	0	38
East Feliciana	Clinton Volunteer Fire Department	1884	N/A	N/A	N/A
	Ethel Volunteer Fire Department	N/A	20	0	20
	Woodland Fire Department	N/A	22	0	22
	East LA State Hospital	N/A	0	9	9
	Jackson Volunteer Fire Department	5300	35	0	35
	Norwood Volunteer Fire Department	1194	22	0	22
	Pecan Grove Volunteer Fire Department	679	15	0	15
	Slaughter Volunteer Fire Department	2500	15	0	15
	Wilson Volunteer Fire Department	630	12	0	12
	Bluff Creek Volunteer Fire Department	3710	18	0	18
	McManus Volunteer Fire Department	3100	16	0	16

Source: References 2.5-84, 2.5-85, 2.5-86, 2.5-87, and 2.5-88.

Table 2.5-47 (Sheet 1 of 2)
Primary Impact Area Hospital Statistics

Parish	Hospital	Beds: Total Hospital Acute	Beds: Psychiatric Unit	Beds: Rehabilitation Unit	Beds: Skilled Nursing Unit	In-Patient Days	Total Hospital Discharges	Average Length of Stay	Average Daily Census
West Feliciana	West Feliciana Parish Hospital	22	-	-	-	687	215	4.1	1.9
East Baton Rouge	Baton Rouge General Medical	363	19	30	30	96,024	18,581	6.2	263.1
	Benton Rehabilitation Hospital	15	-	-	-	1504	95	15.8	4.1
	Cypress Psychiatric Hospital	30	-	-	-	6697	799	8.4	18.3
	Earl K. Long Medical Center	105	44	-	-	32,829	6303	7.8	89.9
	Lane Regional Medical Center	110	-	30	12	20,983	4142	6.7	57.5
	Ochsner Medical Center Baton Rouge	130	12	25	-	20,169	4232	7.4	55.3
	Our Lady of the Lake Regional Medical Center	553	19	25	-	136,723	29,106	5.9	374.6
	Promise Hospital of Baton Rouge (Mid-City Campus)	57	-	-	-	13,314	516	25.8	36.5
	Sage Rehabilitation Institute	42	-	-	-	9007	665	13.5	24.7
	Surgical Specialty Centre	14	-	-	-	809	446	1.8	1.2
	Vista Surgical Hospital of Baton Rouge	39	-	-	-	1247	405	3.1	3.4
	Woman' Hospital	239	-	-	-	77,176	21,070	3.7	211.4
Pointe Coupee	Pointe Coupee General Hospital	27	-	-	-	3429	1224	2.8	9.4

Table 2.5-47 (Sheet 2 of 2)
Primary Impact Area Hospital Statistics

Parish	Hospital	Beds: Total Hospital Acute	Beds: Psychiatric Unit	Beds: Rehabilitation Unit	Beds: Skilled Nursing Unit	In-Patient Days	Total Hospital Discharges	Average Length of Stay	Average Daily Census
East Feliciana	Eastern Louisiana Health System-Feliciana Forensic Facility	45	-	-	-	15,176	35	449	43.1
	Gulf States LTAC of Feliciana	16	-	-	-	3350	130	25.8	9.2
	Villa Feliciana Medical Complex	40	-	-	185	1007	84	756.6	2.8

Note: There were no hospitals listed for West Baton Rouge Parish.
Definitions:
Average Length of Stay - The average number of days a patient stays at the facility (Calculation: Total number of patient days divided by the number of discharges for a given period).
Average Daily Census - Average number of people served on an inpatient basis on a single day during the reporting period (calculated by dividing the total number of inpatient days by the number of days in the reporting period).
Beds - An adult bed, pediatric bed, birthing room, or newborn bed maintained in a patient care area for lodging patients in acute, long-term or domiciliary areas of the hospital.
Discharges - The total number of patients released from a hospital after being treated in the facility for a period of one night or more.

Source: References 2.5-89, 2.5-90, 2.5-91, 2.5-92, 2.5-93, 2.5-94, 2.5-95, 2.5-96, 2.5-97, 2.5-98, 2.5-99, 2.5-100, 2.5-101, 2.5-102, 2.5-103, and 2.5-104.

Table 2.5-48 (Sheet 1 of 2)
Primary Impact Area Vital Hospital Statistics

Parish	Hospital	Eligible to Participate in Medicare/ Medicaid	In Compliance with Program Requirements	Accreditation	Participates in Medicare, Medicaid, or Both	Staff				
						Physicians	Resident Physicians	Physician Assistants	Nurse Practitioners	Registered Nurses
West Feliciana	West Feliciana Hospital	Yes	Yes	JCAHO and AOA	Medicare and Medicaid	-	-	-	-	5.25
East Baton Rouge	Baton Rouge General Medical	Yes	Yes	JCAHO and AOA	Medicare and Medicaid	6	20	-	10	309
	Benton Rehabilitation Hospital	No	Yes	None	Medicare and Medicaid	-	-	-	-	1
	Cypress Rehabilitation Hospital	Yes	Yes	JCAHO and AOA	Medicare and Medicaid	0.02	-	-	-	4
	Earl K. Long Medical Center	Yes	Yes	JCAHO and AOA	Medicare and Medicaid	-	62	-	-	123
	Lane Regional Medical Center	Yes	Yes	JCAHO and AOA	Medicare and Medicaid	8.75	-	0.73	-	111.04
	Ochsner Medical Center Baton Rouge	Yes	No	JCAHO and AOA	Medicare and Medicaid	2	-	-	-	63
	Our Lady of the Lake Regional Medical Center	Yes	Yes	JCAHO and AOA	Medicare and Medicaid	44	-	-	-	797.5
	Promise Hospital of Baton Rouge (Mid-City Campus)	Yes	Yes	None	Medicare and Medicaid	-	-	-	-	10
	Sage Rehabilitation Institute	Yes	Yes	None	Medicare and Medicaid	-	-	-	-	5
	Surgical Specialty Center	Yes	Yes	JCAHO and AOA	Medicare and Medicaid	-	-	-	-	40
	Vista Surgical Hospital of Baton Rouge	Yes	Yes	None	Medicare and Medicaid	-	-	-	-	39.9
	Woman's Hospital	Yes	Yes	JCAHO and AOA	Medicare and Medicaid	7	-	-	-	124.75

Table 2.5-48 (Sheet 2 of 2)
Primary Impact Area Vital Hospital Statistics

Parish	Hospital	Eligible to Participate in Medicare/ Medicaid	In Compliance with Program Requirements	Accreditation	Participates in Medicare, Medicaid, or Both	Staff				
						Physicians	Resident Physicians	Physician Assistants	Nurse Practitioners	Registered Nurses
Pointe Coupee	Pointe Coupee General Hospital	No	Yes	None	Medicare and Medicaid	-	-	-	-	20
East Feliciana	Eastern Louisiana Health System- Feliciana Forensic Facility	Yes	Yes	JCAHO and AOA	Medicare and Medicaid	6.5	-	-	-	71
	Gulf States LTAC of Feliciana	Yes	Yes	JCAHO and AOA	Medicare and Medicaid	-	-	-	-	5
	Villa Feliciana Medical Complex	No	Yes	None	Medicare and Medicaid	4	-	-		-

Source: References 2.5-105, 2.5-106, 2.5-107, 2.5-108, 2.5-109, 2.5-110, 2.5-111, 2.5-112, 2.5-113, 2.5-114, 2.5-115, 2.5-116, 2.5-117, 2.5-118, 2.5-119, and 2.5-120.

Table 2.5-49 (Sheet 1 of 3)
Tourist Attractions Within the Primary Impact Area

West Feliciana Parish	St. Francisville Historic District	Buildings dating to the early 19th and 20th century line the streets, reflecting the history of the region.
	Oakley Plantation House	John James Audubon stayed at Oakley for 4 mo.; he painted 32 pictures here.
	Rosedown Plantation	Rosedown Plantation, encompassing 374 ac. in St. Francisville, Louisiana, is one of the most intact, documented examples of a domestic plantation complex in the South.
	Butler-Greenwood Plantation	Example of an antebellum plantation house; consists of 44 ac. and a plantation complex including the plantation house, a gazebo, and a rear brick kitchen.
	Afton Villa Gardens	Begun in 1849 and restored in 1915, the terraced garden of Afton Villa stands as an outstanding example of antebellum landscape architecture.
	Myrtles Plantation	Example of the expanded raised cottage form that characterized many Louisiana plantation houses by the mid-19th century.
	Catalpa	A late Victorian cottage, significant for the beautiful gardens that surround it.
	Cottage Plantation	Built from 1795 to 1859 and consists of three buildings joined together. The architecture reflects both Spanish and English influence.

Table 2.5-49 (Sheet 2 of 3)
Tourist Attractions Within the Primary Impact Area

East Baton Rouge Parish	Mount Hope Plantation House	Example of architecture typical of Southeastern Louisiana farmhouses constructed during the 19th century. Built in 1817, it is the only farmhouse of its kind remaining in the Baton Rouge area.
	Louisiana State University,	Consists of 46 buildings, with the majority of these dating from the 1920s and 1930s. Styled in a manner reminiscent of the architecture of the Italian Renaissance.
	Magnolia Mound Plantation House	Example of the architectural influences of early settlers from France and the West Indies. One of the earliest buildings in the city of Baton Rouge, the property was owned originally by James Hillen, an early settler who arrived in 1786.
	City Park Golf Course	City Park Golf Course was Baton Rouge's first public golf course and the city's only public course until the mid-1950s.
	U.S.S. Kidd	Extremely rare example of an American World War II Fletcher class destroyer.
	Old Louisiana State Capitol	Example of Gothic Revival architecture. Designed by architect James Harrison Dakin, has the appearance of a 15th-century Gothic Cathedral.
	Old Louisiana Governor's Mansion	Reported to be a copy of the White House as it was designed by James Hoban.
	Pentagon Barracks	These barracks have been won and lost by the Spanish, French, and the British, and are the site of the birth of a nation - the short-lived Republic of West Florida.
	Louisiana State Capitol Building	A 34-story, 450-ft. Alabama limestone-clad skyscraper, an excellent example of a greatly simplified classicism with Art Deco details.
West Baton Rouge Parish	Poplar Grove Plantation House	A single-story, galleried pavilion featuring a combination of Chinese, Italianate, Eastlake, and Queen Anne revival elements.
	Aillet House	Aillet House is an important example of a small Creole plantation house.
	Cinclare Sugar Mill Historic District	Consists of 46 buildings and two structures, including a sugar mill and associated support buildings, a "big house" and other management facilities, including housing for workers and managers.

Table 2.5-49 (Sheet 3 of 3)
Tourist Attractions Within the Primary Impact Area

Pointe Coupee Parish	Cherie Quarters Cabins	The two single-story slave dwellings are significant because they are rare surviving examples of a once common antebellum building.
	Riverlake	Examples of the Creole architectural influence.
	Parlange Plantation	Built about 1750, it is a classic example of a large French colonial plantation house in the United States
	Poydras High School	Significant because its construction represents a "coming of age" for public education in the parish seat of New Roads. Poydras High School is the descendent of a succession of schools made possible by the philanthropy of Julien Poydras, a local planter and public benefactor.
	Pointe Coupee Parish Museum	A rare example of a log cabin type construction in a Creole type house. The original portion of the house dates from the early 19th century.
	St. Francis Chapel	An historic church designed in the Gothic Revival architectural style with an open hall plan of four bays.
East Feliciana Parish	Centenary College	Centenary College stands as a monument to Louisiana's education; it is one of four major state church schools existing prior to 1860.
	Courthouse and Lawyers' Row	One of only four courthouses built in Louisiana before the Civil War that is still used for parish proceedings.
	Port Hudson	Port Hudson was the site of the longest siege in American history, lasting 48 days, when 7500 Confederates resisted some 40,000 Union soldiers for almost 2 mo. during 1863.

Source: Reference 2.5-121.

Table 2.5-50 (Sheet 1 of 17)
Archaeological Sites Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Site Number	USGS 7.5 Quad	Parish	Site Name	Site Description	Cultural Affiliation	Field Methodology	NRHP Eligibility	Recorder (Year)
16EBR015	Port Hudson	East Baton Rouge	Mount Pleasant	Unknown prehistoric	Unknown prehistoric	Pedestrian survey	No data	Haag (ND)
16EBR032	Walls	East Baton Rouge	Sterling Cemetery	Moderate brick scatter and two shallow depressions	Possibly 19th century	Informant interviews, pedestrian survey, and shovel testing	Likely not eligible	Stephen Hinks and Rebecca Bruce (1989)
16EBR042	Port Hudson	East Baton Rouge	Port Hudson Battlefield	Civil War battlefield including earthworks and associated artifact scatter	Historic	Shovel testing	National Historic Landmark 7/1/74 (see Site 16EF07)	FORM BLANK
16EBR047	Port Hudson	East Baton Rouge	Port Hudson Breastwork	Military	Historic	Pedestrian survey	Listed	Neuman, Futch, and Cousins (1978)
16EBR052	Port Hudson	East Baton Rouge		Military--earthen breastwork remnants ~6 ft. high and 18-24 ft. wide at base	Historic	Pedestrian survey	No data	Robert Neuman (1981)
16EBR062	Port Hudson	East Baton Rouge	Faulkner Lake Site No. 1	Moderate density historic artifact scatter and two associated structures. Structures likely relate to a former plantation	Historic	Pedestrian survey and boat survey	Unknown/ potentially eligible	Judy Shafer (1984)
16EBR064	Port Hudson	East Baton Rouge	Georgia Pacific	Historic battleground with possible plantation homestead and artifact scatter	19th and 20th century historic artifacts	Unit excavation	Not eligible	Smith (1985)
16EBR082	Zachary	East Baton Rouge	Young Cemetery	Historic cemetery	Historic (1866-present); unknown	Pedestrian survey	Potentially eligible	Susan Wurtzburg (1991)
16EBR086	Zachary	East Baton Rouge	Cemetery of Buhler Plains	Historic cemetery	Historic (earliest legible 1886-present)	Pedestrian survey	Potentially eligible	Susan Wurtzburg (1991)
16EBR129	Scotlandville	East Baton Rouge	F-JR-1	Historic dwelling or outbuilding and low-density artifact scatter	Possibly late 19th to early 20th century	Pedestrian survey and shovel testing	Not eligible	Hopkins and Ryan (1993)

Table 2.5-50 (Sheet 2 of 17)
Archaeological Sites Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Site Number	USGS 7.5 Quad	Parish	Site Name	Site Description	Cultural Affiliation	Field Methodology	NRHP Eligibility	Recorder (Year)
16EBR130	Scotlandville	East Baton Rouge	F-JR-2	Historic dwelling or outbuilding and low-density artifact scatter	Possibly late 19th to early 20th century	Pedestrian survey and shovel testing	Not eligible	Hopkins and Ryan (1993)
16EBR131	Walls	East Baton Rouge	F-JR-3	Historic dwelling or outbuilding and low-density artifact scatter	Historic; probably mid19th to early 20th century	Pedestrian survey and shovel testing	Unknown	Joanne Ryan (1993)
16EBR132	Scotlandville	East Baton Rouge	F-DH-1	Likely prehistoric campsite with low-density artifact scatter	Unknown prehistoric	Pedestrian survey and shovel testing	Undetermined: monitoring recommended	Hopkins and Ryan (1993)
16EBR133	Scotlandville	East Baton Rouge	F-DH-2	Likely prehistoric campsite with moderate density artifact scatter	Unknown prehistoric	Pedestrian survey and shovel testing	Undetermined: monitoring recommended	Hopkins and Ryan (1993)
16EBR134	Scotlandville	East Baton Rouge	F-DH-3	Multi-component prehistoric occupation and historic dwelling or outbuilding. Artifact density was low.	Unknown prehistoric and late 19th to early 20th century	Pedestrian survey	Not eligible	Hopkins and Ryan (1993)
16EBR135	Walls	East Baton Rouge	Creamware Site	Historic midden associated with a dwelling and possibly cemetery EBR32	Historic, possibly late 18th to early 19th century	Pedestrian survey	Potentially eligible	Joanne Ryan (1993)
16EBR138	Walls	East Baton Rouge	Possible Devall Plantation Site	Former structure and artifact scatter	Historic, possibly late 18th century through early 20th century	Pedestrian survey and shovel testing	Undetermined	Joanne Ryan (1993)
16EBR139	Walls	East Baton Rouge	Spot Find No. 1	Low-density prehistoric site	Unknown prehistoric	Pedestrian survey and shovel testing	Not eligible	David Hopkins and Joanne Ryan (1993)
16EBR140	Walls	East Baton Rouge	Spot Find No. 2	Low-density prehistoric site	Unknown prehistoric	Pedestrian survey and shovel testing	Not eligible	David Hopkins and Joanne Ryan (1993)
16EBR142	Walls	East Baton Rouge	Spot Find No. 3	Low-density prehistoric site	Unknown prehistoric	Pedestrian survey and shovel testing	Not eligible	Joanne Ryan (1993)
16EBR143	Walls	East Baton Rouge	Spot Find No. 4	Low-density prehistoric site	Unknown prehistoric	Pedestrian survey and shovel testing	Not eligible	Joanne Ryan (1993)

Table 2.5-50 (Sheet 3 of 17)
Archaeological Sites Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Site Number	USGS 7.5 Quad	Parish	Site Name	Site Description	Cultural Affiliation	Field Methodology	NRHP Eligibility	Recorder (Year)
16EBR149	Walls	East Baton Rouge	Springfield Landing	Medium-density historic artifact scatter associated with Port Hudson	1863 (Siege of Port Hudson); late 19th to early 20th century	Informant interview and pedestrian survey	Potentially eligible	Kenneth Ashworth and Ann Markell (1995); Kenneth Ashworth and Ann Markell (1997)
16EBR168	Zachary	East Baton Rouge	Townsend-Lilledy Cemetery	Historic cemetery	19th century historic	Pedestrian survey	Potentially eligible	Jason Emery and Andrew Rhodes (2001)
16EBR170	Zachary	East Baton Rouge	Plains Store	Former Masonic Hall and residence with associated artifact scatter	Historic-19th and 20th century	Pedestrian survey and shovel testing	Not eligible	Stephanie L. Perrault (2002)
16EBR171	Zachary	East Baton Rouge	Troth	Former structure and artifact scatter	Historic-19th and 20th century	Pedestrian survey and shovel testing	Not eligible	Stephanie L. Perrault (2002)
16EBR172	Zachary	East Baton Rouge	Toler	Former structure and artifact scatter	Historic 20th century	Pedestrian survey and shovel testing	Not eligible	Stephanie L. Perrault (2002)
16EBR173	Zachary	East Baton Rouge	Paxton	Former structure and artifact scatter	Historic 20th century	Pedestrian survey and shovel testing	Not eligible	Stephanie L. Perrault (2002)
16EBR174	Zachary	East Baton Rouge	Andre	Former structure and artifact scatter	Historic late 19th-20th century	Pedestrian survey and shovel testing	Not eligible	Stephanie L. Perrault (2002)
16EBR175	Zachary	East Baton Rouge	Marguerite	Low-density artifact scatter	Historic late 19th-20th century	Pedestrian survey and shovel testing	Not eligible	Stephanie L. Perrault (2002)
16EBR178	Zachary	East Baton Rouge	Amitech 2	Low-density artifact scatter	Euro- or Afro-American (no date given)	Pedestrian survey and shovel testing	Not eligible	Malcolm K. Shuman (2002)
16EBR179	Zachary	East Baton Rouge	Amitech 5	High-density artifact scatter	Euro- or Afro-American (no date given)	Pedestrian survey and shovel testing	Potentially not eligible	Malcolm K. Shuman (2002)
16EBR187	Walls	East Baton Rouge	6/13/02-01	Low-density artifact scatter	Historic	Pedestrian survey and shovel testing	Not eligible	Rhonda Smith (2005)
16EF007	Port Hudson	East Feliciana	Port Hudson Battlefield	Various forts and skirmishing areas	Historic	Pedestrian survey, shovel testing, and unit excavation	Eligible	1985
16EF017	Port Hudson	East Feliciana	Delombre Plantation	Multi-component artifact scatter	Unknown prehistoric; unknown historic	Pedestrian survey	No data	Philip G. Rivet (1985)

Table 2.5-50 (Sheet 4 of 17)
Archaeological Sites Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Site Number	USGS 7.5 Quad	Parish	Site Name	Site Description	Cultural Affiliation	Field Methodology	NRHP Eligibility	Recorder (Year)
16EF018	Port Hudson	East Feliciana	Port Hudson No. 2	Civil War breastworks	Historic	No data	No data	Neuman, Futch, Cousins (1985)
16EF019	Port Hudson	East Feliciana	Port Hudson No. 3	Civil War breastworks	Historic	No data	No data	Neuman, Futch, Cousins (1985)
16EF020	Jackson	East Feliciana	Centenary College Site	Multi-component site consisting of prehistoric occupation and historic structure complex	Historic-constructed around 1832, used until 1908; unknown prehistoric with historic refuse dating to the second quarter of 20th century; Euro-American, ca 1830-present	Pedestrian survey and shovel testing	Listed	Mark Swanson (NWR 1979); James A. Green (2002); R. Mann (2004)
16EF056	Jackson	East Feliciana	Old Sugar Mills on Thompson's Creek	Possible sugar mill foundation and low-density artifact scatter	Antebellum; historic 19th century	Pedestrian survey	Not eligible	Leon and Marie Standifer (1992); C. Hays (1997)
16EF057	Port Hudson	East Feliciana		Low-density artifact scatter	Unknown prehistoric	Pedestrian survey	No data	Wade Carr (1984)
16EF066	Jackson	East Feliciana	Horton Cemetery	Historic cemetery and high-density artifact scatter	Historic European, early 19th century	Unit excavation	Not eligible	Whitmer and Owsley (1986)
16EF068	Port Hudson	East Feliciana	Port Hudson Military and Civilian Cemetery	Artifact scatter including military and funeral artifacts	Historic (three cemeteries-white cemetery, black civilian cemetery, and military cemetery)	Pedestrian survey and shovel testing	Eligible	A. Whitmer and Mary H. Manheim (1989)
16EF078	Jackson	East Feliciana	First Baptist Cemetery	Historic cemetery	Historic (1860-present)	Pedestrian survey	Potentially eligible	Susan Wurtzburg (1991)

Table 2.5-50 (Sheet 5 of 17)
Archaeological Sites Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Site Number	USGS 7.5 Quad	Parish	Site Name	Site Description	Cultural Affiliation	Field Methodology	NRHP Eligibility	Recorder (Year)
16EF080	Jackson	East Feliciana	Harvey Site	Multi-component artifact scatter	Unknown prehistoric; historic artifacts from ca. 1820 to 1970s (2 concentrations of ca. 1820 to 1895 and ca.1928 to present), prehistorics possible Middle Archaic, Late Archaic to possibly Tchefuncte, and Middle Woodland with possible Kirk component	Pedestrian survey and shovel testing	Potentially eligible	Susan Wurtzburg (1991); James A. Green (2003)
16EF107	Jackson	East Feliciana	Asphodel Plantation	Multi-component artifact scatter and historic cemetery	19th century Euro-American plantation; unknown Neo-Indian	Pedestrian survey and shovel testing	Listed	Malcolm Shuman and Dennis Jones (1996)
16EF108	Jackson	East Feliciana	Old Road Site	Multi-component artifact scatter	19th century Euro-American plantation; unknown Neo-Indian	Pedestrian survey and shovel testing	Not eligible	Shuman, Jones and Watts (1996)
16EF109	Jackson	East Feliciana	Karr Creek Bluff Site	High-density artifact scatter	Unknown prehistoric	Pedestrian survey and shovel testing	Potentially eligible	Shuman, Jones and Watts (1996)
16EF110	Jackson	East Feliciana	South Asphodel Site	Multi-component artifact scatter	Unknown prehistoric; 19th century Euro-Amerian	Pedestrian survey and shovel testing	Potentially eligible	Shuman and Jones (1996)
16EF112	Jackson	East Feliciana	North Asphodel Site	Low-density artifact scatter	Late 19th century/early 20th century Afro- or Euro-American	Pedestrian survey and shovel testing	Not eligible	Shuman and Watts (1996)
16EF113	Jackson	East Feliciana	Small Worth	Multi-component artifact scatter	Early 20th century Euro-American or Afro-American; unknown prehistoric	Pedestrian survey and shovel testing	Not eligible	Lindemuth and Bordelon (1997)
16EF114	Jackson	East Feliciana	McKowen Bluff Site	High-density artifact scatter	Possibly Plaquemine	Pedestrian survey and shovel testing	Potentially eligible	Shuman, Jones, Lindemuth (1997)
16EF116	Jackson	East Feliciana	Y Site	Low-density artifact scatter	Early 20th century Euro-American or Afro-American	Pedestrian survey and shovel testing	Not eligible	Lindemuth and Bordelon (1997)

Table 2.5-50 (Sheet 6 of 17)
Archaeological Sites Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Site Number	USGS 7.5 Quad	Parish	Site Name	Site Description	Cultural Affiliation	Field Methodology	NRHP Eligibility	Recorder (Year)
16EF117	Jackson	East Feliciana	Dead Tree Site	Medium-density artifact scatter	Unknown prehistoric	Pedestrian survey and shovel testing	Not eligible	Jones and Lindemuth (1997)
16EF118	Jackson	East Feliciana	Collins Cemetery	Historic cemetery	Presumably late 19th century Euro-American	Pedestrian survey and shovel testing	N/A; cemeteries usually not eligible	Jones, Watts, Shuman, Hill, Bordelon (1997)
16EF120	Jackson	East Feliciana	North Boundary Site	Medium-density artifact scatter	Neo-Indian	Pedestrian survey and shovel testing	Not eligible	Shuman and Watts (1996)
16EF121	Jackson	East Feliciana	Asphodel Cemetery	Historic cemetery	19th/20th century Euro-American	Pedestrian survey	Not eligible	Shuman and Jones (1996)
16EF122	Jackson	East Feliciana	Dike Site	Multi-component artifact scatter	19th/20th century Euro-American; small prehistoric component	Pedestrian survey	Not eligible	Shuman and Watts (1996)
16PC025	New Roads	Point Coupee	Poydras College	Historic structural remains	Antebellum and postbellum periods	Informant interview	Potentially eligible, however has not been surveyed	J.M. Exnicios (1991)
16PC027	Port Hudson	Point Coupee	West Bank Pipeline Crossing Site	Multi-component artifact scatter	Plaquemine, late 19th-20th century European-American	Pedestrian survey, shovel testing, and unit excavation	Potentially eligible	David W. Hopkins (1991)
16PC031	Port Hudson	Point Coupee	Waterloo	Historic town	Historic; antebellum, war and aftermath	Pedestrian survey	Not assessed; additional survey necessary	J. Paige (1983); Jill-Karen Yakubik (1992)
16PC033	St. Francisville	Point Coupee	Lakeland Plantation	Medium-density artifact scatter and historic structure	Historic (late 18th-20th century)	Pedestrian survey, shovel testing, and unit excavation	Not eligible	Peter, A. Gendel (1984)
16PC056	New Roads	Point Coupee	ESI 11/15/91-01	Low-density artifact scatter	Industrial and modern; late 19th to early 20th century artifacts only	Pedestrian survey, shovel testing, and unit excavation	Not eligible	Kenneth R. Jones (1992)
16PC057	New Roads	Point Coupee	ESI 11/15/91-02	Medium-density artifact scatter	Early to mid 19th century	Pedestrian survey and shovel testing	Not eligible	Kenneth R. Jones (1992)
16PC058	St. Francisville	Point Coupee	ESI 11/21/91-01	Medium-density artifact scatter	Industrial and modern	Pedestrian survey and shovel testing	Not eligible	Kenneth R. Jones (1992)

Table 2.5-50 (Sheet 7 of 17) Archaeological Sites Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Site Number	USGS 7.5 Quad	Parish	Site Name	Site Description	Cultural Affiliation	Field Methodology	NRHP Eligibility	Recorder (Year)
16PC059	St. Francisville	Point Coupee	ESI 11/21/91-02	Medium-density artifact scatter	19th century	Pedestrian survey and shovel testing	Not eligible	Kenneth R. Jones (1992)
16PC060	St. Francisville	Point Coupee	ESI 1/21/92-01	Low-density artifact scatter	19th century to modern	Pedestrian survey and shovel testing	Not eligible	Kenneth R. Jones (1992)
16PC061	Port Hudson	Point Coupee	ESI 3/6/92-1	Low-density artifact scatter	19th century	Pedestrian survey	Not assessed	Jill-Karen Yakubik (1992)
16PC062	Port Hudson	Point Coupee	Nina Plantation	High-density artifact scatter and structural remains	19th century	Pedestrian survey, shovel testing, unit excavation, and trench excavation	Eligible	Jill-Karen Yakubik (1992)
16PC063	Erwinville	Point Coupee	River Lake Plantation	High-density artifact scatter and structural remains	Antebellum-modern	Pedestrian survey and shovel testing	Potentially eligible	R. Saunders (1993)
16PC064	New Roads	Point Coupee	St. Francisville Bridge-B	High-density artifact scatter and structural remains	Industrial and modern	Pedestrian survey	Not eligible	T. Hahn III (1994)
16PC073	New Roads	Point Coupee	Mad-Cow Site	Low-density artifact scatter	19/20th century	Pedestrian survey and shovel testing	Not eligible	Thurston Hahn and Jerame Cramer (2001)
16PC075	New Roads	Point Coupee	Swamp House	Low-density artifact scatter	Late 19th to early 20th century	Pedestrian survey and shovel testing	Not eligible	Thurston Hahn and Jerame Cramer (2002)
16WBR020	Walls	West Baton Rouge	ESI 4/20/92-05 and 4/ 20/92-04	Multi-component artifact scatter	Early Troyville; possibly Coles Creek; mid 19th century; Neo-Indian, Marksville, and Mississippi; late 19th to early 20th century	Pedestrian survey, shovel testing, auger testing, and unit excavation	Not eligible	Howard Earnest and Carrie Leven (1992); Hinks (1993)
16WBR015	Port Hudson	West Baton Rouge	Point Menoir Shipwreck	Historic shipwreck	Historic	No data	No data	Joan M. Exnicios (1988)
16WBR017	Walls	West Baton Rouge	ESI 4/13/92-01	Medium-density artifact scatter	Industrial and modern	Shovel testing	Not eligible	Howard Earnest, Jr. (1992)

Table 2.5-50 (Sheet 8 of 17)
Archaeological Sites Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Site Number	USGS 7.5 Quad	Parish	Site Name	Site Description	Cultural Affiliation	Field Methodology	NRHP Eligibility	Recorder (Year)
16WBR018	Walls	West Baton Rouge	ESI 4/20/92-01	Multi-component artifact scatter	Mississippian, mid- to late 19th century, early 20th century, possibly Coles Creek; Coles Creek through Mississippi periods, with a possible protohistoric component; postbellum and early 20th century	Pedestrian survey, shovel testing, auger testing, and unit excavation	Not eligible	Howard Earnest and Carrie Leven (1992); Hinks (1993)
16WBR019	Walls	West Baton Rouge	ESI 4/20/92-02 and ESI 4/20/92-03	Multi-component artifact scatter	Coles Creek; Mississippian; industrial and modern; Neo-Indian unknown between Marksville and Mississippi; late 19th to early 20th century	Pedestrian survey, shovel testing, auger testing, and unit excavation	Potentially eligible; not eligible	Howard Earnest, Jr. (1992); Hinks (1993)
16WBR035	Walls	West Baton Rouge	ESI 5/13/92-01	Low-density artifact scatter	Industrial and modern	Pedestrian survey and shovel testing	Not eligible	Howard Earnest and Carrie Leven (1992)
16WBR036	Port Hudson	West Baton Rouge	ESI 11/13/91-01	Low-density artifact scatter	Industrial and modern	Pedestrian survey, shovel testing, and unit excavation	Not eligible	Kenneth R. Jones (1992)
16WBR037	Walls	West Baton Rouge	ESI 3/7/92-01	Medium-density artifact scatter	Historic unknown (industrial?)	Pedestrian survey, shovel testing, and unit excavation	Not eligible	Jill-Karen Yakubik (1992)
16WBR038	Walls	West Baton Rouge	ESI 4/17/92-01	Low-density artifact scatter	Unknown prehistoric	Shovel testing	Potentially eligible	Howard Earnest, JR (1992)
16WF004	Port Hudson	West Feliciana	Riddle Mounds	Mound site	Archaic; Marksville, Coles Creek, Plaquemine(?); Archaic, Marksville, Coles Creek, Plaquemine	Pedestrian survey and shovel testing	Eligible; undetermined	C. Hays (1997); Dennis Jones/Mk Shuman (1986); Chip McGimsey (2005)

Table 2.5-50 (Sheet 9 of 17)
Archaeological Sites Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Site Number	USGS 7.5 Quad	Parish	Site Name	Site Description	Cultural Affiliation	Field Methodology	NRHP Eligibility	Recorder (Year)
16WF005	Port Hudson	West Feliciana	Thompson Creek Mounds	Mound site	Unknown prehistoric	No data	Not eligible	Philip Rivet (1989)
16WF007	St. Francisville	West Feliciana	Nolan Mound	Mound site	Marksville or later; ceramics are Troyville-Coles Creek	Pedestrian survey	Eligible	Dennis Jones and Malcolm Shuman (1986)
16WF008/ 16WF027	St. Francisville	West Feliciana	Little Bayou Sara	Mound site	Unknown; Plaquemine component suggested	Pedestrian survey and shovel testing	No data; possibly eligible	Haag (ND-the site of WF008 was mislocated and the mound originally reported by Haag was later assigned a different site number 16WF27 with the correct location); Dennis Jones/MK Shuman (1986)
16WF009	Jackson	West Feliciana	Thompson	High-density artifact scatter	Unknown prehistoric	Pedestrian survey	No data	John B. Thompson and W. G. Haag (ND)
16WF010	St. Francisville	West Feliciana	Cane Field	High-density artifact scatter	Unknown prehistoric	No data	No data	Haag (1962)
16WF011	Port Hudson	West Feliciana		Medium-density artifact scatter	Neo-Indian	Surface collection	No data	Haag (ND)
16WF011	St. Francisville	West Feliciana		Medium-density artifact scatter	Neo-Indian	Pedestrian survey	No data	Hagg (ND)
16WF013	St. Francisville	West Feliciana	Ritchie	Low-density artifact scatter	Unknown prehistoric	Pedestrian survey	Not eligible	Haag, Jones, and Shuman (1986)
16WF019	Port Hudson	West Feliciana	Locality 1	Low-density artifact scatter	Plaquemine	Surface collection	No data	R.W. Neuman (1972)
16WF031	Port Hudson	West Feliciana	Riddle Family Cemetery	Historic cemetery	Historic (Late 19th early 20th century)	Surface collection	No data	Neuman, Futch, Cousins (1978)

Table 2.5-50 (Sheet 10 of 17)
Archaeological Sites Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Site Number	USGS 7.5 Quad	Parish	Site Name	Site Description	Cultural Affiliation	Field Methodology	NRHP Eligibility	Recorder (Year)
16WF034	Elm Park	West Feliciana	Oakley Plantation	Historic plantation	Historic 18th to 20th century (antebellum and late 1797 to 1947); historic plantation, occupied 1797 to 1947 by european and african americans	Pedestrian survey, shovel testing, auger testing, remote sensing and unit excavation	Listed	Debbie Woodiel (1979); Paul Farnsworth (1993)
16WF035	Elm Park	West Feliciana	Jack Spear's Cabin	Historic structural remains	Mid 19th to early 20th century	Shovel testing	Possibly significant	Chris Hays (1997)
16WF037	St. Francisville	West Feliciana	Bayou Sara	Historic structural remains	Historic	Pedestrian survey	No data	J. Paige (1983)
16WF039	Elm Park	West Feliciana	Star Hill Sugar Mill	Historic structural remains	19th century sugar mill, possibly 20th century also; early to late 19th century	Pedestrian survey, shovel testing, trench excavation, and unit excavation	Potentially eligible	Steve Smith (1984); Sean Coughlin (2007)
16WF041	Port Hudson	West Feliciana	Temporary No. 5	High-density artifact scatter	Marksville/Baytown, Coles Creek	Pedestrian survey and shovel testing	Not eligible	Wade Carr (1984)
16WF042	Port Hudson	West Feliciana	Temporary No. 2	Low-density artifact scatter	Neo-Indian; Woodland	Pedestrian survey and shovel testing	Not eligible	Wade Carr (1984)
16WF043	Port Hudson	West Feliciana	Temporary No. 6	Low-density artifact scatter	Neo-Indian; Woodland	Pedestrian survey	Not eligible	Wade Carr (1984)
16WF044	Port Hudson	West Feliciana	Temporary No. 1	High-density artifact scatter	Neo-Indian; Woodland; Late Archaic; Baytown, and Coles Creek periods	Pedestrian survey, shovel testing, and trench excavation	Not eligible	Wade Carr (1984); David Kelley (1991)
16WF045	Port Hudson	West Feliciana	Temporary No. 4	Low-density artifact scatter	Neo-Indian; Woodland	Pedestrian survey	Not eligible	Wade Carr (1984)
16WF046	Port Hudson	West Feliciana		Low-density artifact scatter	Neo-Indian; Woodland	Pedestrian survey	Not eligible	Wade Carr (1984)
16WF047	Port Hudson	West Feliciana		Low-density artifact scatter	Modern 20th century	Shovel testing	Not eligible	Wade Carr (1984)

Table 2.5-50 (Sheet 11 of 17)
Archaeological Sites Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Site Number	USGS 7.5 Quad	Parish	Site Name	Site Description	Cultural Affiliation	Field Methodology	NRHP Eligibility	Recorder (Year)
16WF048	St. Francisville	West Feliciana	Wilcox	Medium-density artifact scatter	Prehistoric-early Plaquemine with minor Coles Creek component; historic-19th century; Coles Creek through Plaquemine; some historic ca. 1800	Pedestrian survey, shovel testing, and unit excavation	Not eligible	George Castille (1985); Shuman/ Jones (1985)
16WF052	Port Hudson	West Feliciana	Alice Site	Tenant house	Late 19th to early 20th century Afro-American; war and aftermath; industrial and modern (ca. 1875 to 1925)	Pedestrian survey and shovel testing	Unknown	MK Shuman; DC Jones (1986); Thurston HG Hahn (1994)
16WF053	Port Hudson	West Feliciana		Low-density artifact scatter	Probably Troyville-Coles Creek	Pedestrian survey and shovel testing	Not eligible	MK Shuman/DC Jones (1986)
16WF054	Port Hudson	West Feliciana		Low-density artifact scatter	Marksville and Troyville-Coles Creek	Pedestrian survey	No data	R.W. Neuman (1972)
16WF055	Port Hudson	West Feliciana		Low-density artifact scatter	Unknown prehistoric	Pedestrian survey	No data	R.W. Neuman (1972)
16WF056	Port Hudson	West Feliciana		Low-density artifact scatter	Coles Creek	Pedestrian survey	No data	R.W. Neuman (1972)
16WF057	St. Francisville	West Feliciana	St. Francisville Bridge-F	Historic structural remains	Antebellum-industrial and modern (artifacts are early 19th century through early 20th century)	Shovel testing	Potentially eligible	T. Hahn, III (1994)
16WF058	St. Francisville	West Feliciana	Deep Ravine Site	Low-density artifact scatter	War and aftermath	Pedestrian survey and shovel testing	Not eligible	T. Hahn, III (1994)
16WF060	Elm Park	West Feliciana	Tick Site	Low-density artifact scatter	Unknown prehistoric and historic	Pedestrian survey and shovel testing	Possibly eligible	T. Hahn III (1994)
16WF061	Port Hudson	West Feliciana	Cottonmouth Mound	Mound site	Baytown	Pedestrian survey and shovel testing	Possibly eligible	Thurston H. G. Hahn, III (1994)

Table 2.5-50 (Sheet 12 of 17) Archaeological Sites Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Site Number	USGS 7.5 Quad	Parish	Site Name	Site Description	Cultural Affiliation	Field Methodology	NRHP Eligibility	Recorder (Year)
16WF062	Elm Park	West Feliciana	Barrow Creek	Medium-density artifact scatter	Late Archaic through Plaquemine/ Mississippi; same	Pedestrian survey	Potentially significant; ineligible as site boundaries are presently defined	R. Saunders (1994); Chris Hays (1999)
16WF064	Port Hudson	West Feliciana	Red Bug Site	Medium-density artifact scatter and historic structure	Industrial and modern (ca. 1890 to 1950)	Pedestrian survey and shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)
16WF065	Elm Park	West Feliciana	Rainy Day Site	Low-density artifact scatter	Hist. explr.; antebellum (1780 to 1820)	Shovel testing	Not eligible	Thurston HG Hahn, III (1994)
16WF066	Elm Park	West Feliciana	St. Francisville Bridge-K	Medium-density artifact scatter and historic structure	Antebellum; war and aftermath; industrial and modern (ca. 1850 to 1970s)	Shovel testing	Unknown	Thurston HG Hahn, III (1994)
16WF067	Elm Park	West Feliciana	St. Francisville Bridge-L	Multi-component artifact scatter	Unknown prehistoric and industrial/modern historic (ca. 1890 to 1920)	Pedestrian survey and shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)
16WF068	Elm Park	West Feliciana	St. Francisville Bridge-M	Multi-component artifact scatter	Industrial and modern (ca. 1890 to 1920)	Pedestrian survey and shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)
16WF069	Elm Park	West Feliciana	St. Francisville Bridge-N	Low-density artifact scatter	Antebellum; war and aftermath; industrial and modern (ca. 1830 to 1910)	Pedestrian survey and shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)
16WF070	Elm Park	West Feliciana	St. Francisville Bridge-P	Medium-density artifact scatter	War and aftermath; industrial and modern (ca. 1875 to 1970s)	Pedestrian survey and shovel testing	Unknown	Thurston H. G. Hahn, III (1994)
16WF071	Jackson	West Feliciana	Vaughn Creek Site	High-density artifact scatter	Possible late Coles Creek and/or early Plaquemine	Shovel testing	Unknown: further testing recommended	Thurston H. G. Hahn, III (1994)
16WF072	Elm Park	West Feliciana	The Logging Road House	Low-density artifact scatter	Unknown prehistoric; industrial and modern (ca. 1890 to 1920)	Pedestrian survey and shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)

Table 2.5-50 (Sheet 13 of 17)
Archaeological Sites Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Site Number	USGS 7.5 Quad	Parish	Site Name	Site Description	Cultural Affiliation	Field Methodology	NRHP Eligibility	Recorder (Year)
16WF073	Elm Park	West Feliciana	The Farm Road Site	Low-density artifact scatter	War and aftermath; industrial and modern (ca. 1875 to 1920)	Pedestrian survey and shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)
16WF074	Elm Park	West Feliciana	St. Francisville Bridge-T	Low-density artifact scatter	Unknown prehistoric	Pedestrian survey and shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)
16WF075	Elm Park	West Feliciana	St. Francisville Bridge-U	Low-density artifact scatter	Industrial and modern (ca. 1890 to 1920?)	Pedestrian survey and shovel testing	Unknown: further testing recommended	Thurston H. G. Hahn, III (1994)
16WF076	Elm Park	West Feliciana	St. Francisville Bridge-V	Low-density artifact scatter	War and aftermath; industrial and modern (ca. 1880 to 1910)	Pedestrian survey and shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)
16WF077	Elm Park	West Feliciana	St. Francisville Bridge-W	Low-density artifact scatter	Unknown prehistoric; unknown historic (ca. 1800 to 1920?)	Pedestrian survey and shovel testing	Unknown: further testing recommended	Thurston H. G. Hahn, III (1994)
16WF078	Elm Park	West Feliciana	Flea Site	Low-density artifact scatter	Antebellum; war and aftermath; industrial and modern (ca. 1850 to 1980s?)	Pedestrian survey and shovel testing	Unknown: further testing recommended	Thurston H. G. Hahn, III (1994)
16WF079	Elm Park	West Feliciana	Bayou Self Hunting Association Camp Site	Low-density artifact scatter	War and aftermath; industrial and modern (1870 to 1940)	Pedestrian survey and shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)
16WF080	Elm Park	West Feliciana	Waterloo	Historic town	Antebellum (ca. 1820 to 1860)	Pedestrian survey and shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)
16WF081	Elm Park	West Feliciana	Bouncing Bambi Site	High-density artifact scatter	War and aftermath; industrial and modern (ca. 1875 to 1970)	Pedestrian survey and shovel testing	Unknown: further testing recommended	Thurston H. G. Hahn, III (1994)
16WF082	Jackson	West Feliciana	The Half Dime Site	Low-density artifact scatter	Antebellum; war and aftermath (ca. 1820 to 1870)	Pedestrian survey and shovel testing	Unknown: further testing recommended	Thurston H. G. Hahn, III (1994)
16WF083	Jackson	West Feliciana	Old Louisiana State Highway No. 35 Trash Dump	Low-density artifact scatter	Industrial and modern (ca. 1930 to 1940)	Pedestrian survey and shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)
16WF084	Port Hudson	West Feliciana	The Causeway Site	High-density artifact scatter	Baytown-Mississippian	Pedestrian survey and shovel testing	Unknown	Thurston H. G. Hahn, III (1994)

Table 2.5-50 (Sheet 14 of 17)
Archaeological Sites Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Site Number	USGS 7.5 Quad	Parish	Site Name	Site Description	Cultural Affiliation	Field Methodology	NRHP Eligibility	Recorder (Year)
16WF085	Port Hudson	West Feliciana	The Cistern Pit Site	Low-density artifact scatter	Industrial and modern (ca. 1890 to 1930)	Pedestrian survey and shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)
16WF086	St. Francisville	West Feliciana	Highway 61-B	Low-density artifact scatter	War and aftermath; industrial and modern (ca. 1880 to 1920)	Pedestrian survey and shovel testing	Not eligible	T. Hahn, III (1994)
16WF087	St. Francisville	West Feliciana	Oaks Lithic Site	Medium-density artifact scatter	Unknown prehistoric	Pedestrian survey and shovel testing	Not eligible	T. Hahn, III (1994)
16WF088	St. Francisville	West Feliciana	Pines Site	Low-density artifact scatter	War and aftermath; industrial and modern (ca. 1880 to 1900)	Pedestrian survey and shovel testing	Not eligible	T. Hahn, III (1994)
16WF089	St. Francisville	West Feliciana	John Dortch Site	High-density artifact scatter	Hist. Explr.; antebellum (ca. 1789 to 1806)	Pedestrian survey and shovel testing	Potentially significant	T. Hahn, III (1994)
16WF090	St. Francisville	West Feliciana	Oaks Site	Low-density artifact scatter	Hist. Explr.; antebellum (ca. 1762 to 1820)	Pedestrian survey and shovel testing	Not eligible	T. Hahn, III (1994)
16WF091	St. Francisville	West Feliciana	Gilber Mills Site	Low-density artifact scatter	Hist.expl.; antebellum (ca. 1800 to 1840)	Pedestrian survey and shovel testing	Not eligible	Thurston HG Hahn, III (1994)
16WF092	Elm Park	West Feliciana	Newspaper House Site	High-density artifact scatter	Industrial and modern (ca. 1940? to 1980)	Pedestrian survey and shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)
16WF093	Elm Park	West Feliciana	Well Site	Medium-density artifact scatter and historic structure	Industrial and modern (ca. 1945 to 1992)	Pedestrian survey and shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)
16WF094	Elm Park	West Feliciana	Trash Well Site	Low-density artifact scatter and historic structure	Industrial and modern (ca. 1950 to 1992)	Pedestrian survey and shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)
16WF095	Elm Park	West Feliciana	Hemingbaugh Site	High-density artifact scatter	Industrial and modern (ca. 1945 to 1992)	Pedestrian survey and shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)
16WF096	Port Hudson	West Feliciana	Highway 61-L	Medium-density artifact scatter	Historic expl.; antebellum (ca. 1798 to 1830)	Pedestrian survey and shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)
16WF097	Port Hudson	West Feliciana	Highway 61-M	Low-density artifact scatter	Historic expl.; antebellum, war and aftermath; industrial and modern (ca. 1800 to 1940)	Pedestrian survey and shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)

Table 2.5-50 (Sheet 15 of 17)
Archaeological Sites Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Site Number	USGS 7.5 Quad	Parish	Site Name	Site Description	Cultural Affiliation	Field Methodology	NRHP Eligibility	Recorder (Year)
16WF098	Elm Park	West Feliciana	Fiber Optic Site	Low-density artifact scatter	Industrial and modern (ca. 1890 to 1957)	Pedestrian survey and shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)
16WF099	Elm Park	West Feliciana	Highway 61-O	Low-density artifact scatter	Unknown prehistoric	Pedestrian survey and shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)
16WF100	Elm Park	West Feliciana	Star Hill Post Office	Low-density artifact scatter	Industrial and modern (1899) (ca. 1935 to 1970)	Shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)
16WF101	Elm Park	West Feliciana	Star Hill Plantation Main House Site	Medium-density artifact scatter and historic structure	Antebellum; war and aftermath; industrial and modern (ca. 1825 to DATE)	Shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)
16WF102	Elm Park	West Feliciana	Daniel's Corner Site	Medium-density artifact scatter	Industrial and modern (ca. 1890 to 1935)	Shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)
16WF103	Elm Park	West Feliciana	Roadside Grocery Site	Medium-density artifact scatter	Industrial and modern (ca. 1940 to DATE)	Pedestrian survey and shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)
16WF104	Elm Park	West Feliciana	Briars Site	Low-density artifact scatter	Industrial and modern (ca. 1945 to 1960)	Pedestrian survey and shovel testing	Not eligible	Thurston H. G. Hahn, III (1994)
16WF106	Elm Park	West Feliciana	Dart Cistern Site	Historic cistern	Euro-American, early 20th century	Pedestrian survey and shovel testing	Not eligible	Dennis Jones and Malcolm Shuman (1995)
16WF107	Elm Park	West Feliciana	Open Pasture Site	Low-density artifact scatter	Neo-Indian with small historic component	Pedestrian survey, shovel testing, and unit excavation	Not eligible	Dennis Jones and Malcolm Shuman (1995)
16WF108	St. Francisville	West Feliciana	Berry Thicket Site	Low-density artifact scatter	Unknown prehistoric	Pedestrian survey and shovel testing	Not eligible	Malcolm K. Shuman and Paul Lemke (1995)
16WF109	St. Francisville	West Feliciana	Stream Side Site	Low-density artifact scatter	Neo-Indian with small historic component	Pedestrian survey, shovel testing, and unit excavation	Not eligible	Dennis Jones and Malcolm Shuman (1995)
16WF110	Elm Park	West Feliciana	Linda Bickham	Medium-density artifact scatter	Late Archaic and Coles Creek	Pedestrian survey	Unknown: further testing recommended	C. Hays (1996)

Table 2.5-50 (Sheet 16 of 17)
Archaeological Sites Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Site Number	USGS 7.5 Quad	Parish	Site Name	Site Description	Cultural Affiliation	Field Methodology	NRHP Eligibility	Recorder (Year)
16WF112	Elm Park	West Feliciana	Linda Bickham	Medium-density artifact scatter	Archaic and Late Coles Creek/Plaquemine	Pedestrian survey	Not eligible	C. Hays (1996)
16WF113	Elm Park	West Feliciana	Magazine House Site	Medium-density artifact scatter and historic structure	Industrial and modern (ca. 1922 to 1970)	Pedestrian survey and shovel testing	Not eligible	Thurston H. G. Hahn, III (1996)
16WF114	Port Hudson	West Feliciana	Fancy Point Cemetery	Medium-density artifact scatter and historic cemetery	Mid to late 19th to early 20th century	Pedestrian survey and unit excavation	Not eligible	C. Hays (1996)
16WF145	Elm Park	West Feliciana	Audubon Woods	Low-density artifact scatter and historic structure	Built about 1930	Pedestrian survey and shovel testing	Unknown	Chris Hays (1999)
16WF148	St. Francisville	West Feliciana		Medium-density artifact scatter	Modern industrial (1890 to)	Pedestrian survey and shovel testing	Not eligible	Aixa Wilson and Michael Godzinski (2001)
16WF149	Port Hudson	West Feliciana	Site No. 1	Low-density artifact scatter	Historic--early 20th century	Pedestrian survey and shovel testing	Not eligible	Stephanie L. Perrault (2001)
16WF150	Port Hudson	West Feliciana	Site No. 2	Low-density artifact scatter	Historic--early 20th century	Pedestrian survey and shovel testing	Not eligible	Stephanie L. Perrault (2001)
16WF151	Port Hudson	West Feliciana	Site No. 3	Low-density artifact scatter	Historic--early 20th century	Pedestrian survey and shovel testing	Not eligible	Stephanie L. Perrault (2001)
16WF152	Port Hudson	West Feliciana	Site No. 4	Low-density artifact scatter	Prehistoric	Pedestrian survey and shovel testing	Not eligible	Stephanie L. Perrault (2001)
16WF153	Port Hudson	West Feliciana	Site No. 5	Low-density artifact scatter	Unknown prehistoric/ historic--early 20th century	Pedestrian survey and shovel testing	Not eligible	Stephanie L. Perrault (2001)
16WF154	Port Hudson	West Feliciana	Site No. 6	Low-density artifact scatter	Unknown prehistoric/ historic--early 20th century	Pedestrian survey and shovel testing	Unknown	Stephanie L. Perrault (2001)
16WF155	Port Hudson	West Feliciana	2002-B	Low-density artifact scatter	Prehistoric	Pedestrian survey and shovel testing	Not eligible	Stephanie L. Perrault (2001)
16WF156	St. Francisville/ Elm Park	West Feliciana	Rosedown Plantation	Multi-component artifact scatter and historic structure	Unknown prehistoric and mid 20th century	Pedestrian survey and shovel testing	Potentially eligible	R. Mann (2002)

Table 2.5-50 (Sheet 17 of 17)
Archaeological Sites Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Site Number	USGS 7.5 Quad	Parish	Site Name	Site Description	Cultural Affiliation	Field Methodology	NRHP Eligibility	Recorder (Year)
16WF157	St. Francisville	West Feliciana	Bayou Sara Brick Company Site	Historic structural remains	Euro-American	Pedestrian survey	Unknown	R. Mann (2002)
16WF175	St. Francisville	West Feliciana	West Feliciana Courthous/Royal Hotel	High-density artifact scatter and structural remains	Euro-American (very large, diverse collection of 19th century material culture)	Pedestrian survey and unit excavation	Potentially eligible	R. Mann (2003)
16WF180	Elm Park	West Feliciana	Locus Area 03-01	Historic structural remains	Unknown historic	Pedestrian survey and shovel testing	Not eligible	James Eberwine (2007)
16WF181	Elm Park	West Feliciana	Locus Area 03-02	Medium-density artifact scatter	Unknown historic	Pedestrian survey and shovel testing	Potentially significant	James Eberwine (2007)
16WF182	Port Hudson	West Feliciana	Tranline-02	Low-density artifact scatter and structural remains	Unknown historic; unknown prehistoric	Pedestrian survey and shovel testing	Not eligible	Meredith Moreno (2007)

Table 2.5-51 (Sheet 1 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
17	1793	Zachary	East Baton Rouge	No data	Circa (ca.) 1960s	No style	No
17	1794	Zachary	East Baton Rouge	No data	ca. 1940s	National folk	No
17	1795	Zachary	East Baton Rouge	No data	ca. 1980s	No style	No
17	1796	Zachary	East Baton Rouge	No data	ca. 1950s	Craftsman/National folk	No
17	1797	Zachary	East Baton Rouge	No data	ca. 1980s	Modern	No
17	1798	Zachary	East Baton Rouge	No data	ca. 1960s	No style	No
17	1799	Zachary	East Baton Rouge	No data	ca. 1930s	Folk/Victorian	No
17	1800	Zachary	East Baton Rouge	No data	ca. 1940s	Craftsman/National folk	No
17	1801	Zachary	East Baton Rouge	No data	ca. 1980s	Elements of colonial revival	No
17	1802	Zachary	East Baton Rouge	No data	ca. 1910 to 1920	Elements of greek revival, Queen Anne, and folk Victorian	No
17	1803	Zachary	East Baton Rouge	No data	ca. 1950s	National folk	No
39	14	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1910	Style unknown; saddlebag-like house	No
39	15	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1930	L-shaped	No
39	16	Erwinville	Pointe Coupee	Robert Carnes (1982)	1908	Polite	No
39	17	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1920	Polite	No
39	18	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1890	Shotgun	No
39	19	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1895	Mid to late 19th century Victorian	No
39	20	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1928	Shotgun	No
39	21	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1900	Shotgun	No
39	22	Erwinville	Pointe Coupee	Robert Carnes (1982)	1926	Church (Immaculate Conception Catholic Church); indeterminate style	No
39	23	Erwinville	Pointe Coupee	Robert Carnes (1982)	1926	Bungalow and pyramidal house	No
39	24	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1885	French Creole folk and vernacular	No
39	25	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1907	No style	No
39	26	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1880	L-shaped	No
39	27	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1928	Monitor clerestory barn form	No
39	28	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1928	Barn or corn crib	No

Table 2.5-51 (Sheet 2 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
39	29	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1921	French Creole folk and vernacular	No
39	30	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1927	Shotgun	No
39	31	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1927	Shotgun	No
39	32	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1890	French Creole folk and vernacular	No
39	33	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1907	Shotgun	No
39	34	Erwinville	Pointe Coupee	Robert Carnes (1982)	1910	Mid to late 19th century Victorian	No
39	35	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1939	Bungalow and pyramidal house	No
39	36	Erwinville	Pointe Coupee	No data available	No data available	No data available	No data available
39	37	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1923	Anglo-folk and vernacular houses	No
39	38	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1931	Shotgun	No
39	39	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1916	Shotgun	No
39	40	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1916	Bungalow and pyramidal house	No
39	41	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1911	Anglo-folk and vernacular houses	No
39	42	Erwinville	Pointe Coupee	Robert Carnes (1982)	1914	Monitor clerestory barn form	No
39	43	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1882	French Creole folk and vernacular	No
39	44	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1830	Barn or corncrib	No
39	45	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1912	Bungalow and pyramidal house	No
39	46	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1910	Stable	No
39	47	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1918	Mid to late 19th century Victorian	No
39	48	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1920	French Creole folk and vernacular	No
39	49	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1920	Barn or corncrib	No
39	50	Erwinville	Pointe Coupee	Robert Carnes (1982)	1916	Bungalow and pyramidal house	No
39	51	Erwinville	Pointe Coupee	Robert Carnes (1982)	1928	French Creole folk and vernacular	No
39	52	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1920	French Creole folk and vernacular	No

Table 2.5-51 (Sheet 3 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
39	53	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1920	Anglo-folk and vernacular houses	No
39	54	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1930	Anglo-folk and vernacular houses	No
39	55	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1920	Shotgun	No
39	56	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1920	Anglo-folk and vernacular houses	No
39	57	Erwinville	Pointe Coupee	Robert Carnes (1982)	1923	Anglo-folk and vernacular houses	No
39	58	Erwinville	Pointe Coupee	Robert Carnes (1982)	1914	Polite	No
39	59	Erwinville	Pointe Coupee	Robert Carnes (1982)	1912	Anglo-folk and vernacular houses	No
39	60	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1887	Anglo-folk and vernacular houses	No
39	61	Erwinville	Pointe Coupee	Robert Carnes (1982)	1830s	French Creole folk and vernacular	No
39	62	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1920	Anglo-folk and vernacular houses	No
39	67	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1919	Anglo-folk and vernacular houses	No
39	74	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1885	No style	No
39	75	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1819	Exhibits colonial and early U.S. periods, especially French colonial	No
39	85	Erwinville	Pointe Coupee	Robert Carnes (1982)	1937	Exhibits 20th century styles, including Georgian Revival	No
39	86	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1790	Exhibits colonial and early U.S. periods, especially French colonial; plantation (Caillet Estate)	No
39	87	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1790	Exhibits colonial and early U.S. periods, especially French colonial; plantation; pigeonniere	No
39	88	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1790	Exhibits colonial and early U.S. periods, especially French colonial; plantation; pigeonniere	No
39	130	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1923	Colonial and early U.S. periods	No
39	131	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1900	Oblong in plan; no style	No
39	132	New Roads	Pointe Coupee	No data	No data	No data	No
39	133	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1907	Anglo-folk and vernacular houses	No
39	134	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1900	Anglo-folk and vernacular houses	No

Table 2.5-51 (Sheet 4 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
39	135	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1907	French Creole folk and vernacular	No
39	136	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1912	Anglo-folk and vernacular houses	No
39	137	New Roads	Pointe Coupee	Robert Carnes (1982)	1919	Anglo-folk and vernacular houses	No
39	138	New Roads	Pointe Coupee	Robert Carnes (1982)	1914	Bungalow and pyramidal house	No
39	139	New Roads	Pointe Coupee	Robert Carnes (1982)	1930	Shotgun	No
39	140	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1929	Shotgun	No
39	141	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1930	Shotgun	No
39	142	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1929	Shotgun	No
39	143	New Roads	Pointe Coupee	Robert Carnes (1982)	1905	Anglo-folk and vernacular houses	No
39	144	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1920	Anglo-folk and vernacular houses	No
39	145	New Roads	Pointe Coupee	Robert Carnes (1982)	1890	No style; commercial building	No
39	146	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1900	Early 20th century, including California bungalow	No
39	155	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1937	Anglo-folk and vernacular houses	No
39	156	Erwinville	Pointe Coupee	Robert Carnes (1982)	1910	Anglo-folk and vernacular houses	No
39	163	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1919	Anglo-folk and vernacular houses	No
39	164	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1880	French Creole folk and vernacular	No
39	165	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1900	Early 20th century, including California bungalow	No
39	166	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1919	Bungalow and pyramidal house	No
39	167	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1910	Shotgun	No
39	181	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1900	French and Creole folk and vernacular	No
39	182	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1919	Shotgun	No
39	200	Erwinville	Pointe Coupee	Robert Carnes (1982)	1928	Shotgun	No
39	201	Erwinville	Pointe Coupee	Robert Carnes (1982)	1928	Shotgun	No
39	219	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1939	No style; commercial building	No

Table 2.5-51 (Sheet 5 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
39	220	Erwinville	Pointe Coupee	Robert Carnes (1982)	1882	Anglo-folk and vernacular house	No
39	221	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1920	Shotgun	No
39	222	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1916	Indeterminate style	No
39	223	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1870	French Creole folk and vernacular	No
39	224	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1920	Barn or corncrib	No
39	225	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1900	Barn or corncrib	No
39	226	Erwinville	Pointe Coupee	Robert Carnes (1982)	1915	Anglo-folk and vernacular houses	No
39	227	Erwinville	Pointe Coupee	Robert Carnes (1982)	1916	French Creole folk and vernacular	No
39	228	Erwinville	Pointe Coupee	Robert Carnes (1982)	1914	Shotgun	No
39	229	Erwinville	Pointe Coupee	Robert Carnes (1982)	1918	No style; commercial building	No
39	230	Erwinville	Pointe Coupee	Robert Carnes (1982)	1918	Anglo-folk and vernacular houses	No
39	231	Erwinville	Pointe Coupee	Robert Carnes (1982)	1914	Anglo-folk and vernacular houses	No
39	232	Erwinville	Pointe Coupee	Robert Carnes (1982)	1916	Shotgun	No
39	233	Erwinville	Pointe Coupee	Robert Carnes (1982)	1912	20th century, including Tudor Revival	No
39	234	Erwinville	Pointe Coupee	Robert Carnes (1982)	1929	Used as storage barn	No
39	235	Erwinville	Pointe Coupee	No data	No data	No data	No
39	236	Erwinville	Pointe Coupee	Robert Carnes (1982)	1902	Barn or corncrib	No
39	237	Erwinville	Pointe Coupee	Robert Carnes (1982)	1930	Bungalow and pyramidal house	No
39	238	Erwinville	Pointe Coupee	Robert Carnes (1982)	1931	Shotgun	No
39	239	Erwinville	Pointe Coupee	Robert Carnes (1982)	1931	Bungalow and pyramidal house	No
39	240	Erwinville	Pointe Coupee	Robert Carnes (1982)	1932	Bungalow and pyramidal house	No
39	241	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1928	Barn or corncrib	No
39	242	Erwinville	Pointe Coupee	Robert Carnes (1982)			No
39	243	Erwinville	Pointe Coupee	Robert Carnes (1982)	1928	Barn or corncrib	No

Table 2.5-51 (Sheet 6 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
39	244	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1881	Mid to late 19th century Victorian	No
39	245	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1930	Bungalow and pyramidal house	No
39	246	Erwinville	Pointe Coupee	Robert Carnes (1982)	1832	French Creole folk and vernacular	No
39	247	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1919	Shotgun	No
39	248	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1920	Anglo-folk and vernacular	No
39	249	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1841	Early U.S. periods, especially French Colonial	No
39	250	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1932	Garage	No
39	251	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1895	Anglo-folk and vernacular	No
39	252	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1925	Barn or corncrib	No
39	253	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1782	French Creole folk and vernacular	No
39	254	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1938	Shotgun	No
39	255	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1928	Shotgun	No
39	256	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1928	Shotgun	No
39	257	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1886	French Creole folk and vernacular	No
39	258	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1920	Anglo-folk and vernacular	No
39	259	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1919	Barn or corncrib	No
39	260	Erwinville	Pointe Coupee	Robert Carnes (1982)	1830	French and Creole folk and vernacular	No
39	261	Erwinville	Pointe Coupee	Robert Carnes (1982)	1830	Support structure; pigeonniere	No
39	262	Erwinville	Pointe Coupee	Robert Carnes (1982)	1900	Anglo-folk and vernacular	No
39	263	Erwinville	Pointe Coupee	Robert Carnes (1982)	1909	Shotgun	No
39	265	Erwinville	Pointe Coupee	Robert Carnes (1982)	1918	Bungalow and pyramidal house	No
39	268	Erwinville	Pointe Coupee	Robert Carnes (1982)	1916	Barn or corncrib	No
39	269	Erwinville	Pointe Coupee	Robert Carnes (1982)	1897	Barn or corncrib	No
39	270	Erwinville	Pointe Coupee	Robert Carnes (1982)	1890	Barn or corncrib	No

Table 2.5-51 (Sheet 7 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
39	271	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1899	Barn or corncrib	No
39	272	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1900	Anglo-folk and vernacular	No
39	273	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1931	Barn or corncrib	No
39	274	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1900	Anglo-folk and vernacular	No
39	275	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1905	Anglo-folk and vernacular	No
39	276	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1903	Bungalow and pyramidal house	No
39	277	Erwinville	Pointe Coupee	Robert Carnes (1982)	1962 (?)	Bungalow and pyramidal house	No
39	278	Erwinville	Pointe Coupee	Robert Carnes (1982)	1901	Bungalow and pyramidal house	No
39	279	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1904	Bungalow and pyramidal house	No
39	280	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1901	Bungalow and pyramidal house	No
39	281	Erwinville	Pointe Coupee	Robert Carnes (1982)	1901	Bungalow and pyramidal house	No
39	282	Erwinville	Pointe Coupee	Robert Carnes (1982)	1902	Bungalow and pyramidal house	No
39	283	Erwinville	Pointe Coupee	Robert Carnes (1982)	1903	Bungalow and pyramidal house	No
39	284	Erwinville	Pointe Coupee	Robert Carnes (1982)	1902	Bungalow and pyramidal house	No
39	285	Erwinville	Pointe Coupee	Robert Carnes (1982)	1932	Church (no name given); no style	No
39	286	Erwinville	Pointe Coupee	Robert Carnes (1982)	1902	Bungalow and pyramidal house	No
39	287	Erwinville	Pointe Coupee	Robert Carnes (1982)	1903	Bungalow and pyramidal house	No
39	288	Erwinville	Pointe Coupee	Robert Carnes (1982)	1902	Bungalow and pyramidal house	No
39	289	Erwinville	Pointe Coupee	Robert Carnes (1982)	1903	Bungalow and pyramidal house	No
39	290	Erwinville	Pointe Coupee	Robert Carnes (1982)	1901	Anglo-folk and vernacular	No
39	291	Erwinville	Pointe Coupee	Robert Carnes (1982)	1902	Anglo-folk and vernacular	No
39	292	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1902	Bungalow and pyramidal house	No
39	293	Erwinville	Pointe Coupee	Robert Carnes (1982)	1902	Bungalow and pyramidal house	No
39	294	Erwinville	Pointe Coupee	Robert Carnes (1982)	1917	Anglo-folk and vernacular	No

Table 2.5-51 (Sheet 8 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
39	295	Erwinville	Pointe Coupee	Robert Carnes (1982)	1917	Boarding house; no style	No
39	296	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1900	Includes sugar house and steam powered mill, and farm machinery, no style	No
39	297	Erwinville	Pointe Coupee	Robert Carnes (1982)	1932	Includes sugar house and steam powered mill, and farm machinery, no style	No
39	298	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1926	Anglo-folk and vernacular	No
39	299	Erwinville	Pointe Coupee	Robert Carnes (1982)	1903	Anglo-folk and vernacular	No
39	300	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1907	Anglo-folk and vernacular	No
39	301	Erwinville	Pointe Coupee	Robert Carnes (1982)	1800+	French colonial (Alma Plantation)	No
39	302	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1930	Barn or corncrib	No
39	303	Erwinville	Pointe Coupee	Robert Carnes (1982)	1920	Old commissary store; shotgun house	No
39	304	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1910	Anglo-cottage	No
39	305	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1911	Anglo-cottage	No
39	306	Erwinville	Pointe Coupee	Robert Carnes (1982)	1931	Bungalow	No
39	307	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1931	Bungalow	No
39	308	Erwinville	Pointe Coupee	Robert Carnes (1982)	ca. 1930	Bungalow	No
39	311	Erwinville	Pointe Coupee	Robert Carnes (1982)	1931	Store and post office; commercial building	No
39	312	New Roads	Pointe Coupee	Robert Carnes (1982)	1928	Barn or corncrib	No
39	313	New Roads	Pointe Coupee	Robert Carnes (1982)	1920	Shotgun	No
39	314	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1918	Anglo-cottage later modified into barn	No
39	315	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1920	Barn or corncrib	No
39	317	New Roads	Pointe Coupee	Robert Carnes (1982)	1926	Shotgun	No
39	318	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1919	Shotgun	No
39	319	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1919	Shotgun	No
39	320	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1929	Shotgun	No

Table 2.5-51 (Sheet 9 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
39	321	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1917	Shotgun	No
39	322	New Roads	Pointe Coupee	Robert Carnes (1982)	1917	Shotgun	No
39	323	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1917	Shotgun	No
39	324	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1919	Shotgun	No
39	325	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1909	Anglo-cottage	No
39	326	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1916	Shotgun	No
39	327	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1921	Shotgun	No
39	328	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1927	Shotgun	No
39	329	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1912	Four-pen central hall	No
39	330	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1923	No style; store; commercial building	No
39	331	New Roads	Pointe Coupee	Robert Carnes (1982)	1926	Early 20th century, including California bungalow	No
39	332	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1920	Shotgun	No
39	333	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1892	Lesser Creole house	No
39	334	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1882	Anglo-folk and vernacular	No
39	335	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1800	French cottage, bousillage	No
39	336	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1930	No style; store; commercial building	No
39	337	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1929	Shotgun	No
39	338	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1786	French cottage, bousillage; chimney built on Spanish land grant; cypress wood throughout	No
39	339	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1932	Bungalow	No
39	341	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1926	Barn or corncrib	No
39	342	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1926	Single crib barn	No
39	343	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1850	French cottage; bousillage walls	No
39	344	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1889	Anglo-cottage	No

Table 2.5-51 (Sheet 10 of 44) Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
39	345	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1910	Anglo-cottage	No
39	346	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1910	Anglo-cottage	No
39	347	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1897	French cottage	No
39	348	New Roads	Pointe Coupee	Robert Carnes (1982)	1919	Small single crib barn	No
39	349	New Roads	Pointe Coupee	Robert Carnes (1982)	1919	Small barn	No
39	351	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1880	Anglo-cottage	No
39	355	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1880	Late 19th century eastlake; French house	No
39	356	New Roads	Pointe Coupee	Robert Carnes (1982)	1904	Shotgun	No
39	357	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1920	Barn or corncrib	No
39	358	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1900	French Creole folk and vernacular	No
39	359	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1902	Anglo-folk and vernacular	No
39	360	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1900	French Creole folk and vernacular	No
39	361	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1903	French Creole folk and vernacular	No
39	362	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1880	French Creole folk and vernacular	No
39	363	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1880	French Creole folk and vernacular	No
39	364	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1925	Anglo-folk and vernacular	No
39	365	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1922	Shotgun	No
39	366	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1800	French Creole folk and vernacular	No
39	367	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1880	French Creole folk and vernacular	No
39	368	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1803	French Creole folk and vernacular; bousillage walls	No
39	369	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1918	Anglo-cottage	No
39	370	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1882	French and Creole folk and vernacular	No
39	371	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1900	Shed	No
39	372	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1890	Bungalow and pyramidal house	No

Table 2.5-51 (Sheet 11 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
39	373	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1890	Barn	No
39	374	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1870	Anglo-cottage	No
39	375	New Roads	Pointe Coupee	Robert Carnes (1982)	ca. 1881	Anglo-cottage	No
39	400	Erwinville	Pointe Coupee	No data	No data	No data	No
39	401	Erwinville	Pointe Coupee	No data	No data	No data	No
39	402	Erwinville	Pointe Coupee	No data	No data	No data	No
39	403	Erwinville	Pointe Coupee	No data	No data	No data	No
39	404	Erwinville	Pointe Coupee	No data	No data	No data	No
39	405	Erwinville	Pointe Coupee	No data	No data	No data	No
39	406	Erwinville	Pointe Coupee	No data	No data	No data	No
39	407	Erwinville	Pointe Coupee	No data	No data	No data	No
39	410	Erwinville	Pointe Coupee	No data	No data	No data	No
39	560	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1900	French Creole folk and vernacular	No
39	561	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1915	French Creole folk and vernacular	No
39	562	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1920	French Creole folk and vernacular	No
39	563	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1920	Gazebo	No
39	564	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1890	No style; store; commercial building	No
39	566	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1880	French vernacular	No
39	567	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1900	French Creole folk and vernacular	No
39	568	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1890	Shotgun	No
39	569	New Roads BM	Pointe Coupee	C. Airriess (1983)	1902	Courthouse; no style	Yes-Pointe Coupee Parish Courthouse
39	570	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1850	Bungalow and pyramidal house	No
39	571	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1910	French Creole folk and vernacular	No
39	572	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1924	New Roads United Methodist Church; no style	No
39	573	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1910	French Creole folk and vernacular	No
39	574	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1900	French Creole folk and vernacular	No
39	575	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1900	French Creole folk and vernacular	No

Table 2.5-51 (Sheet 12 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
39	576	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1900	Bertha Lumber Company; first lumber company in New House; built house as a rent house; no style	No
39	577	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1910	French Creole folk and vernacular	No
39	580	New Roads BM	Pointe Coupee	C. Airriess (1983)	1898	French Creole folk and vernacular	No
39	581	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1830	French Creole folk and vernacular	Yes-LeJeune House
39	582	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1880	Mid to late 19th century Victorian; modified from simple Creole cottage	No
39	583	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1880	Washroom for HSS 582; no style	No
39	584	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1900	Anglo-folk and vernacular	No
39	585	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1900	French Creole folk and vernacular	No
39	586	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1910	Anglo-folk and vernacular	No
39	587	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1890	Anglo-folk and vernacular	No
39	588	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1890	Shotgun	No
39	589	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1910	French Creole folk and vernacular	No
39	590	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1900	French Creole folk and vernacular	No
39	591	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1900	Anglo-folk and vernacular	No
39	592	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1900	French Creole folk and vernacular	No
39	593	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1905	No style	No
39	594	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1880	Anglo-folk and vernacular	No
39	595	New Roads BM	Pointe Coupee	C. Airriess (1983)	1912	No style	No
39	596	New Roads BM	Pointe Coupee	C. Airriess (1983)	1912	Yard and garden for HSS 595	Yes-Could not be identified on NRHP database, however
39	597	New Roads BM	Pointe Coupee	C. Airriess (1983)	1880	French Creole folk and vernacular	No
39	598	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1880	No style; minor storage building	No
39	600	New Roads	Pointe Coupee	C. Airriess (1983)	ca. 1900	Early 20th century, including California bungalow	No
39	601	New Roads	Pointe Coupee	C. Airriess (1983)	ca. 1830	French Creole folk and vernacular	No
39	602	New Roads	Pointe Coupee	C. Airriess (1983)	ca. 1920	Tenant's quarters; brought from Hagen-Tanglewood Plantation (near Lettsworth) in 1950s; French and Creole folk and vernacular	No

Table 2.5-51 (Sheet 13 of 44) Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
39	603	New Roads	Pointe Coupee	C. Airriess (1983)	ca. 1920	Barn; brought from Hagen-Tanglewood Plantation (near Lettsworth) in 1950s	No
39	604	New Roads	Pointe Coupee	C. Airriess (1983)	ca. 1900	French Creole folk and vernacular	No
39	605	New Roads	Pointe Coupee	C. Airriess (1983)	ca. 1910	French Creole folk and vernacular	No
39	606	New Roads	Pointe Coupee	C. Airriess (1983)	ca. 1820	Wickliffe; French Creole plantation	Yes-Wickliffe
39	607	New Roads	Pointe Coupee	C. Airriess (1983)	ca. 1820	Wickliffe; overseer's house for plantation; French Creole folk and vernacular	No
39	608	New Roads	Pointe Coupee	C. Airriess (1983)	ca. 1910	French Creole folk and vernacular	No
39	609	New Roads	Pointe Coupee	C. Airriess (1983)	ca. 1900	French Creole folk and vernacular	No
39	610	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1910	No style; commercial building	Yes-First National Bank of New Roads
39	611	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1860	Cemetery; oldest in New Roads; St. Mary's Catholic Cemetery	No
39	612	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1900	French Creole folk and vernacular	No
39	613	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1880	French Creole folk and vernacular	No
39	614	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1910	Polite	No
39	615	New Roads BM	Pointe Coupee	C. Airriess (1983)	ca. 1900	Shotgun; structure brought from Lacour Plantation and placed in read of HSS 614	No
39	616	New Roads BM	Pointe Coupee	C. Airriess (1983)	1923	No style; St. Augustine Catholic Church	No
39	617	New Roads	Pointe Coupee	C. Airriess (1983)	ca. 1850	Barn or corncrib	No
39	618	New Roads	Pointe Coupee	C. Airriess (1983)	ca. 1920	French Creole folk and vernacular	No
39	619	New Roads BM	Pointe Coupee	D. White (1983)	ca. 1920	Bungalow	No
39	620	New Roads BM	Pointe Coupee	D. White (1983)	ca. 1850	Anglo-folk and vernacular	No
39	621	New Roads BM	Pointe Coupee	D. White (1983)	1923	Polite	No
39	622	New Roads BM	Pointe Coupee	D. White (1983)	1926	No style; commercial building; was Henry Morel Hotel	No
39	623	New Roads BM	Pointe Coupee	D. White (1983)	No date listed	No style; was First Bank of New Roads	No
39	624	New Roads BM	Pointe Coupee	D. White (1983)	ca. 1905	No style; house	No
39	625	New Roads BM	Pointe Coupee	D. White (1983)	ca. 1905	No style; garage	No
39	626	New Roads BM	Pointe Coupee	D. White (1983)	No date listed	No style; beside railroad tracks	No
39	627	New Roads BM	Pointe Coupee	D. White (1983)	1890	No style; L-shaped	No
39	628	New Roads BM	Pointe Coupee	D. White (1983)	No date listed	Shotgun; commercial building	No

Table 2.5-51 (Sheet 14 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
39	736	Morganza	Pointe Coupee	D. White (1983)	ca. 1823	French Creole folk and vernacular	No
39	737	Morganza	Pointe Coupee	D. White (1983)	1920	Anglo-folk and vernacular	No
39	738	Morganza	Pointe Coupee	D. White (1983)	No date listed	French Creole folk and vernacular; one in a line of quarter houses that have since been torn down; possibly part of plantation complex now called Wilbert Plantation	No
39	739	Morganza	Pointe Coupee	D. White (1983)	No date listed	French Creole folk and vernacular; one in a line of quarter houses that have since been torn down; possibly part of plantation complex now called Wilbert Plantation	No
39	740	Morganza	Pointe Coupee	D. White (1983)	ca. 1928	Anglo-folk and vernacular	No
39	741	Morganza	Pointe Coupee	D. White (1983)	No date listed	French Creole folk and vernacular	No
39	742	New Roads	Pointe Coupee	D. White (1983)	No date listed	Barn for Sugarland Plantation	No
39	743	New Roads	Pointe Coupee	D. White (1983)	No date listed	French Creole folk and vernacular	No
39	744	New Roads	Pointe Coupee	D. White (1983)	ca. 1900	Anglo-folk and vernacular; overseer's house; has central hallway	No
39	745	New Roads	Pointe Coupee	D. White (1983)	No date listed	Gothic Revival (St. Francis Church)	Yes-St. Francis Chapel
39	746	New Roads	Pointe Coupee	D. White (1983)	No date listed	Cemetery (St. Francis)	No
39	747	New Roads	Pointe Coupee	D. White (1983)	ca. 1900	Anglo-folk and vernacular	No
39	748	New Roads	Pointe Coupee	D. White (1983)	No date listed	Cemetery (Fairlane Cemetery)	No
39	749	New Roads	Pointe Coupee	D. White (1983)	1825	French Colonial	No
39	750	New Roads	Pointe Coupee	D. White (1983)	1901	French Creole folk and vernacular	No
39	751	New Roads	Pointe Coupee	D. White (1983)	No date listed	French Creole folk and vernacular	No
39	752	New Roads	Pointe Coupee	D. White (1983)	No date listed	French Creole folk and vernacular	No
39	753	New Roads	Pointe Coupee	D. White (1983)	1853	French Creole folk and vernacular; used to be Pointe Coupee School Board office; moved from behind New Roads Courthouse	No
39	754	New Roads	Pointe Coupee	D. White (1983)	No date listed	Anglo-folk and vernacular	No
39	755	New Roads	Pointe Coupee	D. White (1983)	ca. 1845	No style	No
39	757	New Roads	Pointe Coupee	D. White (1983)	ca. 1780	French Colonial	No
39	758	New Roads	Pointe Coupee	D. White (1983)	No date listed	Late 19th century Queen Anne	No

Table 2.5-51 (Sheet 15 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
39	759	New Roads	Pointe Coupee	D. White (1983)	No date listed	French Creole folk and vernacular	No
39	760	New Roads	Pointe Coupee	D. White (1983)	No date listed	Bungalow	No
39	761	New Roads	Pointe Coupee	D. White (1983)	ca. 1926	French Creole folk and vernacular	No
39	762	New Roads	Pointe Coupee	D. White (1983)	ca. 1900	French Creole folk and vernacular	No
39	763	New Roads	Pointe Coupee	D. White (1983)	ca. 1900	French Creole folk and vernacular	No
39	767	New Roads BM	Pointe Coupee	D. White (1983)	1918	No style; house	No
39	768	New Roads BM	Pointe Coupee	D. White (1983)	1918	No style; built as playhouse	No
39	769	New Roads BM	Pointe Coupee	D. White (1983)	ca. 1900	French Creole folk and vernacular	No
39	770	New Roads BM	Pointe Coupee	D. White (1983)	ca. 1900	Early 20th century, including California bungalow	No
39	771	New Roads BM	Pointe Coupee	D. White (1983)	ca. 1900	Anglo-folk and vernacular	No
39	772	New Roads BM	Pointe Coupee	D. White (1983)	No date listed	French Creole	No
39	773	New Roads BM	Pointe Coupee	D. White (1983)	ca. 1910	No style; originally Poydras Elementary	No
39	774	New Roads BM	Pointe Coupee	D. White (1983)	ca. 1900	Late 19th century Queen Anne	No
39	775	New Roads BM	Pointe Coupee	D. White (1983)	ca. 1900	Anglo-folk and vernacular	No
39	776	New Roads BM	Pointe Coupee	D. White (1983)	No date listed	Anglo-folk and vernacular	No
39	777	New Roads BM	Pointe Coupee	D. White (1983)	1856	French Creole folk and vernacular	No
39	778	New Roads BM	Pointe Coupee	D. White (1983)	No date listed	No style; originally Poydras High Dormitory	No
39	779	New Roads BM	Pointe Coupee	D. White (1983)	1923	Classic Revival; Poydras High School	Yes-Poydras High School
39	780	New Roads BM	Pointe Coupee	D. White (1983)	ca. 1885	Julian Poydras Monument	No
39	781	New Roads BM	Pointe Coupee	D. White (1983)	ca. 1910	Bungalow and pyramidal house	No
39	782	New Roads BM	Pointe Coupee	D. White (1983)	ca. 1900	No style; rectory for St. Mary's Church	No
39	783	New Roads BM	Pointe Coupee	D. White (1983)	1904	No style; St. Mary's Church	No
39	784	New Roads BM	Pointe Coupee	D. White (1983)	1827	No style; house	No
39	785	New Roads BM	Pointe Coupee	D. White (1983)	ca. 1925	Anglo-folk or vernacular	No
39	786	New Roads BM	Pointe Coupee	D. White (1983)	ca. 1930	Shotgun	No
39	787	New Roads BM	Pointe Coupee	D. White (1983)	1823	French Creole folk and vernacular	No
39	788	New Roads BM	Pointe Coupee	D. White (1983)	ca. 1886	Anglo-folk or vernacular	No
39	789	New Roads BM	Pointe Coupee	D. White (1983)	1890	Queen Anne style	No
39	790	New Roads BM	Pointe Coupee	D. White (1983)	1912	Bungalow and pyramidal house	No
39	791	New Roads BM	Pointe Coupee	D. White (1983)	ca. 1910	No style	No

Table 2.5-51 (Sheet 16 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
39	792	New Roads BM	Pointe Coupee	D. White (1983)	ca. 1910	Anglo-folk or vernacular	No
39	793	New Roads BM	Pointe Coupee	D. White (1983)	1903	Late 19th century Queen Anne	No
39	794	New Roads BM	Pointe Coupee	D. White (1983)	1903	Anglo-folk or vernacular	No
39	795	New Roads BM	Pointe Coupee	D. White (1983)	1902	No style	No
39	796	New Roads BM	Pointe Coupee	D. White (1983)	1923	Bungalow and pyramidal house	No
39	797	New Roads BM	Pointe Coupee	D. White (1983)	No date listed	Late 19th century Queen Anne	No
39	798	New Roads BM	Pointe Coupee	D. White (1983)	ca. 1910	No style	No
39	799	New Roads BM	Pointe Coupee	D. White (1983)	No date listed	Late 19th century Queen Anne	No
39	880	New Roads BM	Pointe Coupee	No data	No data	No data	No
61	3	Walls	West Baton Rouge	R. Fonienoi and J. Luvireaux (1989)	ca. 1945 to 1950	Shotgun/bungalow	No
61	4	Walls	West Baton Rouge	R. Fonienoi and J. Luvireaux (1989)	1935 to 1940	Bungalow	No
61	5	Walls	West Baton Rouge	R. Fonienoi and J. Luvireaux (1989)	1880 to 1900	Queen Anne	No
61	6	Walls	West Baton Rouge	R. Fonienoi and J. Luvireaux (1989)	1810 to 1840	Greek Revival, Creole, Anglo-folk	No
61	7	Walls	West Baton Rouge	R. Fonienoi and J. Luvireaux (1989)	ca. 1870 to 1890	No style	No
61	8	Walls	West Baton Rouge	R. Fonienoi and J. Luvireaux (1989)	1890 to 1915	Shotgun/folk tradition	No
61	9	Walls	West Baton Rouge	R. Fonienoi and J. Luvireaux (1989)	1890 to 1915; rebuilt in 1927	Shotgun/folk tradition	No
61	10	Walls	West Baton Rouge	R. Fonienoi and J. Luvireaux (1989)	1890 to 1915; rebuilt in 1927	Shotgun/folk tradition	No
61	11	Walls	West Baton Rouge	R. Fonienoi and J. Luvireaux (1989)	1820 to 1850	No style; plantation cabin; part of Arbroth Plantation	No
61	12	Walls	West Baton Rouge	R. Fonienoi and J. Luvireaux (1989)	1890 to 1915; rebuilt in 1927	No style	No
61	13	Walls	West Baton Rouge	R. Fonienoi and J. Luvireaux (1989)	1900 to 1920; rebuilt in 1927	Shotgun/folk tradition	No
61	14	Walls	West Baton Rouge	R. Fonienoi and J. Luvireaux (1989)	No date listed	No style; Baptist church	No
61	15	Walls	West Baton Rouge	R. Fonienoi and J. Luvireaux (1989)	ca. 1935 to 1940	No style; open shed; part of Arbroth Plantation	No
61	16	Walls	West Baton Rouge	R. Fonienoi and J. Luvireaux (1989)	1890 to 1915	Shotgun/folk tradition; part of Arbroth Plantation	No
61	17	Walls	West Baton Rouge	R. Fonienoi and J. Luvireaux (1989)	1930 to 1940	No style; church	No
61	18	Walls	West Baton Rouge	R. Fonienoi and J. Luvireaux (1989)	1890 to 1915	Shotgun/folk tradition	No
61	19	Walls	West Baton Rouge	R. Fonienoi and J. Luvireaux (1989)	1890 to 1915	Shotgun/folk tradition	No

Table 2.5-51 (Sheet 17 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
61	20	Walls	West Baton Rouge	R. Fonienoi and J. Luvireaux (1989)	1890 to 1915	Shotgun/folk tradition	No
61	21	Walls	West Baton Rouge	R. Fonienoi and J. Luvireaux (1989)	ca. 1865 to 1880	No style	No
61	22	Walls	West Baton Rouge	R. Fonienoi and J. Luvireaux (1989)	1870 to 1900	No style	No
61	23	Walls	West Baton Rouge	R. Fonienoi and J. Luvireaux (1989)	ca. 1870 to 1890	No style	No
61	24	Walls	West Baton Rouge	R. Fonienoi and J. Luvireaux (1989)	ca. 1900 to 1920	No style	No
63	149	SFBM	West Feliciana	Embree and Johnston (1987)	pre 1808	The Myrtles: kitchen (1 story renaissance; plantation cottage)	Yes-Myrtles Plantation
63	150	SFBM	West Feliciana	Embree and Johnston (1987)	by 1808/1830s/ 1850s	The Myrtles: home/ headquarters (central hall)	Yes-Myrtles Plantation
63	151	SFBM	West Feliciana	Brian Berggren (1987)	Late 19th to early 20th century; moved in 1942	One-story L-shaped; vernacular	No
63	152	SFBM	West Feliciana	Brian Berggren (1987)	Established 1891 some headstones date from 1940s	High Victorian Gothic	No
63	153	SFBM	West Feliciana	Brian Berggren (1987)	Earliest headstones from 1910s	Vernacular	No
63	154	SFBM	West Feliciana	Brian Berggren (1987)	ca. 1930 to 1940	Prairie style/4-square	No
63	155	SFBM	West Feliciana	Johnston and Berggren (1987)	ca. 1870	Greek Revival	No
63	156	SFBM	West Feliciana	Johnston and Berggren (1987)	Mid 19th century	Vernacular	No
63	157	SFBM	West Feliciana	Brian Berggren (1987)	Mid 19th century	Vernacular	No
63	158	SFBM	West Feliciana	Brian Berggren (1987)	ca. 1830	Vernacular/Greek Revival	No
63	159	SFBM	West Feliciana	Brian Berggren (1987)	ca. 1825	Federal/Greek Revival	No
63	160	SFBM	West Feliciana	Johnston and Berggren (1987)	1920 to 1930s	Vernacular	No
63	161	SFBM	West Feliciana	Embree and Johnson (1987)	Late 19th to early 20th century	Vernacular	No
63	162	SFBM	West Feliciana	Embree and Johnston (1987)	Late 19th century	Vernacular cottage	No
63	163	SFBM	West Feliciana	Embree and Johnston (1987)	ca. 1920s to 1930s	Vernacular	No
63	164	SFBM	West Feliciana	Johnston and Berggren (1987)	1930s	Vernacular	No

Table 2.5-51 (Sheet 18 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
63	165	SFBM	West Feliciana	Johnston and Berggren (1987)	1930s	Vernacular	No
63	166	SFBM	West Feliciana	Johnston and Berggren (1987)	Late 19th century	Vernacular	No
63	167	SFBM	West Feliciana	Johnston and Berggren (1987)	1890 to 1910	Vernacular/Queen Anne	No
63	168	SFBM	West Feliciana	Johnston and Berggren (1987)	1927	Vernacular (commercial structure)	No
63	169	SFBM	West Feliciana	Johnston and Berggren (1987)	1920s to 1930s	Vernacular	No
63	170	SFBM	West Feliciana	Johnston and Berggren (1987)	ca. 1880 to 1900	Vernacular	No
63	171	SFBM	West Feliciana	Johnston and Berggren (1987)	1920s to 1930s	Vernacular	No
63	172	SFBM	West Feliciana	Johnston and Berggren (1987)	1920s to 1930s	Vernacular	No
63	173	SFBM	West Feliciana	Johnston and Berggren (1987)	1917	Bungalow	No
63	174	SFBM	West Feliciana	Johnston and Berggren (1987)	ca. 1870 to 1890	Vernacular	No
63	175	SFBM	West Feliciana	Brian Berggren (1987)	1929	Colonial Revival	No
63	176	SFBM	West Feliciana	Johnston and Berggren (1987)	1930s	Bungalow	No
63	177	SFBM	West Feliciana	Johnston and Berggren (1987)	1920	Vernacular	No
63	178	SFBM	West Feliciana	Johnston and Berggren (1987)	ca. 1900	Vernacular	No
63	179	SFBM	West Feliciana	Johnston and Berggren (1987)	1920s to 1930s	Bungalow	No
63	180	SFBM	West Feliciana	Johnston and Berggren (1987)	1910s to 1920s	vernacular	No
63	181	SFBM	West Feliciana	Johnston and Berggren (1987)	1939	Colonial Revival	No
63	182	SFBM	West Feliciana	Embree and Johnston (1987)	Mid to late 19th century	Vernacular/Greek Revival	No
63	183	SFBM	West Feliciana	Embree and Johnston (1987)	Late 19th to early 20th century	Vernacular/Greek Revival	No
63	184	SFBM	West Feliciana	Johnston and Berggren (1987)	1880	Gothic Revival/Italianate/ Queen Anne	No
63	185	SFBM	West Feliciana	Brian Berggren (1987)	ca. 1930	No style	No
63	186	SFBM	West Feliciana	Brian Berggren (1987)	1930s	Early motel	Yes-3 V Tourist Court
63	187	SFBM	West Feliciana	Brian Berggren (1987)	ca. 1930	Early motel	Yes-3 V Tourist Court
63	188	SFBM	West Feliciana	Brian Berggren (1987)	ca. 1930	Early motel	Yes-3 V Tourist Court

Table 2.5-51 (Sheet 19 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
63	189	SFBM	West Feliciana	Brian Berggren (1987)	1890 to 1920	Vernacular	No
63	190	SFBM	West Feliciana	Johnston and Berggren (1987)	Rebuilt 1928 to 1929	Vernacular	No
63	191	SFBM	West Feliciana	Johnston and Berggren (1987)	1880	Greek Revival	No
63	192	SFBM	West Feliciana	Brian Berggren (1987)	1900 to 1910	Vernacular	No
63	193	SFBM	West Feliciana	Johnston and Berggren (1987)	ca. 1890	Vernacular	No
63	194	SFBM	West Feliciana	Johnston and Berggren (1987)	ca. 1890 to 1910	Vernacular	No
63	195	SFBM	West Feliciana	Johnston and Berggren (1987)	ca. 1890 to 1910	Vernacular	No
63	196	SFBM	West Feliciana	Embree and Johnston (1987)	1930s	Craftsman details on Vernacular house	No
63	197	SFBM	West Feliciana	Johnston and Berggren (1987)	ca. 1890 to 1910	Vernacular	No
63	198	SFBM	West Feliciana	Embree and Johnston (1987)	Turn of century	No style	No
63	199	SFBM	West Feliciana	Johnston and Berggren (1987)	ca. 1930 to 1935	Bungalow/vernacular	No
63	200	SFBM	West Feliciana	Brian Berggren (1987)	1906 to 1930s	Bungalow façade on vernacular building	No
63	201	SFBM	West Feliciana	Embree and Johnston (1987)	Late 19th to early 20th century	Vernacular tenant	No
63	202	SFBM	West Feliciana	Embree and Johnston (1987)	Late 19th to early 20th century	Vernacular Victorian	No
63	203	SFBM	West Feliciana	Embree and Johnston (1987)	Early 20th century	Vernacular tenant	No
63	204	SFBM	West Feliciana	Embree and Johnston (1987)	1930s	Shotgun	No
63	205	SFBM	West Feliciana	Embree and Johnston (1987)	ca. 1930s	Vernacular	No
63	206	SFBM	West Feliciana	Brian Berggren (1987)	ca. 1840	Greek Revival	No
63	207	SFBM	West Feliciana	Johnston and Berggren (1987)	1900 to 1925	Vernacular	No
63	208	SFBM	West Feliciana	Johnston and Berggren (1987)	1900 to 1925	Vernacular	No
63	209	SFBM	West Feliciana	Johnston and Berggren (1985)	1920	Vernacular	No
63	210	SFBM	West Feliciana	Johnston and Berggren (1987)	1880s to 1890s	Queen Anne/Vernacular	No
63	211	SFBM	West Feliciana	Brian Berggren (1987)	ca. 1880 to 1890	Queen Anne/stick	No

Table 2.5-51 (Sheet 20 of 44) Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
63	212	Port Hudson	West Feliciana	Brian Berggren (1987)	ca. 1840 to 1870	Italianate/Queen Anne	No
63	213	Port Hudson	West Feliciana	Brian Berggren (1987)	Late 19th century	Vernacular	No
63	214	Port Hudson	West Feliciana	Embree and Johnston (1987)	Late 19th century	Louisiana planter's cottage	No
63	215	Port Hudson	West Feliciana	Embree and Johnston (1987)	1900 to 1930	No style; board and batten	No
63	216	Port Hudson	West Feliciana	Brian Berggren (1987)	1930s to 1940s	Vernacular	No
63	217	Jackson	West Feliciana	Embree and Johnston (1987)	Post 1865	Cemetery (Boone Cemetery)	No
63	218	Jackson	West Feliciana	Johnston (1987)	Post 1894	Connell Family Cemetery	No
63	219	Jackson	West Feliciana	Embree and Johnston (1987)	1937	Craftsman	No
63	220	Jackson	West Feliciana	Embree and Johnston (1987)	1930s	Bungalow	No
63	233	Elm Park	West Feliciana	Embree and Johnston (1987)	Late 1930s	Modified bungalow	No
63	234	Elm Park	West Feliciana	Embree and Johnston (1987)	Pre-Civil War	Cemetery; slave cemetery for Troy Plantation	No
63	235	Elm Park	West Feliciana	Johnston and Berggren (1987)	1920s	Colonial revival	No
63	236	Elm Park	West Feliciana	Johnston and Berggren (1987)	Mid 19th century	Gothic Revival	No
63	237	Elm Park	West Feliciana	Johnston and Berggren (1987)	1927	Craftsman bungalow	No
63	238	Elm Park	West Feliciana	Embree and Johnston (1987)	Early 20th century	Vernacular/tenant house	No
63	239	Elm Park	West Feliciana	Embree and Johnston (1987)	Early 20th century	Vernacular	No
63	240	Elm Park	West Feliciana	Embree and Johnston (1987)	1880s	Vernacular/tenant house	No
63	241	Elm Park	West Feliciana	Johnston and Berggren (1987)	1918	Colonial revival (Ambrosia Plantation-main house)	No
63	242	Elm Park	West Feliciana	Johnston and Berggren (1987)	Mid to late 19th century	Vernacular (Ambrosia Plantation-wellhouse, milkhouse, and shop)	No
63	243	Elm Park	West Feliciana	Johnston and Berggren (1987)	Second half of 19th century	Italianate (Ambrosia Plantation-dove cote)	No
63	244	Elm Park	West Feliciana	Johnston and Berggren (1987)	19th century	Vernacular (Ambrosia Plantation-poultry shed)	No
63	245	Elm Park	West Feliciana	Johnston and Berggren (1987)	1890 to 1910	Vernacular (Ambrosia Doctor's office)	No
63	246	Elm Park	West Feliciana	Berggren, Johnston, and Embree (1987)	1930s	Vernacular	No

Table 2.5-51 (Sheet 21 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
63	247	Elm Park	West Feliciana	Johnston and Berggren (1987)	Mid 19th century	Vernacular (tenant house associated with Troy Plantation)	No
63	248	Elm Park	West Feliciana	Johnston and Berggren (1987)	ca. 1832	No style (Star Hill Plantation)	No
63	249	Elm Park	West Feliciana	Embree and Johnston (1987)	Early 20th century	Shotgun (associated with Perkins Plantation)	No
63	250	Elm Park	West Feliciana	Embree and Johnston (1987)	ca. 1832	Vernacular/federal (Star Hill Billiard House)	Yes-Star Hill Billiard Hall
63	251	Elm Park	West Feliciana	Johnston and Berggren (1987)	Late 19th century	Vernacular	No
63	252	Elm Park	West Feliciana	Johnston and Berggren (1987)	1890 to 1920	Vernacular	No
63	253	Elm Park	West Feliciana	Johnston and Berggren (1987)	1890 to 1920	Planters cottage	No
63	254	Elm Park	West Feliciana	Johnston and Berggren (1987)	1899	Vernacular (Star Hill Post Office)	Yes-Star Hill Post Office and Store
63	255	Elm Park	West Feliciana	Johnston and Berggren (1987)	1930s	Vernacular	No
63	256	Elm Park	West Feliciana	Brian Berggren (1987)	1881	High victorian gothic obelisks; Star Hill Cemetery (AKA Daniels Cemetery)	No
63	257	Elm Park	West Feliciana	Brian Berggren (1987)	1900 to 1920	Vernacular/tenant house (associated with Beaushamp Plantation)	No
63	258	Elm Park	West Feliciana	Embree (1987)	1920s to 1940s	Vernacular/tenant house/ frame	No
63	259	Elm Park	West Feliciana	Johnston and Embree (1987)	1850s	Vernacular/Greek Revival	No
63	260	Elm Park	West Feliciana	Johnston and Embree (1987)	Pre 1832	Vernacular/Greek Revival (Bickham House)	No
63	261	Elm Park	West Feliciana	Brian Berggren (1987)	1803	Double pen dogtrot (Dogwood)	No
63	262	Elm Park	West Feliciana	Berggren and Embree (1987)	1930	No style	No
63	263	Elm Park	West Feliciana	Brian Berggren (1987)	ca. 1920s to 1930s	Vernacular/bungalow	No
63	264	Elm Park	West Feliciana	Berggren and Embree (1987)	1900?	Vernacular/tenant house	No
63	265	Elm Park	West Feliciana	Brian Berggren (1987)	ca. 1890 to 1910	Vernacular cottage	No
63	266	Elm Park	West Feliciana	Brian Berggren (1987)	ca. 1935 to 1938	Bungalow	No
63	267	Elm Park	West Feliciana	Embree (1987)	1900 to 1940	Typical barn (Live Oak)	No
63	268	Elm Park	West Feliciana	Johnston and Embree (1987)	1900 to 1940	Vernacular (Live Oak; residence)	No
63	269	Elm Park	West Feliciana	Johnston and Embree (1987)	ca. 1895	Queen Anne (Independence Baptist Church)	No

Table 2.5-51 (Sheet 22 of 44) Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
63	270	Elm Park	West Feliciana	Embree (1987)	1900 to 1940	Vernacular/tenant house	No
63	271	Elm Park	West Feliciana	Brian Berggren (1987)	ca. 1920	Bungalow	No
63	272	Elm Park	West Feliciana	Embree (1987)	1920s to 1930s	Bungalow	No
63	273	Elm Park	West Feliciana	Johnston and Embree (1987)	1803	French Colonial and Federal (Oakley Plantation-main house)	Yes-Oakley Plantation House
63	274	Elm Park	West Feliciana	Johnston and Embree (1987)	Early 1800s	No style (Oakley Plantation-kitchen)	Yes-Oakley Plantation House
63	275	Elm Park	West Feliciana	Johnston and Embree (1987)	1850 to 1860	Cold frame (Oakley Plantation-for plant propagation)	No
63	276	Elm Park	West Feliciana	Johnston and Embree (1987)	1870	Barn (Oakley Plantation)	Yes-Oakley Plantation House
63	277	Elm Park	West Feliciana	BLANK	ca. 1860	Greek Revival (Pauline Plantation)	No
63	278	Elm Park	West Feliciana	Johnston and Embree (1987)	Early 20th century	Vernacular cottage	No
63	279	Elm Park	West Feliciana	Johnston and Embree (1987)	Post 1837	Cemetery (Hamilton and Bickham Cemetery)	No
63	280	Elm Park	West Feliciana	Embree (1987)	1835	Greek Revival with federal details (Rosedown Plantation-main house)	Yes-Rosedown Plantation
63	281	Elm Park	West Feliciana	Johnston and Embree (1987)	Early to mid 19th century	Greek Revival (Rosedown Plantation-doctor's office)	Yes-Rosedown Plantation
63	282	Elm Park	West Feliciana	Johnston and Embree (1987)	Mid 19th century	No style (Rosedown Plantation-barn)	Yes-Rosedown Plantation
63	283	Elm Park	West Feliciana	Johnston and Embree (1987)	Mid 19th century	No style (Rosedown Plantation-gazebo No. 2)	Yes-Rosedown Plantation
63	284	Elm Park	West Feliciana	Johnston and Embree (1987)	Mid 19th century	French and English garden influence structures (Rosedown Plantation-gazebo)	Yes-Rosedown Plantation
63	285	Elm Park	West Feliciana	Johnston and Embree (1987)	Mid 19th century	Utilitarian (Rosedown Plantation-garden tool shed)	Yes-Rosedown Plantation
63	286	Elm Park	West Feliciana	Johnston and Embree (1987)	Mid 19th century	French influence style adapted from European formal garden furnishings (Rosedown Plantation-gazebo No. 3)	Yes-Rosedown Plantation
63	287	Elm Park	West Feliciana	Johnston and Embree (1987)	Mid 19th century	No style (Rosedown Plantation-hothouse)	Yes-Rosedown Plantation
63	288	Elm Park	West Feliciana	Johnston (1987)	Mid 19th century	Hewning with French Colonial roof and exterior (Rosedown Plantation-milkshed)	Yes-Rosedown Plantation

Table 2.5-51 (Sheet 23 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
63	289	Elm Park	West Feliciana	Johnston and Embree (1987)	Mid 19th century	Plantation cottage miniaturized (Rosedown Plantation-outhouse)	No
63	290	Elm Park	West Feliciana	Embree (1987)	Mid 19th century	No style (Rosedown Plantation-pigeonniere)	No
63	291	Elm Park	West Feliciana	Johnston (1987)	19th century	No style; brick furnace (Rosedown Plantation-outdoor furnace)	No
63	292	Elm Park	West Feliciana	Embree (1987)	Late 19th to early 20th century	No style (Rosedown Plantation-Miss Nina's wing)	No
63	293	Elm Park	West Feliciana	Johnston and Embree (1987)	Early to mid 19th century	Log cabin (Rosedown Plantation-woodshed)	Yes-Rosedown Plantation
63	294	Elm Park	West Feliciana	Johnston (1987)	1835 to 1845	Greenhouse-type of conservatory (Rosedown Plantation-conservatory for tropical plants)	No
63	295	Elm Park	West Feliciana	Johnston and Embree (1987)	Mid 19th century	Plantation cottage miniaturized (Rosedown Plantation-outhouse)	No
63	296	Elm Park	West Feliciana	Johnston and Embree (1987)	Mid 19th century	Influenced by Romantic European garden structures (Rosedown Plantation-garden arch "the rockery")	No
63	297	Elm Park	West Feliciana	Johnston and Embree (1987)	Early 20th century	Vernacular	No
63	298	Elm Park	West Feliciana	Johnston and Embree (1987)	Late 19th to early 20th century	Vernacular cottage	No
63	299	Elm Park	West Feliciana	Johnston (1987)	1900?	Barn	No
63	300	Elm Park	West Feliciana	Johnston and Embree (1987)	1930s	Vernacular Craftsman (Locust Grove Plantation-residence)	No
63	301	Elm Park	West Feliciana	Johnston (1987)	No date listed	Barn (Locust Grove Plantation)	No
63	302	Elm Park	West Feliciana	Johnston and Embree (1987)	1880s to 1890s	Eastlake details (Locust Grove Plantation-barn)	No
63	303	Elm Park	West Feliciana	Johnston and Embree (1987)	1880 to 1920	Barn	No
63	304	Elm Park	West Feliciana	Johnston and Embree (1987)	Pre-Civil War	Cemetery (Park Plantation Slave Cemetery)	No
63	305	Elm Park	West Feliciana	Johnston and Embree (1987)	Early 1900s	Vernacular cottage/tenant house	No
63	306	Elm Park	West Feliciana	Johnston and Embree (1987)	1915	Mostly Craftsman details; early 20th century eclectic (Wildwood)	No
63	307	Elm Park	West Feliciana	Johnston and Embree (1987)	1915	Early garage (Wildwood)	No
63	308	Elm Park	West Feliciana	Johnston and Embree (1987)	Early 20th century	Gabled house	No

Table 2.5-51 (Sheet 24 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
63	309	Elm Park	West Feliciana	Johnston and Embree (1987)	1930s	Craftsman bungalow	No
63	310	Elm Park	West Feliciana	Johnston and Embree (1987)	1880s to 1890s	Planter’s Creek Revival (originally called The Oaks)	No
63	311	Elm Park	West Feliciana	Johnston and Embree (1987)	1936	Barn	No
63	312	Elm Park	West Feliciana	Johnston and Embree (1987)	Mid 19th century	Southern planter, French Colonial, and Greek Revival (The Oaks Plantation)	No
63	313	Elm Park	West Feliciana	Johnston and Embree (1987)	Early 20th century	Vernacular (associated with Cutrer Place)	No
63	314	Elm Park	West Feliciana	Johnston and Embree (1987)	1918	Vernacular	No
63	315	Elm Park	West Feliciana	Johnston and Embree (1987)	1901	Planter’s cottage	No
63	316	Elm Park	West Feliciana	Johnston and Embree (1987)	Post 1815	Cemetery (Locust Grove Cemetery)	No
63	317	Elm Park	West Feliciana	Johnston and Embree (1987)	Mid 19th century	Greek Revival/vernacular (Anchorage)	No
63	318	Elm Park	West Feliciana	Johnston and Embree (1987)	1900 to 1930	Vernacular/tenant house (Catalpa Plantation)	No
63	319	Elm Park	West Feliciana	Johnston and Embree (1987)	1900 to 1930	Vernacular/tenant house	No
63	320	Elm Park	West Feliciana	Berggren and Johnston (1987)	ca. 1900 to 1922	Early 20th century planter’s cottage (Beechwood)	No
63	321	Elm Park	West Feliciana	Berggren and Johnston (1987)	ca. 1900	Vernacular (Beechwood-barn)	No
63	322	Elm Park	West Feliciana	Berggren and Johnston (1987)	Early 19th century	Cemetery (Greek and gothic revival markers; Beechwood Cemetery)	No
63	323	Elm Park	West Feliciana	Johnston and Embree (1987)	1812 to 1850	French Colonial and Greek Revival details (The Cottage)	Yes-Cottage Plantation
63	324	Elm Park	West Feliciana	Johnston and Embree (1987)	1815	No style (Cottage Law Office)	Yes-Cottage Plantation
63	325	Elm Park	West Feliciana	Johnston and Embree (1987)	1815	Utilitarian outbuilding (The Cottage Milkhouse)	Yes-Cottage Plantation
63	326	Elm Park	West Feliciana	Johnston and Embree (1987)	1815	No style (The Cottage kitchen and ironing house)	Yes-Cottage Plantation
63	327	Elm Park	West Feliciana	Johnston and Embree (1987)	1850s	Agricultural/utilitarian (The Cottage cold frame)	Yes-Cottage Plantation
63	328	Elm Park	West Feliciana	Johnston and Embree (1987)	1850s to 1860s	Agricultural/utilitarian (The Cottage cold frame)	Yes-Cottage Plantation
63	329	Elm Park	West Feliciana	Johnston and Embree (1987)	19th century	Vernacular/tenant house (The Cottage gardener's cottage)	Yes-Cottage Plantation
63	330	Elm Park	West Feliciana	Johnston and Embree (1987)	19th century	Vernacular/tenant house (The Cottage slave cabin)	Yes-Cottage Plantation
63	331	Elm Park	West Feliciana	Johnston and Embree (1987)	No date listed	Vernacular/tenant house (The Cottage slave cabin)	Yes-Cottage Plantation

Table 2.5-51 (Sheet 25 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
63	332	Elm Park	West Feliciana	Johnston and Embree (1987)	No date listed	Plantation utilitarian (The Cottage horse barn)	Yes-Cottage Plantation
63	333	Elm Park	West Feliciana	Johnston and Embree (1987)	Post 1815	Cemetery (The Cottage family cemetery)	Yes-Cottage Plantation
63	334	Elm Park	West Feliciana	Johnston and Embree (1987)	No date listed	Plantation utilitarian (The Cottage carriage house)	Yes-Cottage Plantation
63	335	Elm Park	West Feliciana	Johnston and Embree (1987)	1815	Plantation utilitarian (The Cottage smokehouse)	Yes-Cottage Plantation
63	336	Elm Park	West Feliciana	Johnston and Embree (1987)	1815	Plantation outbuilding (The Cottage Commissary/Store house)	Yes-Cottage Plantation
63	337	Elm Park	West Feliciana	Johnston and Embree (1987)	19th century	No style (The Cottage cistern/ well house)	Yes-Cottage Plantation
63	338	Elm Park	West Feliciana	Johnston and Embree (1987)	1850s wing	French Colonial, Greek Revival, and Victorian (The Cottage bedroom wing)	Yes-Cottage Plantation
63	339	Elm Park	West Feliciana	Johnston and Embree (1987)	1840 to 1900	Four-room schoolhouse central hall (Rosale Plantation-main house)	Yes-Rosale Plantation
63	340	Elm Park	West Feliciana	Johnston and Embree (1987)	1835	Gothic Revival (Rosale Plantation-cistern/well house)	Yes-Rosale Plantation
63	341	Elm Park	West Feliciana	Johnston and Embree (1987)	Pre-Civil War	Vernacular/tenant house (Rosale Plantation-slave cabin)	Yes-Rosale Cabins
63	342	Elm Park	West Feliciana	Johnston and Embree (1987)	1850s	Vernacular/tenant house (Rosale Plantation-tenant house)	Yes-Rosale Cabins
63	343	Elm Park	West Feliciana	Johnston and Embree (1987)	1850s	Vernacular/tenant house (Rosale Plantation-slave cabin)	Yes-Rosale Cabins
63	344	Elm Park	West Feliciana	Johnston and Embree (1987)	ca. 1905	Turn of the century outbuilding style (Avalon Plantation-carriage house)	No
63	345	Elm Park	West Feliciana	Johnston and Embree (1987)	1905	Agricultural (Avalon Plantation-one horse wagon barn for raising trotting horses)	No
63	346	Elm Park	West Feliciana	Brian Berggren (1987)	1840	Greek Revival (The Troy Plantation well house)	No
63	347	Elm Park	West Feliciana	Johnston and Embree (1987)	1896	Utilitarian/Queen Anne	No
63	348	Elm Park	West Feliciana	Johnston and Embree (1987)	As of 1994, No Longer Standing	Vernacular	No
63	349	Elm Park	West Feliciana	Johnston and Embree (1987)	As of 1995, Demolished	Vernacular (Ambrosia tenant house)	No
63	350	Elm Park	West Feliciana	Johnston and Embree (1987)	1900 to 1940	Shotgun (board and batten)	No
63	351	Elm Park	West Feliciana	Johnston and Embree (1987)	Early 20th century	Vernacular	No

Table 2.5-51 (Sheet 26 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
63	352	St. Francisville	West Feliciana	Johnston, Embree, and Berggren (1987)	ca. 1914	Italianate	No
63	353	St. Francisville	West Feliciana	Johnston and Embree (1987)	1937	Agricultural (Middle Gate seed house)	No
63	354	St. Francisville	West Feliciana	Berggren and Johnston (1987)	No date listed	Vernacular; barn	No
63	355	St. Francisville	West Feliciana	Johnston, Embree, and Berggren (1987)	1938; wing added in 1960	Bungalow (Middle Gate)	No
63	356	St. Francisville	West Feliciana	Johnston and Embree (1987)	1930s	Agricultural (feed storage barn for Parker Place)	No
63	357	St. Francisville	West Feliciana	Embree (1987)	1880s to 1890s/1915	Italianate details (Governer Parker House)	No
63	358	St. Francisville	West Feliciana	Embree (1987)	Early 20th century	Agricultural; corncrib	No
63	359	St. Francisville	West Feliciana	Johnston and Embree (1987)	1913 to 1927	Agricultural; house and mule barn	No
63	360	St. Francisville	West Feliciana	Johnston and Embree (1987)	Turn of century	Vernacular (Parker Place)	No
63	361	St. Francisville	West Feliciana	Johnston and Embree (1987)	Pre-Civil War to 1930s	Solitude Plantation Black Cemetery	No
63	362	St. Francisville	West Feliciana	Johnston and Embree (1987)	Turn of century (1880 to 1910)	Vernacular	No
63	363	St. Francisville	West Feliciana	Johnston and Embree (1987)	1880 to 1910	Vernacular (Solitude Plantation-tenant house)	No
63	364	St. Francisville	West Feliciana	Johnston and Embree (1987)	Early 20th century	Vernacular (Solitude Plantation-tenant house)	No
63	365	St. Francisville	West Feliciana	Johnston and Embree (1987)	1930s	Bungalow	No
63	366	St. Francisville	West Feliciana	Embree (1987)	Possibly 19th century	Plantation/vernacular (Solitude Plantation cistern house)	Yes-Solitude Plantation House
63	367	St. Francisville	West Feliciana	Embree (1987)	Early 19th century (1815?)	French Creole raised cottage and Greek Revival (Solitude Plantation residence)	Yes-Solitude Plantation House
63	368	St. Francisville	West Feliciana	Embree (1987)	1916	Utilitarian (Solitude Plantation-kitchen)	Yes-Solitude Plantation House
63	369	St. Francisville	West Feliciana	Johnston and Embree (1987)	Turn of century	Agricultural; seed house/barn	No
63	370	St. Francisville	West Feliciana	Johnston and Embree (1987)	1930s	Vernacular	No
63	371	St. Francisville	West Feliciana	Johnston and Embree (1987)	1910 to 1930	Vernacular	No
63	372	St. Francisville	West Feliciana	Johnston and Embree (1987)	1900 to 1930	Vernacular	No
63	373	St. Francisville	West Feliciana	Embree (1987)	1920s or 1930s	Vernacular	No
63	374	St. Francisville	West Feliciana	Embree (1987)	Late 1930s	Vernacular	No

Table 2.5-51 (Sheet 27 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
63	375	St. Francisville	West Feliciana	Embree (1987)	1940	Agricultural; corncrib	No
63	376	St. Francisville	West Feliciana	Embree (1987)	1920s, 1930s possible	Saddlebag	No
63	377	St. Francisville	West Feliciana	Embree (1987)	1900 to 1930	Agricultural; corncrib or feed storage	No
63	378	St. Francisville	West Feliciana	Embree (1987)	1900	Cottage farmstead	No
63	379	St. Francisville	West Feliciana	Embree (1987)	1900 to 1925	Bungalow/farmhouse	No
63	380	St. Francisville	West Feliciana	Johnston and Embree (1987)	1900	Agricultural; barn	No
63	381	St. Francisville	West Feliciana	Johnston and Embree (1987)	1930s	Vernacular	No
63	382	St. Francisville	West Feliciana	Johnston and Embree (1987)	1900 to 1920	Vernacular	No
63	383	St. Francisville	West Feliciana	Embree (1987)	Late 19th century	Planters cottage (Pea Ridge)	No
63	384	St. Francisville	West Feliciana	Embree (1987)	Mid-to-late 19th century	Vernacular	No
63	385	St. Francisville	West Feliciana	Embree (1987)	Early 20th century	Colonial farmhouse (McIntyre House)	No
63	386	St. Francisville	West Feliciana	Embree (1987)	1906 to 1907; addition in 1960	Early 20th century colonial revival (Hillside Dairy)	No
63	387	St. Francisville	West Feliciana	Embree (1987)	Late 19th to early 20th century	No style	No
63	388	St. Francisville	West Feliciana	Johnston and Embree (1987)	1938	Vernacular; roadside store	No
63	389	St. Francisville	West Feliciana	Berggren and Johnston (1987)	1888	Italianate and Queen Anne (The Oaks)	Yes-The Oaks
63	390	St. Francisville	West Feliciana	Berggren and Johnston (1987)	Late 19th century	Vernacular (The Oaks-well shelter)	Yes-The Oaks
63	391	St. Francisville	West Feliciana	Berggren and Johnston (1987)	1880	No style (The Oaks mill house)	No
63	392	St. Francisville	West Feliciana	Johnston and Embree (1987)	1900	Vernacular (The Oaks-tenant house)	No
63	393	St. Francisville	West Feliciana	Johnston and Embree (1987)	1920s to 1930s	Vernacular	No
63	394	St. Francisville	West Feliciana	Berggren and Johnston (1987)	19th century to mid-20th century	Vernacular (Greenwood Plantation)	Yes-Butler Greenwood Plantation
63	395	St. Francisville	West Feliciana	Berggren and Johnston (1987)	ca. 1850 (possibly pre1810)	Vernacular (Greenwood Plantation-kitchen, millhouse, smokehouse)	Yes-Butler Greenwood Plantation
63	396	St. Francisville	West Feliciana	Berggren and Johnston (1987)	ca. 1810/ remodeling ca. 1850 to 1860	Gothic Revival/Italianate (Greenwood Plantation-residence)	Yes-Butler Greenwood Plantation
63	397	St. Francisville	West Feliciana	Berggren and Johnston (1987)	1850s	Gothic Revival (Greenwood Plantation-summerhouse)	Yes-Butler Greenwood Plantation

Table 2.5-51 (Sheet 28 of 44) Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
63	398	St. Francisville	West Feliciana	Embree (1987)	Turn of century	Saddlebag with additions	No
63	399	St. Francisville	West Feliciana	Embree (1987)	Turn of century	Vernacular	No
63	400	St. Francisville	West Feliciana	Johnston and Embree (1987)	1930s	Vernacular	No
63	401	St. Francisville	West Feliciana	Brian Berggren (1987)	1895/1910 to 1920	Queen Anne details (Spring Grove)	No
63	402	St. Francisville	West Feliciana	Brian Berggren (1987)	PAGE MISSING	PAGE MISSING (Spring Grove Dairy Barn)	No
63	403	St. Francisville	West Feliciana	Brian Berggren (1987)	ca. 1910 to 1930	Vernacular (Spring Grove Delco shed)	No
63	404	St. Francisville	West Feliciana	Johnston and Embree (1987)	Post 1913 (first remaining marker)	Cemetery (Afton Villa Cemetery)	No
63	405	St. Francisville	West Feliciana	Johnston and Embree (1987)	1910 to 1930	Farmhouse/cottage	No
63	406	St. Francisville	West Feliciana	Embree (1987)	Mid to late 19th century	Victorian cemetery (Afton Villa Plantation Gardens)	No
63	407	St. Francisville	West Feliciana	Berggren and Johnston (1987)	1885	Queen Anne (Catalpa)	Yes-Catalpa
63	408	St. Francisville	West Feliciana	No data	Mid to late 19th century	Italianate (Catalpa residential dependency)	No
63	409	St. Francisville	West Feliciana	Johnston and Embree (1987)	ca. 1830, remodeled in 1906	Louisiana plantation house style and greek revival (The Cedars)	No
63	410	St. Francisville	West Feliciana	Johnston and Embree (1987)	19th century	Vernacular (The Cedars summer or cistern house)	No
63	411	St. Francisville	West Feliciana	Johnston and Embree (1987)	19th century	Vernacular (The Cedars barn)	No
63	412	St. Francisville	West Feliciana	Johnston and Embree (1987)	19th century	No style (The Cedars outhouse)	No
63	413	St. Francisville	West Feliciana	Johnston and Embree (1987)	1900 to 1930	Vernacular/tenant house	No
63	414	St. Francisville	West Feliciana	Johnston and Embree (1987)	Mid-to-late 19th century	Plantation outbuilding (Gibson Place-kitchen)	No
63	415	St. Francisville	West Feliciana	Johnston and Embree (1987)	Mid-to-late 19th century	Planters cottage (Gibson Place-residence, originally part of Highland Plantation)	No
63	416	St. Francisville	West Feliciana	Embree (1987)	Early 20th century	No style (Parker Farm-tenant house)	No
63	417	St. Francisville	West Feliciana	Embree (1987)	1941	Bungalow related	No
63	418	St. Francisville	West Feliciana	Embree, Berggren, Johnston (1987)	ca. 1914 or earlier	Vernacular; barn/outbuilding/ corngrinding mill	No
63	419	St. Francisville	West Feliciana	Johnston (1987)	1930s	No style; cattle weighing shed	No
63	420	St. Francisville	West Feliciana	Johnston and Embree (1987)	1914 to 1938	Agricultural (Middle Gate/ Governor Parker's Stock Farm)	No
63	421	St. Francisville	West Feliciana	Johnston and Embree (1987)	Early 1930s	Agricultural; pump house	No

Table 2.5-51 (Sheet 29 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
63	422	St. Francisville	West Feliciana	Johnston (1987)	1900 to 1920	Shotgun	No
63	423	St. Francisville	West Feliciana	Johnston (1987)	Mid 1870s	Vernacular/Greek Revival (Woodland part of Highland Plantation)	No
63	424	St. Francisville	West Feliciana	Johnston (1987)	Pre 1922	Overgrown cemetery (possibly associated with Highland Plantation)	No
63	425	St. Francisville	West Feliciana	Johnston (1987)	1900 to 1920	Saddlebag/tenant house	No
63	426	Laurel Hill	West Feliciana	Johnston and Embree (1987)	Early 20th century	Vernacular	No
63	427	Laurel Hill	West Feliciana	Johnston and Embree (1987)	Earliest remaining headstone is 1902	Cemetery	No
63	428	Laurel Hill	West Feliciana	Johnston and Embree (1987)	Earliest remaining headstone is 1922	Cemetery; cement and marble markers	No
63	429	Laurel Hill	West Feliciana	Johnston and Embree (1987)	1880 to 1910	Vernacular/tenant house (Jones Plantation tenant house)	No
63	430	Laurel Hill	West Feliciana	Johnston and Embree (1987)	1890	Eastlake and planters cottage styles (land part of High Grove Plantation)	No
63	431	Laurel Hill	West Feliciana	Johnston and Embree (1987)	Turn of century	Roadside commercial; store	No
63	432	Laurel Hill	West Feliciana	Johnston and Embree (1987)	Turn of century	Plantation outbuilding; corncrib	No
63	433	Laurel Hill	West Feliciana	Johnston and Embree (1987)	1890 to 1910	Vernacular/tenant house (Holly Grove Plantation tenant house)	No
63	434	Laurel Hill	West Feliciana	Johnston and Embree (1987)	1890 to 1910	Vernacular/tenant house (Holly Grove Plantation tenant house)	No
63	435	Laurel Hill	West Feliciana	Johnston and Embree (1987)	1880 to 1920	Corncrib (Holly Grove Plantation)	No
63	436	Laurel Hill	West Feliciana	Johnston and Embree (1987)	Late 19th century	Queen Anne/Italianate superimposed on planters cottage	No
63	437	Laurel Hill	West Feliciana	Johnston and Embree (1987)	Early 19th century	Beech Grove Cemetery	No
63	438	Laurel Hill	West Feliciana	Johnston and Embree (1987)	1900?	Updated '40s farmhouse	No
63	533	Laurel Hill	West Feliciana	Johnston and Embree (1987)	1900 to 1930	Sophisticated saddlebag	No
63	534	Laurel Hill	West Feliciana	Johnston and Embree (1987)	1900 to 1930	Vernacular/tenant house	No
63	535	Laurel Hill	West Feliciana	Johnston and Embree (1987)	Post 1937 (Earliest accessible grave)	St. Mary's Baptist Church cemetery	No

Table 2.5-51 (Sheet 30 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
63	536	Laurel Hill	West Feliciana	Johnston and Embree (1987)	1920s to 1930s	Bungalow	No
63	537	Laurel Hill	West Feliciana	Johnston and Embree (1987)	1920s to 1930s	Shotgun	No
63	538	Laurel Hill	West Feliciana	Berggren and Johnston (1987)	1834 to 1836; modified in 1877	Greek Revival (Wakefield Plantation-main house)	Yes-Wakefield Plantation
63	539	Laurel Hill	West Feliciana	Berggren and Johnston (1987)	1877	Vernacular (Wakefield Plantation-kitchen and ironing room)	No
63	540	Laurel Hill	West Feliciana	Berggren and Johnston (1987)	ca. 1836	Vernacular (Wakefield Plantation-barn)	No
63	541	Laurel Hill	West Feliciana	Berggren and Johnston (1987)	ca. 1836	Vernacular (Wakefield Plantation-slave quarters)	No
63	542	Laurel Hill	West Feliciana	Berggren and Johnston (1987)	Mid-to-late 19th century	Vernacular (Wakefield Plantation-privy)	No
63	543	Laurel Hill	West Feliciana	Johnston and Embree (1987)	Mid to 19th century/ modified in 1939	Combination of plantation outbuilding and 20th century farmhouse (Oak Grove kitchen and laundry room)	No
63	544	Laurel Hill	West Feliciana	Berggren and Johnston (1987)	ca. 1840	Greek Revival (on NR says French Creole) (Oak Grove pigeonniere)	Yes-Oak Grove Plantation Dependencies
63	545	Laurel Hill	West Feliciana	Berggren and Johnston (1987)	ca. 1840/1985	Greek Revival (on NR says French Creole) (Oak Grove pigeonniere)	Yes-Oak Grove Plantation Dependencies
63	546	Laurel Hill	West Feliciana	Johnston and Embree (1987)	ca. 1840	Greek Revival (on NR says French Creole) (Oak Grove Cistern House)	Yes-Oak Grove Plantation Dependencies
63	547	Laurel Hill	West Feliciana	Berggren and Johnston (1987)	Late 19th-early 20th century	Vernacular (Oak Grove Carriage house/garage)	Yes-Oak Grove Plantation Dependencies
63	548	Laurel Hill	West Feliciana	Johnston and Embree (1987)	1850s	Late version of Greek Revival (Oak Grove Plantation Slave School)	No
63	549	Weyanoke	West Feliciana	Johnston and Embree (1987)	1920s to 1930s	Bungalow (Island Plantation home site)	No
63	550	Weyanoke	West Feliciana	Johnston and Embree (1987)	1910 to 1920	Vernacular/tenant house with sophisticated porch details (Island Plantation-tenant house)	No
63	551	Weyanoke	West Feliciana	Johnston and Embree (1987)	1910?	Plantation outbuilding (Island Plantation tack room)	No
63	568	Weyanoke	West Feliciana	Johnston and Embree (1987)	Post 1900	Cemetery (St. Peter's Baptist Church)	No
63	569	Weyanoke	West Feliciana	Johnston and Embree (1987)	Late 1930s	No style; commercial building; store (Harrell Store)	No
63	639	Elm Park	West Feliciana	Hahn (1994)	ca. 1940	Vernacular	No

Table 2.5-51 (Sheet 31 of 44) Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
63	640	St. Francisville	West Feliciana	Hahn (1994)	1923 to 1933	I-house	No
63	641	Elm Park	West Feliciana	Hahn (1994)	ca. 1880	Vernacular	No
63	642	Elm Park	West Feliciana	Hahn (1994)	ca. 1880	Vernacular	No
63	643	St. Francisville	West Feliciana	Hahn (1994)	ca. 1880 to 1900	Vernacular	No
	560	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	561	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	562	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	563	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	564	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	565	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	566	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	567	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	568	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	569	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	570	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	571	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	572	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	573	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	574	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	575	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	576	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	577	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	579	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	580	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	581	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available

Table 2.5-51 (Sheet 32 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
	582	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	583	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	584	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	585	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	586	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	587	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	588	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	589	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	590	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	591	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	592	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	593	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	594	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	595	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	596	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	597	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	598	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	599	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	600	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	601	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	602	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	603	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	604	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	605	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available

Table 2.5-51 (Sheet 33 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
	606	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	607	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	608	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	609	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	610	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	611	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	612	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	613	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	614	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	615	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	616	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	617	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	618	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	619	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	620	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	621	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	622	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	623	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	624	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	625	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	626	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	627	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	628	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	629	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available

Table 2.5-51 (Sheet 34 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
	630	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	631	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	632	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	633	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	634	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	635	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	636	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	637	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	638	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	639	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	640	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	641	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	642	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	643	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	644	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	645	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	646	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	647	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	648	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	649	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	650	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	651	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	652	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	653	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available

Table 2.5-51 (Sheet 35 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
	654	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	655	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	656	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	657	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	658	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	659	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	660	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	661	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	662	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	663	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	664	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	665	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	666	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	667	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	668	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	669	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	670	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	671	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	672	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	673	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	675	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	675	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	676	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	677	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available

Table 2.5-51 (Sheet 36 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
	678	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	679	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	680	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	681	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	682	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	683	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	684	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	685	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	686	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	687	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	688	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	689	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	690	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	691	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	692	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	693	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	694	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	695	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	696	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	697	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	698	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	699	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	700	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	701	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available

Table 2.5-51 (Sheet 37 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
	702	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	703	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	704	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	705	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	706	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	707	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	708	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	709	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	710	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	711	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	712	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	713	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	714	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	715	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	716	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	717	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	718	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	719	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	720	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	721	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	722	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	723	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	724	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	725	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available

Table 2.5-51 (Sheet 38 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
	726	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	727	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	728	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	729	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	730	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	731	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	732	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	733	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	734	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	735	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	736	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	737	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	738	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	739	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	740	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	741	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	742	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	743	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	744	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	745	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	746	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	747	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	748	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	749	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available

Table 2.5-51 (Sheet 39 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
	750	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	751	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	753	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	754	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	755	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	756	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	757	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	758	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	759	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	760	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	761	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	762	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	762	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	763	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	764	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	765	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	766	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	767	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	768	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	769	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	770	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	771	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	772	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	773	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available

Table 2.5-51 (Sheet 40 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
	774	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	775	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	776	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	777	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	777	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	778	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	779	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	780	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	781	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	782	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	783	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	784	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	785	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	786	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	787	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	788	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	789	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	790	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	791	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	792	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	793	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	794	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	795	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	796	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available

Table 2.5-51 (Sheet 41 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
	797	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	798	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	799	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	800	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	801	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	802	Jackson BM	East Feliciana	No data available	No data available	No data available	No data available
	809	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	810	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	811	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	812	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	813	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	814	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	815	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	815	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	816	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	817	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	818	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	819	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	820	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	821	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	822	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	1062	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1073	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	1078	Jackson	East Feliciana	No data available	No data available	No data available	No data available

Table 2.5-51 (Sheet 42 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
	1079	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	1080	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	1081	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	1082	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	1084	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1086	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1087	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1089	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1090	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1091	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1092	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1093	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1094	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1095	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1096	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1097	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1098	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1100	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1101	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1102	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1103	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1104	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1105	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1107	Port Hudson	East Feliciana	No data available	No data available	No data available	No data available

Table 2.5-51 (Sheet 43 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
	1108	Port Hudson	East Feliciana	No data available	No data available	No data available	No data available
	1109	Port Hudson	East Feliciana	No data available	No data available	No data available	No data available
	1110	Port Hudson	East Feliciana	No data available	No data available	No data available	No data available
	1111	Port Hudson	East Feliciana	No data available	No data available	No data available	No data available
	1112	Port Hudson	East Feliciana	No data available	No data available	No data available	No data available
	1113	Port Hudson	East Feliciana	No data available	No data available	No data available	No data available
	1114	Port Hudson	East Feliciana	No data available	No data available	No data available	No data available
	1115	Port Hudson	East Feliciana	No data available	No data available	No data available	No data available
	1116	Port Hudson	East Feliciana	No data available	No data available	No data available	No data available
	1117	Port Hudson	East Feliciana	No data available	No data available	No data available	No data available
	1118	Port Hudson	East Feliciana	No data available	No data available	No data available	No data available
	1124	Port Hudson	East Feliciana	No data available	No data available	No data available	No data available
	1125	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1126	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	1127	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	1128	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	1129	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	1130	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	1131	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	1132	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	1133	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	1140	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	1141	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	1142	Jackson	East Feliciana	No data available	No data available	No data available	No data available

Table 2.5-51 (Sheet 44 of 44)
Historic Standing Structures Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish No.	Structure No.	USGS 7.5' Quadrangle	Parish	Recorder (Date)	Construction Date	Type (Name)	On the NRHP
	1143	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	1190	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	1191	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	1192	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	1267	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1268	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1269	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1270	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1271	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1272	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1273	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	1274	Jackson	East Feliciana	No data available	No data available	No data available	No data available
	1275	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1277	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1278	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1279	Zachary	East Feliciana	No data available	No data available	No data available	No data available
	1988	Zachary	East Feliciana	No data available	No data available	No data available	No data available

Table 2.5-52 (Sheet 1 of 3) Properties Listed on the NRHP Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish	Property Name	General Location	NRHP Type	Property Description
East Baton Rouge	Fairhaven Plantation House	Zachary	Individual	Single story frame transitional Greek Revival-Italianate galleried plantation house
East Baton Rouge	Port Hudson National Cemetery	Zachary	Contributing and noncontributing properties	Lodge, utility building, pump house, cemetery, gates (2), perimeter wall, flagpole with bronze plaque, and public restroom building
East Feliciana	Asphodel Plantation and Cemetery	Jackson	Individual	Two-story Greek Revival
East Feliciana	Cenetary College, The College of Louisiana (aka Old Centenary College)	Jackson	Contributing and non-contributing properties	Two-story frame building Greek Revival style; some modern intrusions (i.e., several modern two-story apartment buildings on southern end of property and some modern frame houses on northern end)
East Feliciana	Center Building of East Louisiana State Hospital	Jackson	Individual	Three-and-a-half stories with elongated two elongated wings; Greek Revival; formal garden in front of building
East Feliciana	Jackson Historic District	Jackson	Contributing and non-contributing properties	Ages range from 1815 to ca. 1950; arch styles include Federal, Greek Revival, Victorian, Queen Anne Revival
East Feliciana	Linwood	Jackson	Individual	Greek Revival; two-story, five-bay frame building
East Feliciana	Wildwood Plantation House	Jackson	Individual	One-and-a-half story frame Greek Revival with live oak garden
Pointe Coupee	Albin Major House	New Roads	Individual	One-story frame structure in French Creole style
Pointe Coupee	Austerlitz	Oscar	Individual	Two-story, fully raised, brick and frame French Creole plantation house
Pointe Coupee	Bonnie Glen	New Roads	Individual	Raised plantation house (3 ft.); Creole Greek Revival
Pointe Coupee	Cherie Quarters Cabins (aka River Lake Plantation Cabins)	Oscar	Contributing properties	Two single-story frame slave dwellings
Pointe Coupee	Jacques Dupre House	Jarreau	Individual	Moved in 1994 to Pointe Coupee Parish from St. Landry Parish; two story raised French Creole house; largest type of French Creole house built in LA; umbrella roof
Pointe Coupee	Fannie Riche House	New Roads	Individual	One-story frame structure in French Creole style with some Federal influence
Pointe Coupee	First National Bank of New Roads	New Roads	Individual	Commercial building; two-story brick building in Classical Revival style
Pointe Coupee	Glynwood	Glynn	Individual	A large, frame, Greek Revival and Queen Anne Revival that varies from one-and-a-half to two stories
Pointe Coupee	Jean Baptiste Bergeron House	Jarreau	Individual	Brick and frame structure in French Creole style; raised main living floor above low brick basement story
Pointe Coupee	Labatut	New Roads	Individual	Major two-story Creole plantation house with elaborate Federal woodwork; brick-between-post house
Pointe Coupee	LeBeau House and Kitchen	Jarreau	Contributing and non-contributing properties	Classic Creole raised cottage; two-and-a-half stories; contributing kitchen building and non-contributing modern cattle pen
Pointe Coupee	LeJeune House	New Roads	Individual	Two-story, pitched roof raised cottage; broad front galleries; Greek Revival; "brick entre poteaux" construction
Pointe Coupee	North Bend	Oscar	Contributing and non-contributing properties	Two-story brick and frame raised Creole plantation house; non-contributing two-car garage on-site
Pointe Coupee	Pleasant View Plantation House	Oscar	Individual	Full two-story, brick and frame Creole plantation house; features pre-Greek Revival details that are not common in other similar houses in the parish

Table 2.5-52 (Sheet 2 of 3) Properties Listed on the NRHP Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish	Property Name	General Location	NRHP Type	Property Description
Pointe Coupee	Pointe Coupee Parish Courthouse	New Roads	Individual	Two-story bearing wall brick building; Romanesque Revival with two-story Art Deco wing added in 1939
Pointe Coupee	Poydras High School	New Roads	Individual	Three-story brick with decorative concrete elements Classical Revival (20th century)
Pointe Coupee	Riverlake	Oscar	Contributing properties	Two-story galleried raised Creole plantation house; has Greek Revival features; to east and west of main house are two pigeonnieres; to the east is two-story; the one to the west was once identical but has lost upper story; both are deteriorated
Pointe Coupee	Saint Francis of Point Coupee (aka St. Francis Chapel)	New Roads	Individual	Gothic Revival; open hall church plan of four bays with small balcony over front entrance; balloon frame structure with truss roof
Pointe Coupee	Saizon House (aka Stuart Woody House)	Jarreau	Individual	Small one-story frame French Creole structure
Pointe Coupee	Samson House	New Roads	Contributing and non-contributing properties	One-and-a-half story frame French Creole cottage; has been moved twice; built in Waterloo; three modern non-contributing properties (carport/storage building, an entertainment pavilion, and a bathroom resembling an outhouse)
Pointe Coupee	Satterfield Motor Company Building	New Roads	Individual	One-story stucco over brick party wall commercial building
Pointe Coupee	Valmont Bergeron House (aka Chateau Semas)	Jarreau	Individual	One-story frame French Creole structure
Pointe Coupee	Wickliffe	New Roads	Individual; non-contributing	Two-story raised French Creole style plantation; overseer's house is non-contributing; also has Greek Revival features
West Feliciana	3 V Tourist Court	St. Francisville	Contributing and non-contributing properties	Six small frame rental units in Craftsman style; also a contributing manager's house (frame) and three non-contributing units that have been altered to the point that it affects their eligibility
West Feliciana	Afton Villa Gardens	St. Francisville	Landscape architecure	140 ac. of terraced garden; includes Barrow Family Cemetery; Afton Villa itself is 4-ft. tall brick ruins (fire in 1963) standing walls have been stabilized and planted like a rock garden
West Feliciana	Butler Greenwood (aka Greenwood Plantation)	St. Francisville	Contributing properties	44 ac. with plantation complex, including the plantation house, gazebo, a rear brick kitchen, and several small wood frame buildings and formal gardens
West Feliciana	Catalpa	St. Francisville	Contributing and non-contributing properties	19th century oak alley, an antebellum dependency, and an 1885 one-and-a-half story frame house (Victorian cottage); and two non-contributing sheds
West Feliciana	Cottage Plantation	St. Francisville	Contributing properties	Main house, old school house, outside kitchen, milk house, two greenhouses, two cistern sheds, a carriage barn, a horse barn, three slave cabins, a cemetery, smoke house, and utility house; main house consists of two buildings in the form of an L, with the original structure from the Spanish colonial era; Federal style
West Feliciana	Grace Episcopal Church (aka Grace Church)	St. Francisville	Contributing and non-contributing properties	Five-bay open hall plan; brick with wood trusses supporting the roof; only intrusion is small parking lot over site of old parsonage
West Feliciana	Myrtles Plantation	St. Francisville	Contributing properties	One-story house with detached kitchen and landscaped garden; 10 ac. included; Greek Revival/Italianate style
West Feliciana	Oak Grove Plantation Dependencies (aka Senrab)	St. Francisville	Contributing and non-contributing properties	Two antebellum French Creole pigeonnieres, an antebellum French Creole cistern house, a ca. 1900 carriage house, and two non-contributing elements

Table 2.5-52 (Sheet 3 of 3) Properties Listed on the NRHP Identified within 10 Mi. (16.1 Km) of the Proposed Project Area

Parish	Property Name	General Location	NRHP Type	Property Description
West Feliciana	Oakley Plantation House	St. Francisville	Contributing and non-contributing properties	Plantation building complex includes three-story main house, a detached kitchen, a stable/barn, and a 20th century worker's house; six modern structures are also present; 100 ac.; Federal style
West Feliciana	Propinquity	St. Francisville	Contributing and non-contributing properties	Two-story Greek Revival structure; a two-story wing of antique brick was added to the south end of the structure in 1966 to 1968
West Feliciana	Rosale Cabins	St. Francisville	Individual	Three frame dependencies cabins
West Feliciana	Rosale Plantation	St. Francisville	Contributing and non-contributing properties	The main house is a two-story Greek Revival/Gothic Revival (19th century) with which the old schoolhouse was incorporated to form one large structure; also present is the old summer house; a small board and batten shack is beside the main house
West Feliciana	Rosedown Plantation (aka Rosedown Plantation State Historic Site)	St. Francisville	Contributing and non-contributing properties	Two-story main house of transitional Federal-Greek Revival style; 374 ac.; 31 non-contributing resources are spread out over the 374 ac.; contributing elements: (contributing site-garden), (contributing buildings-main house, doctor's office, milk house, garden tool shed, log shed, barn at edge of north garden), (contributing structures - three gazebos and a hothouse)
West Feliciana	Solitude Plantation House	St. Francisville	Contributing properties	Single story raised house built in two stages; both Federal and Creole influences; one cistern house and one kitchen are outbuildings
West Feliciana	St. Francisville Historic District	St. Francisville	Contributing and non-contributing properties	Mainly along Royal and Prosperity Streets; 15 buildings of significant importance to the district, 22 contributing to character, and 12 non-contributing; addendum-81 buildings along Ferdinand and Sewell Streets with 27 percent intrusion rate; varying styles
West Feliciana	Star Hill Plantation Dependency (aka Star Hill Billiard Hall)	Star Hill	Individual	Small brick one-story building; only standing structure of Star Hill Sugar Plantation
West Feliciana	Star Hill Post Office and Store	St. Francisville	Individual	One-story frame store; was moved in 1898 and in early 1920s, was moved back to original location
West Feliciana	The Oaks	Hardwood	Contributing properties	Frame, clapboard plantation house of Renaissance and Queen Anne Revival in style; with several dependencies and 28.5 ac.; dependencies include kitchen/laundry building, dairy, well house (Gothic in style), and carriage house ruins
West Feliciana	Wakefield	Wakefield	Individual	Built as a framed, two-and-a-half story house and reduced to a one-and-a-half stories in 1870s; raised Greek Revival plantation house

Table 2.5-53
Minority/Low Income Areas within the Regional Parish and Counties[a]

Area	Percent Minority	Minority Population	Percent Low Income	Low Income Population[b]
Louisiana	37.40	No	19.64	No
Ascension	23.82	No	12.95	No
Assumption	33.45	No	21.83	No
Avoyelles	32.15	No	25.95	No
Catahoula	28.71	No	28.14	No
Concordia	39.88	No	29.11	No
East Baton Rouge	44.91	No	17.87	No
East Feliciana	48.55	No	23.01	No
Evangeline	30.21	No	32.23	No
Iberia	35.68	No	23.55	No
Iberville	51.38	**Yes**	23.11	No
Lafayette	27.69	No	15.72	No
Livingston	6.46	No	11.37	No
Pointe Coupee	39.73	No	23.13	No
St. Helena	53.83	**Yes**	26.83	No
St. Landry	43.95	No	29.28	No
St. Martin	34.52	No	21.55	No
Tangipahoa	31.11	No	22.69	No
West Baton Rouge	37.99	No	17.01	No
West Feliciana	51.94	**Yes**	19.88	No
Mississippi	39.30	No	19.93	No
Adams	54.28	**Yes**	25.92	No
Amite	43.85	No	22.63	No
Franklin	37.43	No	24.11	No
Pike	49.05	No	25.29	No
Wilkinson	68.95	**Yes**	37.70	No

a) Includes parishes and counties wholly or partly within the 50-mi. radius of the proposed RBS Unit 3 power block.

b) Based on the percentage of individuals in poverty.

Source: Reference 2.5-49.

Table 2.5-54
Regional Farms that Employ Migrant Labor

County or Parish	Total Farms	Farms with Migrant Labor	Percent of Total Farms
Adams County, MS	269	2	<1
Amite County, MS	626	0	0
Franklin County, MS	208	0	0
Pike County, MS	563	0	0
Wilkinson County, MS	298	0	0
Ascension Parish, LA	329	9	3
Assumption Parish, LA	105	13	12
Avoyelles Parish, LA	890	15	2
Catahoula Parish, LA	435	0	0
Concordia Parish, LA	336	0	0
East Baton Rouge Parish, LA	489	2	<1
East Feliciana Parish, LA	460	0	0
Evangeline Parish, LA	648	3	<1
Iberia Parish, LA	340	28	8
Iberville Parish, LA	183	11	6
Lafayette Parish, LA	715	5	<1
Livingston Parish, LA	451	2	<1
Pointe Coupee Parish, LA	465	23	5
St. Helena Parish, LA	326	1	<1
St. Landry Parish, LA	1228	27	2
St. Martin Parish, LA	328	9	3
Tangipahoa Parish, LA	1065	18	2
West Baton Rouge Parish, LA	108	4	4
West Feliciana Parish, LA	165	1	<1

Note:
Includes parishes and counties wholly or partly within the 50-mi. radius of the proposed RBS Unit 3 power block.

Source: References 2.5-122 and 2.5-123.

Table 2.5-55
Summary of Ambient Sound Levels

Receptor	Approximate Distance from Unit 1 (Mi.)	Ambient Sound Level (dBA)	
		Summer 1972	Winter 1980
R1	0.85	52	38
R2	0.89	52	38
R3	1.09	46	40
R4	0.93	46	40
R5	0.89	46	40
R6	0.90	46	40
R7	0.84	46	40
R8	1.19	50	38

Source: Reference 2.5-48.

Table 2.5-56
Ranges of Assumed 2007 Ambient Sound Levels, Including Noise Contributions from RBS Unit 1

Receptor	Approximate Distance from Unit 1 (Mi.)	Ambient Sound Level (dBA),[a] Present Day
R1	0.85	47-57
R2	0.89	47-57
R3	1.09	46-52
R4	0.93	48-54
R5	0.89	49-54
R6	0.90	50-56
R7	0.84	50-56
R8	1.19	43-53

a) Ranges result from the following:
- Separate predictions performed by GSU and the NRC.
- The use of different initial conditions - Summer 1972 and Winter 1980.

Source: References 2.5-47 and 2.5-48.

ER 2.5 Figures

Due to the large file sizes of the figures for ER Section 2.5, they are collected in a single .pdf file, which you can navigate via the figure numbers in the Bookmark pane. When cited in the text, the links for these figures will launch the .pdf file.

2.6 GEOLOGY

In accordance with NUREG-1555, *Standard Review Plans for Environmental Reviews of Nuclear Power Plants*, an environmental review of the site geology is not required in the ER. However, to assess the suitability of the site for Unit 3, a summary of the structural geology and geologic features of the RBS site region (200-mi. radius), vicinity (25-mi. radius), area (5-mi. radius), and site location (0.6-mi. radius) is provided in Section 2.5 of the FSAR, Part 2 of the COLA. In addition, the FSAR presents detailed analyses and evaluation of geological, seismological, and geotechnical data. The FSAR information includes estimates of peak horizontal and vertical ground accelerations and response spectra associated with the safe shutdown earthquake.

2.6.1 REFERENCES

None.

2.7 METEOROLOGY AND AIR QUALITY

This section describes the general climate of the RBS and the surrounding regional meteorological conditions. This section also documents the range of meteorological conditions that would likely exist during the construction and operation of a new facility. The data presented include a climatological summary of normal and extreme values of several meteorological parameters recorded by the National Weather Service (NWS) meteorological instruments located in Louisiana at Baton Rouge (Ryan Airport), New Orleans, Lake Charles, and the RBS on-site meteorological station. Supplemental meteorological data from four NWS Cooperative Observation (COOP) stations, with data sets dating back 50 years or more, are included in the analysis of the region surrounding the RBS. Air quality data obtained from the LDEQ monitors are used to discuss the regional air quality surrounding the proposed new RBS. Short- and long-term diffusion estimates of radiation, as they relate to dose concentrations to the public and surrounding area, are presented in Subsections 2.7.5 and 2.7.6.

2.7.1 GENERAL CLIMATE

The general climate of the proposed site can be described as humid subtropical with summers dominated by the Bermuda High, a semi-permanent anticyclone that is an extension of the Azores High-Pressure System (Reference 2.7-1).The Bermuda High can remain intact into the spring and fall and occasionally even into the winter season. The prevailing southeasterly winds combined with an abundant moisture supply from the warm waters of the Gulf of Mexico provide mild and rather humid weather throughout most of the year (Reference 2.7-2). The Bermuda High historically can lead to very light winds or even calm weather conditions, thus creating air stagnation problems in the region at times during the summer and early fall seasons (Reference 2.7-3). Air from higher latitudes in the north-central United States occasionally brings drier and cooler conditions to the area, but mainly for only brief periods of time during the winter months (Reference 2.7-1).

The summer climate is warm and humid and is characterized by relatively light winds. Afternoon showers and thunderstorms, which account for much of the summer rainfall, occur nearly one-half of the days during June, July, and August (Reference 2.7-1).

The winter climate is characterized by mild temperatures due to the influence of the maritime air (Reference 2.7-1). The main continental storm track also migrates south into portions of northern Louisiana, but typically remains far enough north of the RBS and surrounding region so that convective showers and storms are the primary source of precipitation events, even during winter months (Reference 2.7-4). Monthly precipitation remains high, with mean monthly rainfall being the greatest in January (Reference 2.7-1). Snow and other freezing precipitation events are rare, with annual totals for snowfall and ice accretion events averaging only a fraction of an inch in the RBS region.

Early spring is the season with the highest frequency of tornadoes and large hail events; however, even these occurrences are rare (Reference 2.7-1). Tropical cyclone frequency is climatologically highest in early autumn, but statistically only one hurricane makes landfall along the coastline of Louisiana approximately every 4 years (Reference 2.7-5). The most pleasant weather usually occurs during late September into October when temperatures are cooler, average monthly precipitation totals are lower, and average monthly cloudiness decreases. The threat of heavy rainfall is present in all seasons, attributed to the year-round potential for convective rainfall activity (Reference 2.7-1).

2.7.2 REGIONAL CLIMATOLOGY

The description of the regional climatology at the time of licensing the existing RBS Unit 1 was based primarily on climatological records for Baton Rouge, New Orleans, and Lake Charles, Louisiana, as well as the RBS on-site meteorological tower data. The following climatology uses data from the three NWS first-order stations listed above, as well as four NWS COOP stations located within 50 mi. of the RBS. The above stations have long return periods of meteorological parameters that provide the regional climatology representative of the RBS region.

Table 2.7-1 contains the distances and directions of the meteorological observing stations relative to the RBS, as shown in Figure 2.7-1. Ryan Airport in Baton Rouge is the closest first-order station to the site, with a long-term history of recording hourly wind, temperature, precipitation, atmospheric moisture content (e.g., dew point temperature, relative humidity, and wet-bulb temperature), barometric pressure, and the occurrence of weather phenomena such as thunderstorms and heavy fog (Reference 2.7-1). New Orleans and Lake Charles are additional NWS first-order stations with long-term climatological periods of record (References 2.7-6 and 2.7-7). Table 2.7-2, 2.7-3, and 2.7-4 display the various meteorological parameters in the annual Local Climatological Data Summaries (LCD) for Baton Rouge, New Orleans, and Lake Charles, respectively. The four COOP meteorological stations used in this climatology have complete or nearly complete data sets that extend back to 1948 (Reference 2.7-8).

2.7.2.1 Normal, Mean, and Extreme Climatological Conditions

This subsection discusses 30-year normals, as well as long-term means and historical extremes for temperature, water vapor, precipitation, and wind that characterize the meteorological conditions in the region surrounding the RBS.

Table 2.7-2 contains long-term normals, means, and extremes for Ryan Airport at Baton Rouge, located 19 mi. southeast of the RBS. Tables 2.7-3 and 2.7-4 exhibit long-term meteorological information for New Orleans and Lake Charles. New Orleans and Lake Charles are located 84 mi. south-southeast and 115 mi. west-southwest of the RBS, respectively.

The purpose of this subsection is to demonstrate that the long-term data reported at the three NWS first-order meteorological stations, as well as the four COOP stations, are representative of the short- and long-term climate characteristics of the region surrounding the RBS.Subsections 2.7.2.1.1, 2.7.2.1.2, 2.7.2.1.3, 2.7.2.1.4, and 2.7.2.1.5 provide more detailed discussions of specific meteorological parameters of interest.

2.7.2.1.1 Wind Conditions

According to 35 years of wind data at Ryan Airport, the annual prevailing wind direction is 50 degrees or northeast (Reference 2.7-1). Monthly prevailing winds in Baton Rouge are generally south or southeast during the spring and winter months and northeast during the late summer and fall months. At New Orleans and Lake Charles, the annual prevailing wind directions are 190 degrees (References 2.7-6 and 2.7-7). However, they both generally follow the same monthly variations as Ryan Airport does, except during the winter season when a prominent northerly wind is common. The difference in the winter prevailing wind directions between Baton Rouge and the New Orleans and Lake Charles stations can likely be attributed to offshore flow. As mean temperatures over land begin to cool during the winter, the ocean water along the coastline of Louisiana remains relatively warm. Weak northerly winds tend to blow from coastal areas such as New Orleans and Lake Charles toward the offshore waters in response to the temperature variations of the land versus the sea. Ryan Airport and the RBS are located further inland and are influenced more by the winter storm track that dips into northern Louisiana and produces prevailing surface winds from the southeast.

During the most recent 23-year period, the annual mean wind speed for Ryan Airport was 6.6 miles per hour (mph) (Reference 2.7-1). In comparison, New Orleans and Lake Charles have slightly higher annual mean wind speeds, 8.1 and 7.8 mph, respectively (References 2.7-6 and 2.7-7). The highest seasonal mean wind for all three stations is during the winter and spring, as shown in Tables 2.7-2, 2.7-3, and 2.7-4. The lowest seasonal mean wind speed occurs during the summer months for Baton Rouge (5.3 mph), New Orleans (6.2 mph), and Lake Charles (6.1 mph). The highest monthly mean wind speeds for Baton Rouge occur in February and March, with a value of 7.9 mph. New Orleans and Lake Charles also have their highest monthly mean wind speeds during February; however, they have values that are higher, 9.4 mph and 9.5 mph, respectively. The lowest monthly mean wind speed for Baton Rouge and Lake Charles is during August, while New Orleans experiences its lowest monthly mean during July. The overall variation of monthly wind speeds is consistent for the three first-order stations; however, New Orleans and Lake Charles are approximately 20 percent higher in magnitude annually. A likely explanation is the proximity of the two stations to the coastline where frictional effects are less compared to Baton Rouge, which is located farther inland.

Extreme winds for design basis purposes are discussed in Subsection 2.7.2.2.2. Wind data summaries for the RBS on-site meteorological station are discussed in Subsections 2.7.4.2 and 2.7.4.3.

2.7.2.1.2 Temperature

Table 2.7-5 presents mean annual temperatures for the three NWS first-order and four COOP stations in the RBS region. The daily mean temperature for the stations are generally uniform, with only minor differences apparent between the two first-order stations closer to the coastline and the other stations located farther inland. The slight difference in the daily mean across the RBS region can be explained by examining the daily minimum temperatures. Stations that are closer to the coastline have a slightly higher minimum temperature because of the heat content of the Gulf of Mexico. While Baton Rouge and the COOP stations are also influenced by the effects of the Gulf of Mexico, New Orleans and Lake Charles are closer to the coastline and, as a result, have slightly higher mean daily minimum temperatures. Effects of the Gulf of Mexico on mean daily maximum temperatures across the region are less evident.

During the summer months of June, July, and August, daily maximum and minimum temperatures at Baton Rouge average 91°F and 72°F, respectively (Reference 2.7-1). In comparison, summer mean daily maximum and minimum temperatures at New Orleans and Lake Charles are 90°F and 73°F, respectively (References 2.7-6 and 2.7-7). Table 2.7-6 contains climatological extreme maximum and minimum temperatures for the NWS first-order and COOP stations. The highest daily maximum temperature recorded over the last 55 years at Ryan Airport was 105°F in August of 2000; however, a temperature of 110°F was recorded in August 1909 at an old weather station located in the Baton Rouge business district (References 2.7-1 and 2.7-9). There are no details that describe the accuracy of the thermometer that recorded the temperature of 110°F in 1909, but the National Climatic Data Center (NCDC) considers the measurement as an official reading. The highest temperatures recorded at New Orleans over 68 years and Lake Charles over 45 years were 102°F and 107°F, respectively, also occurring in August 2000 (References 2.7-6 and 2.7-7). The extreme high temperatures recorded over the past 50 years at the NWS COOP sites ranged from 105ºF at New Roads and Amite, Louisiana, in August 2000 to 108ºF at Woodville, Mississippi, in early September 2000 (Reference 2.7-10).

During the winter months, the variation of the mean daily minimum temperature is higher between the stations, while the mean daily maximum temperature remains uniform across the region. Mean daily maximum and minimum temperatures during the winter in Baton Rouge are 63°F and 43°F, respectively (Reference 2.7-1). The values of mean daily maximum and minimum temperatures for New Orleans are 64°F and 45°F, respectively, and for Lake Charles are 63°F and 44°F, respectively (References 2.7-6 and 2.7-7). Temperatures drop below freezing several times annually during the late fall and winter months, generally with the arrival of continental polar air masses originating in Canada. Prolonged cold spells are unusual and typically last only 2 to 3 days before milder air returns. Even during the winter cold spells, daytime temperatures nearly always rise above freezing. The first freeze typically occurs in late November, with the average date of the last freeze in late February, producing a mean freeze-free period of approximately 273 days (Reference 2.7-1). The coldest temperature recorded over the latest 55-year period at Ryan Airport was 8°F in December 1989; however, a lower temperature of 2°F was recorded at the Louisiana State University (LSU) campus in 1899 (References 2.7-1 and 2.7-9). During the past 68 years, the lowest temperature recorded at New Orleans and Lake Charles is 11°F, occurring in December 1989 (References 2.7-6 and 2.7-7). The extreme low temperatures recorded over the past 50 years at the four representative COOP stations are 8°F at New Roads and Grand Coteau, Louisiana, in December 1989; 5°F at Amite, Louisiana, in December 1989; and 4°F at Woodville, Mississippi, also in December 1989 (Reference 2.7-10).

2.7.2.1.3 Atmospheric Moisture

The high content of atmospheric moisture in southern Louisiana can be attributed to the nearby Gulf of Mexico. The moisture content in the atmosphere is measured through several parameters (relative humidity, dew point temperature, and wet-bulb temperature) and can be evaluated by examining the long-term history of the daily, monthly, and annual means for the stations in the RBS region.

As shown in Tables 2.7-2, 2.7-3, and 2.7-4, normal annual relative humidity values at Baton Rouge, New Orleans, and Lake Charles average 75 to 79 percent (References 2.7-1, 2.7-6, and 2.7-7). Nighttime (00 LST row) relative humidity is highest in the late spring, summer, and early fall and lowest in the winter and early spring months. Daytime (18 LST row) humidity readings are highest in the late summer, fall, and winter seasons. Daily relative humidity values are typically highest around 6:00 a.m. local standard time (LST), ranging between 85 and 93 percent during the entire year at Baton Rouge. The lowest relative humidity values occur during early and mid-afternoon, with averages at Baton Rouge ranging between 55 and 64 percent during all months.

The mean annual wet-bulb temperature at Ryan Airport is 61.8ºF, based upon 23 years of records (Reference 2.7-1). July has the highest mean monthly wet-bulb temperature with a value of 75.0ºF. The lowest monthly mean wet-bulb temperature is 46.9ºF, which occurs in January. New Orleans and Lake Charles have mean annual wet-bulb temperatures of 63.4ºF and 63.2ºF, maximum mean monthly wet-bulbs of 76.0ºF and 76.7ºF, and minimum mean monthly wet-bulbs of 49ºF and 48.2ºF, respectively (References 2.7-6 and 2.7-7). New Orleans and Lake Charles have slightly higher mean monthly annual wet-bulb temperatures than Baton Rouge because of their proximity to the Gulf of Mexico.

Table 2.7-7 provides monthly and annual dew point summaries for Baton Rouge on the basis of 35 years of data accumulated between 1961 and 1995. Using hourly Solar and Meteorological Surface Observation Network (SAMSON) and Hourly US Weather Observations (HUSWO) data provided on CD-ROM by the NCDC, the mean annual dew point temperature was calculated to be 57.3ºF (References 2.7-11 and 2.7-12). In comparison, the mean annual dew point temperatures for New Orleans and Lake Charles are 60.1ºF and 60.3ºF, respectively, approximately 5 percent higher than Baton Rouge (References 2.7-6 and 2.7-7). Mean dew point temperatures for every month at Baton Rouge, as expected, are lower than the mean dew point for New Orleans and Lake Charles. According to Tables 2.7-3, 2.7-4, and 2.7-7, the maximum monthly mean dew point temperature occurs in July for all first-order stations. The minimum monthly mean dew point temperature occurs in January, when the mean monthly temperature is the lowest. During the winter, the difference in mean dew point between Ryan Airport and the other first-order stations is greatest, while the differences are smallest during the summer. It is apparent that the content of atmospheric moisture can be directly correlated to the distance from the coastline in the region of the RBS.

Extreme values of dew point temperature are also displayed in Table 2.7-7 for Ryan Airport. The highest dew point temperature measured at Ryan Airport in the 35-year period analyzed is 82.9ºF, corresponding with the summer season, while the lowest dew point temperature of -9ºF occurred during the winter season. The last column in Table 2.7-7 shows that mean diurnal variations in dew point vary the least during the late spring, summer, and early fall when mean dew point temperatures are the highest.

2.7.2.1.4 Precipitation

Annual precipitation in the region ranges from just under 50 in. in northwestern Louisiana to nearly 70 in. in eastern parts of the state (Reference 2.7-13). Table 2.7-5 presents normal annual rainfall totals for the four COOP and three first-order stations surrounding the RBS. The normal annual precipitation for Ryan Airport at Baton Rouge is 63.08 in. In comparison, New Orleans receives 64.16 in. per year, and Lake Charles receives 57.19 in. per year (References 2.7-1, 2.7-6, and 2.7-7). Normal annual rainfall totals at the NWS COOP stations (based upon 50 years of data) range from 61.14 in. in New Roads, Louisiana, to 68.22 in. in Woodville, Mississippi (References 2.7-10 and 2.7-14). The consistent annual rainfall totals for the stations within 50 mi. of the RBS demonstrate the regional nature of precipitation events.

Normal monthly precipitation amounts in Baton Rouge average between 5.07 and 6.19 in. during all months, except for the fall, when they range between 3.81 and 4.84 in. (Reference 2.7-1). There appear to be two maximum precipitation periods historically during a year. One maximum occurs in January (6.19 in.) and another in July (5.96 in.) and August (5.86 in.). The lowest monthly rainfall occurs in October, when only 3.81 in. of rain falls. New Orleans exhibits a similar normal monthly precipitation pattern as Baton Rouge, with consistent precipitation during most of the months and a minimum of precipitation during the fall months. Lake Charles' normal monthly precipitation trends are somewhat different. Monthly values peak during the summer, but have two minima, during the fall and again late winter into spring. For New Orleans and Lake Charles, the highest monthly precipitation occurs in June, with values of 6.83 in. and 6.07 in., respectively. The lowest values of monthly precipitation occur in October (3.05 in.) for New Orleans and February (3.28 in.) for Lake Charles. Lake Charles experiences a secondary minimum in precipitation during October (3.94 in.).

As displayed in Table 2.7-6, since 1951, the highest 24-hr. rainfall total recorded at Baton Rouge is 12.08 in., occurring during April 1967 (Reference 2.7-1). The highest monthly total for Baton Rouge is 23.18 in. during June 1989. The highest 24-hr. rainfall totals for New Orleans and Lake Charles are 12.66 in. (November 1989) and 16.88 in. (May 1980), respectively. The monthly maximum of 21.18 in. of rain at New Orleans occurred in May 1995, while the maximum monthly rainfall amount of 25.33 in. occurred in June 1989 for Lake Charles (References 2.7-1, 2.7-6, and 2.7-7). The maximum 24-hr. rainfall totals based upon 50 years of data for the four COOP stations surrounding the RBS ranged from 8.77 in. at Amite, Louisiana, in April 1983 to 10.82 in. at Woodville, Mississippi, in October 1964. Maximum monthly rainfall totals range from a minimum of 19.38 in. in March 1973 in Woodville, Mississippi, to a maximum of 21.26 in. at New Roads, Louisiana, in June 1989 (Reference 2.7-10). Extreme events of 24-hr. and monthly rainfall occur primarily between March and November in the region surrounding the RBS.

As shown in Tables 2.7-2, 2.7-3, and 2.7-4, snowfall is very infrequent across central and southern Louisiana. Normal annual snowfall values at Baton Rouge and Lake Charles are 0.20 and 0.30 in., respectively, while New Orleans' annual normal snowfall is zero. Table 2.7-6 shows that the maximum 24-hr. and monthly snow total at Baton Rouge over 45 years of records is 3.2 in., occurring in February 1998 (Reference 2.7-1). The largest 24-hr. and monthly snowfall totals at New Orleans and Lake Charles are 2.7 and 4.0 in., respectively (References 2.7-6 and 2.7-7). The highest 24-hr. snowfall at the four NWS COOP stations shown in Table 2.7-6 is 6.0 in., which occurred at Amite and Woodville (Reference 2.7-15). New Roads reported maximum 24-hr. and monthly snowfall totals of 3.2 in., while Grand Coteau reported maximum 24-hr. and monthly snowfall totals of 5.5 in. and 5.6 in., respectively. Higher 24-hr., 2-day, and 3-day snowfall totals were found at other observation sites near the RBS. Simmesport in Avoyelles Parish and Clinton in East Feliciana Parish recorded 24-hr. snowfall totals of 9.0 in. The highest 2- and 3-day snowfall totals occurred at the Baton Rouge government recording station, where an isolated measurement of 12.5 in. was reported in 1899; however, there are no details regarding the accuracy of this measurement (Reference 2.7-9).

2.7.2.1.5 Drought

Louisiana is one of the wettest states in the United States (Reference 2.7-1). However, droughts do happen from time to time. Many of the droughts last only a few weeks and typically occur during the summer or fall months. In Baton Rouge from September 28 through November 6, 1978 (932 hours or 38.8 days), no measurable amounts of precipitation were reported (References 2.7-11 and 2.7-12). This was the longest dry stretch that occurred during the 1961 to 1995 time period. Prolonged extreme droughts, while rare, do occur occasionally (Reference

2.7-2). According to the Palmer Drought Index (PDI), five extreme droughts (PDI values of less than -4.0) have occurred in Louisiana between 1900 and 2000 (References 2.7-16 and 2.7-17).

2.7.2.2 Severe Weather

2.7.2.2.1 Thunderstorms and Lightning

Thunderstorms are a common occurrence at the RBS and the surrounding region at all times during the year. Based upon 59 years of data, Table 2.7-2 indicates that Baton Rouge averages nearly 74 days per year where thunder is at least heard (Reference 2.7-1). The highest seasonal rate of occurrence for thunderstorms is during the summertime (June to August), when around 51 percent of all thunderstorm days occur. Specifically, July has the highest occurrence of thunderstorms, with an average 15.2 days reported. The mean number of thunderstorm days per month is lowest during the late fall and winter seasons, reaching a minimum of 2.2 days per month in January.

The frequency of lightning strikes to Earth can be estimated using a method from the EPRI. The method is presented by the U.S. Department of Agriculture, Rural Utilities Service, in a publication titled *Summary of Items of Engineering Interest*. The formula assumes a relationship between the number of thunderstorm days per year (T) and the number of lightning strikes to hit Earth per square mile (N) (Reference 2.7-18).

$$N = 0.31T$$

Using the above formula and the previously given average of 74 days of thunderstorms per year, the average number of lightning strikes is then calculated as 23 strikes per square mile (mi^2) per year or nearly nine strikes per square kilometer (km^2) per year for the region. This calculation compared well with the 1996 to 2000 flash density map created by Vaisala, which indicates that the RBS falls in the region that averages around 9 to 16 strikes per km^2 per year (Reference 2.7-19).

For a more detailed look at the average number of strikes to occur near the reactor (i.e., within a 1000-ft. radius or 0.113 mi^2), the following ratio was applied:

23 strikes/mi^2 per year x 0.113 mi^2 = 2.60 strikes/year that may strike near (within 1000 ft.) or even possibly hit the reactor itself.

2.7.2.2.2 Extreme Winds and High Wind Events

Extreme Winds

Wind loading on plant structures is estimated using a 3-second wind gust at 33 ft. (10 m) above ground level to create a basic wind speed for regions across the United States. The American Society of Civil Engineers (ASCE) classifies the RBS region into Exposure Category C (Reference 2.7-20). From the Engineering Weather Data, Version 1.0 CD-ROM, the maximum basic wind speed with a 50-year recurrence interval is 120 mph for Baton Rouge (Reference 2.7-21). Applying a 50- to 100-year wind multiplier of 1.07 supplied by the ASCE and

Structural Engineering Institute (SEI) in Table C6-7 of SEI/ASCE 7-05, the maximum basic wind speed for the RBS increases to 128.4 mph (Reference 2.7-20).

Local and regional records of maximum wind speeds occurring from thunderstorms and other high wind events present values lower than the above maximum basic wind speed. According to the NCDC storm database, the highest wind speed recorded for West Feliciana County is 72.5 mph on March 5, 1992 (Reference 2.7-22). Using the same NCDC storm database, the highest wind speed recorded in the surrounding parishes is 86 mph occurring in East Baton Rouge County on August 1, 1959. For comparison, a maximum 2-minute wind speed of 60 mph, along with a corresponding 78 mph 5-second wind gust, was recorded at Ryan Airport in December 2002 (Reference 2.7-1). Wind data records from the LCD for Ryan Airport span back only 13 years. As expected, the observed wind speeds from the NCDC database are much lower than the calculated maximum basic wind speed for the RBS. The reason for this difference is that the highest observed wind speeds in the NCDC database were recorded from thunderstorms, while the maximum basic wind speed value is used to predict maximum wind speeds that could occur during a hurricane.

High Wind Events

This subsection provides the frequency of occurrence of winds greater than 50 knots, as requested by the NRC Regulatory Guide 4.2. Storm reports that include wind speeds of 50 knots or greater occur with many types of weather phenomena such as thunderstorms, tornadoes, and hurricanes. Wind reports for thunderstorms and tornadoes were obtained from the NCDC storm database for the following seven-parish region surrounding the RBS: Pointe Coupee, West Baton Rouge, East Baton Rouge, Avoyelles, West Feliciana, East Feliciana, and the Mississippi County of Wilkinson. Tropical cyclone data was pulled from the National Hurricane Center (NHC) online database.

Between January 1, 1950 and March 31, 2007, there have been 62 reports of wind events that were 50 knots or greater in the seven-parish region. The highest wind speed reported was 75 knots (86 mph) in the East Baton Rouge Parish on August 1, 1959 (Reference 2.7-22). Many of the reports for high winds contained in the NCDC storm database do not specify wind speeds and, therefore, may underestimate the count of wind events 50 knots or greater in the region of the RBS.

In the same time period, 74 tornadoes were reported in the seven-parish area (Reference 2.7-22). All tornadoes are categorized as F0 or stronger on the Enhanced Fujita (EF) scale, thereby containing wind speeds greater than 50 knots. Additional discussion of tornadoes in the region surrounding the RBS is provided in Subsection 2.7.2.2.3.

There were 21 tropical storms and hurricanes where the center of the storm passed within 25 nautical mi. of the current RBS location between 1851 and 2006. Of the 21 tropical storms and hurricanes, only nine remained classified as hurricanes as they passed within 25 nautical mi. of the site (Reference 2.7-23). Hurricanes categorized on the Saffir-Simpson Scale contain minimum wind speeds of 64 knots, indicating that all nine events may have contained winds of 50 knots or greater at the RBS. Tropical storms, however, are classified as storm systems containing wind speeds between 34 and 63 knots. Because of this range, not all of the tropical storms counted in the previous estimate may have contained wind speeds equal to or greater than 50 knots; however, they are included to provide a conservative estimate of high wind events for the RBS.

2.7.2.2.3 Tornadoes

Design-Basis Tornado (DBT) and Tornado Missiles for Nuclear Power Plants (Regulatory Guide 1.76), published in March 2007, was used to determine the design parameters that should be considered in the event that the most severe tornado strikes the RBS. In addition, DBT wind speeds for the RBS, utilizing information from the *Tornado Climatology of the Contiguous United States* (NUREG/CR-4461, Rev. 2), published in February 2007, are presented herein. NUREG/CR-4461, Rev. 2, is an update to Rev. 1 that recalculated the tornado climatology using the EF scale for the time period of 1950 through August 2003 (Reference 2.7-24). The relationship of the damage intensity to the tornado maximum wind speed in the new EF scale is as follows (Reference 2.7-25):

EF0	65 - 85 mph
EF1	86 - 110 mph
EF2	111 - 135 mph
EF3	136 - 165 mph
EF4	166 - 200 mph
EF5	201+ mph

The EF scale uses the fastest 3-second wind speeds as opposed to the fastest quarter mile wind speeds used in the original Fujita Scale (Reference 2.7-24). The result of this new methodology is lower DBT maximum wind speeds, as shown in Table 1 of Reg. 1.76. NUREG/CR-4461, Rev. 2, also introduces a term to account for the finite dimensions of structures, as well as the variations of wind speed along and across the tornado footprint (Reference 2.7-24). The seven DBT values deemed critical by the NRC when designing nuclear facilities are as follows:

- Tornado strike probability.
- Maximum wind speed.
- Translational speed.
- Maximum rotational speed.
- Radius of maximum rotational speed.
- Pressure drop.
- Rate of pressure drop.

Tornado Strike Probability

NUREG/CR-4461, Rev. 2, divides the United States into 2-degree latitude/longitude boxes containing the number of tornado events reported from 1950 through August 2003. Figure 5-7 of NUREG/CR-4461, Rev. 2, shows that the RBS is located in the far northern section of the 2-degree box that is bound between the 90- and 92-degree west longitudes and the 29- and 31-degree north latitudes. Adjacent 2-degree boxes to the north, northwest, and west contain significantly higher numbers of tornado events. In addition, part of the RBS 2-degree box lies in coastal waters of the Gulf of Mexico, which may explain the decreased number of tornado events. To incorporate these higher tornado numbers, a 4-degree latitude/longitude box was chosen to replace the 2-degree box presented in NUREG/CR-4461, Rev. 2. A larger box provides a more conservative view of the probability of a tornado striking the RBS. Guidelines for calculating strike probability are presented in NUREG/CR-4461, Rev 2. Following the NUREG/CR-4461, Rev. 2, methodology, the strike probability for a point structure in any given year is provided by the following equation (Reference 2.7-24):

$$P_p = A_t/NA_r$$

Where:

P_p= Tornado strike probability for a point structure per year, regardless of wind speed.

A_t= Total area affected by tornadoes within a region of interest in N years.

N = Number of years of tornado record.

A_r= Area of the region of interest.

The 4-degree latitude/longitude box was centered on the location of the RBS proposed reactor at the following coordinates:

Latitude: 30º 45' 26.39"N; Longitude: 91º 19' 58.62"W

The 4-degree box encompasses 24 counties in Mississippi and all but eight parishes in Louisiana that are either fully or partially inside the box. The number of tornadoes occurring in the 4-degree box was obtained from the NCDC storm database for the 57.33-year period of January 1, 1950 through March 31, 2007.

In the following table, the number of tornadoes for each EF scale class is displayed. On average, 29.43 tornadoes per year occurred in the 4-degree box based on the 1687 tornadoes that were reported during the 57.33-year period (Reference 2.7-22). The total area affected by tornadoes in the 4-degree box, shown in the following table, can be found by multiplying the number of tornadoes in each EF scale class by the expected values for tornado segment statistics in the central United States (found in Table 2-10 of NUREG/CR-4461, Rev. 2).

	F0	F1	F2	F3	F4	F5	Total
Number of Tornadoes	470	742	345	104	23	3	1687
Expected Value of Tornado Area (mi^2)(a)	0.0341	0.3374	1.1784	3.0857	4.7263	6.0152	
Total Tornado Area (mi^2)=A_t	16.03	250.35	406.55	320.91	108.71	18.05	1120.60

a) From Table 2-10 of NUREG/CR-4461, Rev. 2.

The total area of the 4-degree box is calculated by summing the areas of Mississippi counties and Louisiana parishes inside the 4-degree box. With the county and parish area data collected from the U.S. Census Bureau, an estimate was made of a total area of 51,399.9 mi^2 (Reference 2.7-26). Using a total tornado area of 1120.60 mi^2 (A_t), a 4-degree box area of 51,399.9 mi^2 (A_r), and a time period of 57.33 years (N), the calculated strike probability (P_p) for the RBS becomes 3.80×10^{-4} for the RBS site, or a recurrence interval of once every 2630 years.

In comparison, Table 5-1 in NUREG/CR-4461, Rev. 2, shows the calculated probability of a tornado striking any point in the central United States as 3.58×10^{-4} or a recurrence interval of once every 2793 years (Reference 2.7-24). The results demonstrate that incorporating the tornado statistics for adjacent 2-degree boxes creates a more conservative estimate of the probability of a tornado striking the RBS, rather than utilizing the generalized value for the central United States.

Regulatory Guide 1.76 defines DBT characteristics for nuclear power plants that have a tornado strike probability greater than 1.0×10^{-7}. The calculated RBS tornado strike probability of 3.80×10^{-4} exceeds the previous probability threshold, which requires Unit 3 to meet the design requirements of Regulatory Guide 1.76. Table 1 from Regulatory Guide 1.76 presents the remaining six DBT characteristics for new reactors located in the United States whose tornado strike probabilities exceed the 1.0×10^{-7} threshold. According to Table 1, because the RBS is located in Region I, the DBT characteristics are as follows:

Maximum wind speed (mph)	230
Translational speed (mph)	46
Maximum rotational speed (mph)	184
Radius of maximum rotational speed (ft.)	150
Pressure drop (psi)	1.2
Rate of pressure drop (psi/sec.)	0.5

2.7.2.2.4 Hail, Snow, and Ice

Frozen precipitation falls to the Earth in four forms: hail, snow, sleet, and freezing rain. This subsection discusses the frequencies and intensities of these four frozen precipitation types in the region surrounding the RBS.

Hail

Because of the frequent occurrence of thunderstorms, hail is possible throughout the year at the RBS. In the RBS region, hail occurs most frequently in the spring months, with the peak number of hail events occurring in March (Reference 2.7-27). A secondary, but much smaller, peak for hail occurrence is in December. Hail tends to occur much more frequently north of 31º N latitude in Louisiana, with more than 81 percent of the annual Louisiana hail reports occurring there. The RBS is located in the region south of the 31º N latitude and typically receives fewer hail events.

A study done by Stanley A. Chagnon, Jr., estimates that hail occurs on average 2 days per year at the RBS (Reference 2.7-28). Hail reports were obtained from the NCDC storm database for the Louisiana parishes of Pointe Coupee, West Baton Rouge, East Baton Rouge, West Feliciana, East Feliciana, Avoyelles, and the Mississippi County of Wilkinson. The seven-parish area surrounding the RBS reported 144 severe hail events (hail diameter $\geq$ 0.75 in.) over a 57.33-year period of January 1, 1950 through March 31, 2007, producing an average of 2.51 occurrences of severe hail per year (Reference 2.7-22). Of the 144 severe hail reports, 52 were reported as large hail (hail diameter $\geq$ 1.75 in.). The largest hail report was 2.00 in., occurring in East Baton Rouge County on April 6, 1960. As would be expected, hail reports were more commonly reported near areas with higher population densities. In addition, the overall frequency of hail reports has steadily increased since the study done by Chagnon (1977). It is reasonable to assume that the increase may be explained by the improved technology of Doppler radars, cell phones, and the increased public awareness of reporting hail events (Reference 2.7-29).

Snow and Ice

Snow, sleet, and ice are rather infrequent occurrences in southern Louisiana (Reference 2.7-2). Normal annual snowfall for Baton Rouge is only 0.2 in., with the maximum 24-hr. and monthly snowfall total of 3.2 in. occurring in February 1998 (Reference 2.7-1). For the seven surrounding parishes, the maximum 24-hr. snowfall total was 9.0 in. at Simmesport in Avoyelles Parish and near Clinton in East Feliciana Parish (Reference 2.7-15). Simmesport is located approximately 30 mi. northwest of the RBS, while Clinton is located 25 mi. to the east-northeast. The highest 2- and 3-day snowfall total of 12.5 in. was isolated and occurred southeast of the RBS at the Baton Rouge Government Station. However, none of the other reporting locations in the Baton Rouge area, including Ryan Airport, have 2- or 3-day snowfall totals over 3.5 in.

The region surrounding the RBS averages less than 1 day per year of sleet, freezing drizzle, and/or freezing rain (References 2.7-30 and 2.7-31). Forty percent of the winter weather events at the RBS occur in the form of freezing drizzle or freezing rain. The NCDC storm database contains only three ice storms occurring from 1950 through March 2007 in the seven-parish region surrounding the RBS. One ice storm in February 1996 resulted in ice accumulation of 1/4 to 1/2 in. northwest of the RBS in Avoyelles Parish. Another ice storm in January 1997 occurred across parts of southeast Louisiana, including the RBS, knocking down trees and power lines

(Reference 2.7-22). It is likely that the overall recording of freezing rain and sleet events has improved over the last 10 to 15 years, as evidenced by the fact that no events were recorded in the NCDC storm database before 1996. However, the low frequency of the freezing precipitation events during the last 10 to 15 years signifies how rare and infrequent they are.

2.7.2.2.5 Tropical Weather

This subsection includes statistics regarding hurricanes, tropical storms, tropical depressions, subtropical depressions, and extratropical storms affecting the region surrounding the RBS. The general term that is used to describe all of the mentioned tropical systems is a tropical cyclone. All tropical cyclones present the potential for heavy rain and strong winds to coastal and inland areas. Hurricanes and some tropical storms are more organized systems and usually produce the highest potential for widespread damaging winds. The RBS is located approximately 75 mi. from the nearest point on the Gulf Coast. The potential still exists for strong winds associated with hurricanes and tropical storms to make it as far inland as the RBS, as demonstrated over areas of Mississippi during Hurricane Katrina. As Hurricane Katrina weakened and slowly moved inland, hurricane force sustained winds greater than 100 mph were experienced as far as 60 mi. inland from the coastline (Reference 2.7-32). The intensity and forward speed of hurricanes largely determines how far inland hurricane speeds are realized. Additionally, all hurricanes and tropical storms bring the threat of extremely heavy rainfall intensities and amounts as the center of the storm passes near the RBS.

A total of 76 tropical cyclones have passed within 100 nautical mi. of the current RBS location between 1851 and 2006 (Reference 2.7-23). The frequency of tropical cyclones peaks in September, when 34 of the storms passed within 100 nautical mi. of the RBS. The next highest month is August, with 15 tropical cyclones occurring. Tropical cyclones historically occur near the RBS as early as May and as late as the end of November. Frequencies of the 76 tropical cyclones by classification during the 156-year period are as follows:

Tropical Cyclone Type	Total Occurrences
Hurricane, Category 5	1
Hurricane, Category 4	4
Hurricane, Category 3	3
Hurricane, Category 2	10
Hurricane, Category 1	12
Tropical Storms	40
Tropical Depressions	4
Subtropical Storms	1
Subtropical Depressions	0
Extratropical Storms	1
Total	**76**

Heavy rainfall events associated with tropical cyclones are one of the biggest concerns for the RBS. The occurrence of such events can be seen by examining historical monthly and 24-hr. rainfall amounts around the area, as well as the statistical rainfall values for long return periods. The highest monthly rainfall at Ryan Airport (23.18 in.) and the New Roads COOP site (21.26 in.) occurred in June 1989 when Tropical Storm Allison made landfall (References 2.7-1, 2.7-5, and 2.7-10). The two highest 24-hr. rainfall totals occurred at New Roads (9.85 in.) and Woodville (10.82 in.) when Hurricane Hilda made landfall in 1964. According to the *Rainfall Frequency/ Magnitude Atlas for the South-Central United States*, the 50-year and 100-year return values of 24-hr. maximum rainfall amounts are 11.0 in. and 12.0 in., respectively (Reference 2.7-33). As expected, these values are consistent with and slightly higher than the actual recorded 24-hr. maximum rainfall amounts.

2.7.3 REGIONAL AIR QUALITY

2.7.3.1 Background Air Quality

The RBS is located in the southern tip of West Feliciana Parish and is in attainment for all EPA-listed criteria pollutants. Several of the EPA-listed criteria pollutants are routinely monitored near the RBS. In fact, the area immediately south of the RBS facility, Baton Rouge, is heavily monitored. Monitors in the Baton Rouge area routinely monitor nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), particulate matter $(PM)_{2.5}$, PM_{10}, and ozone. The Baton Rouge area is considered in attainment for NO_2, SO_2, CO, $PM_{2.5}$, and PM_{10} (Reference 2.7-34). However, the Baton Rouge area is considered a nonattainment area for the EPA's 8-hr. ozone standard. The EPA defines ozone nonattainment areas as those that record 8-hr. ozone levels of 0.075 parts per million (ppm) or higher (Reference 2.7-35). The maximum 8-hr. ozone concentration recorded in the five-parish area between 2000 and 2005 was 0.121 ppm at the LSU ozone monitor. In addition, there were 11 design value violations in the Baton Rouge five-parish area between 2002 and 2005. The LSU ozone monitor accounted for 4 of the 11 violations (Reference 2.7-36). The next closest nonattainment area is Orange County, Texas (also nonattainment for ozone), located 155.34 mi. west-southwest of the proposed RBS (Reference 2.7-34).

The closest Class I Area is the Breton National Wildlife Refuge located offshore on the Chandeleur Islands. The Breton National Wildlife Refuge is located 154 mi. east-southeast of the RBS site (Reference 2.7-37). Given the minor nature of air emissions associated with operations of the facility (discussed below and in Section 5.8), this distance is sufficiently far as to not warrant a concern.

2.7.3.2 Projected Air Quality

Air emissions of criteria pollutants would be minor given the nature of a nuclear facility and its lack of significant gaseous exhausts of effluents to the air. Sources of air emissions for the proposed facility include two standby diesel generators, an auxiliary boiler, and two diesel fire pumps, as well as a natural draft and a 12-cell MDCT. The combustion sources mentioned above would be designed for efficiency and operated with good combustion practices on a limited basis throughout the year (often only for testing). Given their small size and infrequent operation, emissions from these sources would not only have little effect on the nearby ozone nonattainment area, but would also have minimal effect on the local and regional air quality. Section 5.8 discusses effects to the air from plant operations in more detail.

Construction of a new facility at the RBS would lead to an increase of vehicular traffic surrounding the site prior to operations. Furthermore, increased traffic and construction activities would lead to further release of particulates prior to operation of a new facility. However, any increase in particulate emissions from vehicles is expected to be short-term, minor, and remain local to the RBS.

The proposed cooling towers would not be a source of the typical combustion-related criteria pollutants or other toxic emissions. They would, however, emit small amounts of PM as drift. The towers would be equipped with drift eliminators designed to limit drift to 0.002 percent or less of total water flow. Additionally, the primary NPHS proposed for the project is a natural draft cooling tower (NDCT). The height of the tower would allow for good dispersion of the drift and not allow localized concentrations of PM to be realized. The minor nature of the effects of the new cooling towers on visibility and air quality, including the potential for increases in ambient temperature and moisture, icing, fogging, and salt deposition, is discussed in greater detail in Subsection 5.3.3.

2.7.3.3 Air Stagnation

The main components of air stagnation are light winds and weak vertical mixing. Light winds can also be associated with weak or poor horizontal mixing of the atmosphere, which has the general effect of leading to restrictive horizontal and vertical dispersion and thus air stagnation (Reference 2.7-3). Along with wind speed, wind direction also plays a role in horizontal mixing, because winds with non-persistent directions can lead to poor dispersion, especially under light wind speeds when the air may recirculate. Finally, temperature inversions are also associated with little to no vertical mixing of the atmosphere and, therefore, air stagnation. Analyses of the persistence of wind speeds and directions are addressed in Subsection 2.7.4.3, while inversions are discussed in Subsection 2.7.3.5.

Air stagnation episodes typically occur when strong high-pressure systems (anti-cyclones) have a strong influence on the regional weather for 4 days or more. These systems often lead to generally light winds and little vertical mixing as a result of a general sinking of the air in their vicinity. The region surrounding the RBS can expect between 20 and 30 days per year of air stagnation, or four to five episodes per year (Reference 2.7-3). The mean duration of each air stagnation episode is approximately 5 days.

Air stagnation conditions primarily occur during an extended summer season that runs from May through October. This is a result of the weaker pressure and temperature gradients and, therefore, weaker wind circulations during this period. Wang & Angell confirm that air stagnation episodes in the region surrounding the RBS begin to occur in May and June. However, during July and August, the likelihood of air stagnation episodes actually decreases before increasing and reaching a maximum likelihood during late September into October. The decrease in the mean air stagnation days in July and August correlates with the Bermuda High. The high is strongest during July, thus creating a stronger meridional flow of the wind field in the Gulf Region and a relative minimum of air stagnation (Reference 2.7-3). The weakening of the Bermuda High from September into October leads to more of a northeasterly surface flow at the RBS during a period when the monthly mean wind speeds are at a minimum. The decreases in mean wind speeds during the late summer and early fall for Baton Rouge are also confirmed by the Lake Charles and New Orleans meteorological stations (References 2.7-1, 2.7-6, and 2.7-7).

2.7.3.4 Monthly Mean Mixing Heights

The mixing height (or depth) is the height above the surface in which air can freely mix vertically without the help of additional atmospheric forcing mechanisms. George C. Holzworth presented seasonal mixing heights for several stations around the United States, based on upper-air data from the period 1960 to 1964 (Reference 2.7-38). Holzworth included seasonal morning and afternoon mixing heights for Lake Charles, Louisiana, in the analysis. In general, morning mixing heights are lowest in the fall and winter seasons and highest in the spring and summer seasons. Afternoon mixing heights followed the same trends, with the highest afternoon mixing heights in the summer and lowest in the winter.

Annual and monthly mean mixing heights for Lake Charles, Louisiana, were calculated using daily morning and afternoon mixing height data obtained from the NCDC (Reference 2.7-39). The NCDC calculated the mixing heights from data recorded during the morning and afternoon release of weather balloons at Lake Charles that measure the vertical temperature and wind information of the atmosphere. Surface wind data from Ryan Airport were used by the NCDC in conjunction with the weather balloon data to create daily mixing heights for the region. The calculated mean monthly and annual mixing heights for Lake Charles during 2002 to 2006 are presented in Table 2.7-8. The values shown in the table follow the same trends found by Holzworth.

2.7.3.5 Inversions

The frequency and persistence of temperature inversions may also indicate periods where air stagnation is highest. Frequency and persistence of inversions were calculated annually and monthly utilizing the vertical change in temperature (ΔT) obtained from the RBS on-site meteorological tower data from December 2004 through November 2006. The presence of an inversion was defined as anytime $\Delta T>0$ for the hour. A summary of the frequency and persistence of inversion conditions is presented in Table 2.7-9, which shows for the 16,609 hours analyzed during the 2-year period that an inversion was present a total of 8151 hr., equivalent to 49.1 percent of the total hours. Many of the inversions were short-lived, with a 46.3 percent probability that if an inversion formed, it would be less than 6 hr. and a 65.8 percent probability of it lasting less than 12 hr. Almost all the inversions lasted less than 24 hr., with only 1.5 percent of all the inversions lasting longer than 24 hr. In the 2 years of data used, the longest inversion lasted 63 hours. Tables 2.7-10 through 2.7-21 present the persistence of inversions tallied for each month. These tables show that the probability of an inversion lasting longer is higher during the months of September through October. This correlates well with the findings by Wang & Angell that the number of days with air stagnation increases during September and October.

2.7.4 LOCAL METEOROLOGY

Measurements from the RBS on-site meteorological tower, located approximately 1/2 mi. from the proposed unit, are used in this subsection to characterize the local meteorology conditions at the RBS. The on-site meteorological tower (the details of which are contained in Section 6.4) collects wind speed, wind direction, and temperature at the 30-ft. and 150-ft. levels. The system also records stability, based on the change in temperature (ΔT) between the two levels. Ten-minute data from the most recent 2 years (December 2004 through November 2006) were obtained and converted into hourly format. Data recovery rates for all meteorological parameters collected at the RBS on-site meteorological station are greater than 93 percent. Dew point, precipitation, and fog are not collected at the RBS on-site meteorological station; however, as mentioned in Subsection 2.7.2, meteorological conditions at Baton Rouge are representative of the RBS and have been used to supplement RBS data.

2.7.4.1 Normal, Mean, and Extreme Values

Regional normal, mean, and extreme values of temperature, wind, moisture, and precipitation are discussed in Subsection 2.7.2.1. To demonstrate that the long-term data reported at Ryan Airport are representative of the RBS, this subsection provides a more comprehensive analysis of these parameters and how they represent conditions at the RBS.

Data were obtained for 2 years (December 2004 through November 2006) for the RBS meteorological on-site station for the analysis of temperature and wind. As mentioned above, data for atmospheric moisture content, precipitation, and heavy fog have been obtained from Ryan Airport because of its long reporting history and proximity to the RBS. Extreme values of temperature, rainfall, and snowfall have also been obtained for several COOP stations within a 50-mi. radius of the RBS, because those parameters are more representative from a regional perspective.

2.7.4.1.1 Temperature

Table 2.7-22 presents monthly and annual mean temperature for the 30-ft. and 150-ft. levels at the RBS, as well as the 10-m temperature at Ryan Airport. To show the similarity of temperatures at Ryan Airport and the RBS, temperature data were analyzed for a 2-year period (December 2004 through November 2006). From Table 2.7-22, it is apparent that the mean annual temperature, as well as extreme maximum and minimum temperatures, are uniform for the two stations. Furthermore, these results indicate that the temperature data at Ryan Airport are characteristic of the RBS for longer climatological periods.

Climatological values of temperature for Ryan Airport are presented in Subsection 2.7.2.1.2 and summarized in Tables 2.7-2 and 2.7-5. As shown in Table 2.7-2, the annual mean daily temperature for the 77-year period is 67.4ºF. Mean daily maximum temperatures are highest in August (91.2ºF) and lowest in January (61.8ºF). Mean daily minimum temperatures are highest in July (72.8ºF) and lowest in January (41.5ºF). To illustrate the extreme maximum and minimum values of temperature that are characteristic of the RBS, temperature data were analyzed for the first-order and COOP stations. Table 2.7-6 presents extreme values of temperature in the region surrounding the RBS. The table shows that temperatures have risen as high as 110ºF and dropped as low as 2ºF in the region surrounding the RBS. In general, the RBS is vulnerable to both extreme heat in the summer and short-lived cold outbreaks during the winter months.

The design of structures is based upon long-term engineering climatological data such as that produced in the *2005 ASHRAE Handbook* (Reference 2.7-40). The design characteristics reflect a maximum ambient threshold of 2.0 percent and 0.4 percent (annual exceedance probabilities) for the dry-bulb (DB) temperature and the mean coincident wet-bulb temperature (MCWB). The minimum design thresholds have annual exceedance probabilities of 99 percent and 99.6 percent. The closest station to the RBS that reports ASHRAE data was Ryan Airport, which was deemed representative of the RBS. Based upon a 30-year period of record from 1972 through 2001, the maximum 2.0 percent annual exceedance DB is 91.2ºF, with a corresponding MCWB of 77.0ºF. The maximum 0.4 percent annual exceedance DB exceedance value is 94.1ºF, with a corresponding MCWB of 77.5ºF. The minimum 99 percent and 99.6 percent annual exceedance DB temperatures are 30.6ºF and 27.0ºF, respectively.

2.7.4.1.2 Atmospheric Moisture

The RBS on-site meteorological monitoring tower does not record atmospheric moisture; however, Subsection 2.7.2.1.3 discusses the uniformity of dew point, relative humidity, and wet-bulb temperature in the RBS region. It also was discovered that the magnitude of atmospheric moisture content for stations in southern Louisiana is directly related to the distance to the coastline. This relationship indicates that moisture parameters at Ryan Airport, only 19 mi. from the RBS, are representative of the conditions at the RBS.

Atmospheric moisture content at the RBS is highly affected by the nearby Gulf of Mexico. Table 2.7-2 provides normal annual and monthly values of relative humidity and wet-bulb temperature for Baton Rouge. Normal annual relative humidity is 75 percent, remaining above 72 percent for each normal monthly value. Daily, the relative humidity is highest around 6:00 a.m. LST and lowest during the early and mid-afternoon hours. The mean annual wet-bulb temperature for Baton Rouge is 61.8 F. Mean monthly wet-bulb values are highest during the summer months and lowest during the winter months. The highest and lowest values of mean monthly wet-bulb, as expected, are during July (75.4°F) and January (46.9°F), respectively.

Table 2.7-7 contains annual and monthly summaries of dew point temperature calculated from HUSWO and SAMSON data for the time period 1961 to 1995. The mean annual dew point temperature for Baton Rouge is 57.3ºF. As would be expected, the mean monthly dew point temperature values are highest during July (72.5ºF) and lowest in January (40.7ºF). Extreme values of dew point temperature are also presented in Table 2.7-7. The highest dew point temperature measured at Ryan Airport is 82.9ºF, corresponding with the summer season, while the lowest dew point temperature of -9ºF occurred during the winter season. The last column in Table 2.7-7 shows that mean monthly diurnal variations in dew point vary the least during the late spring, summer, and early fall, when mean dew point temperatures are the highest.

The design basis ambient wet-bulb temperature, based upon long-term engineering climatological data with a 0.4 percent annual exceedance probability, is 80.4ºF for Ryan Airport (Reference 2.7-40).

2.7.4.1.3 Precipitation

The RBS on-site meteorological station does not measure rainfall or snowfall on a daily basis. Ryan Airport is the nearest first-order station that has a long period-of-record for reporting precipitation. Normal annual and monthly rainfall values are discussed in Subsection 2.7.2.1.4 and are summarized in Tables 2.7-2 and 2.7-5. These tables indicate that the RBS region is annually characterized as having high rainfall and very low snowfall. These values are reasonably consistent over the region so as to indicate that these stations are representative of precipitation averages that would be observed at the site.

Maximum 24-hr. and monthly precipitation totals for the region are discussed in Subsections 2.7.2.1.4 and 2.7.2.2.5 and are summarized in Table 2.7-6 for the NWS first-order and COOP stations presented in this evaluation. The maximum precipitation values are reasonably uniform across the area, given that precipitation is highly influenced by individual storm events that can be local in nature, hitting one station and not another. It is therefore assumed that the precipitation data are representative of precipitation extremes that might be observed at the site.

As identified in Subsection 2.7.2.2.5, tropical cyclones are responsible for some of the highest 24-hr. and monthly rainfall events in the region surrounding the RBS. The highest monthly rainfall of 23.18 in. at Ryan Airport coincided with the landfall of Tropical Storm Allison during June 1989 (Reference 2.7-5). However, the heaviest 24-hr. rainfall total at Ryan Airport of 12.08 in. in April 1967 was not related to a tropical cyclone, occurring outside of the typical tropical cyclone season that runs May 1 through November 30 (Reference 2.7-1).

Hourly precipitation data for Ryan Airport were obtained from the NCDC for the most recent 5-year time period (2002 to 2006) to identify the precipitation intensity frequencies in the region surrounding the RBS (Reference 2.7-41). Ryan Airport is the closest NWS first-order station that has reliable precipitation records and, as previously discussed, is representative of the RBS. Table 2.7-3 presents the distribution of hourly precipitation amounts in various intensity categories for each month during the 2002 to 2006 time frame. Precipitation was recorded roughly 10 percent of the time during the 5-year period. February has the highest occurrence of hourly rainfall, while May has the lowest. Additionally, as expected, rainfall is most frequent in lighter intensity categories and decreases in frequency as intensity increases.

Monthly and annual precipitation roses were created, correlating hourly precipitation with wind direction for Ryan Airport during the 2002 to 2006 time frame, and are presented in Figures 2.7-2 through 2.7-14. As shown in Figure 2.7-2, on an annual basis, the majority of hourly precipitation events, regardless of intensity, occur when winds are from the north, with secondary maximum occurring clockwise to the east-southeast. As presented in both Table 2.7-23 and Figure 2.7-2, a significant amount of the hourly precipitation events were less than 0.10 in.

Mean annual snowfall, as well as maximum monthly and 24-hr. snowfall values, are discussed in Subsections 2.7.2.1.4 and 2.7.2.2.4. Annual snowfall at Ryan Airport averages 0.2 in. per year, with a maximum 24-hr. and monthly snowfall total of 3.2 in. over a 46-year period of record (Reference 2.7-1). Tables 2.7-5 and 2.7-6 present these values for the first-order and COOP stations in the region of the RBS. As indicated in these tables, heavy snow is a rare occurrence in the vicinity of the RBS. The highest 24-hr. snowfall was 9.0 in. at Simmesport in Avoyelles Parish northwest of the RBS and near Clinton in East Feliciana Parish (Reference 2.7-15). The highest 2- and 3-day snowfall was an isolated amount of 12.5 in. reported at the Baton Rouge government recording station in 1899; however, there are no details regarding the accuracy of this measurement. The majority of reporting stations outside of the NWS stations used in this document have 24-hr. and monthly maximum snowfall totals of 9.0 in. or less.

2.7.4.1.4 Heavy Fog

The definition of heavy fog is a horizontal visibility less than or equal to 0.25 mi. Ryan Airport is the nearest NWS station that routinely observes visibility and fog. Ryan Airport is located 19 mi. southeast of the RBS, with a similar elevation and relative proximity to the Mississippi River. Annually, Ryan Airport averages 33.1 days per year where heavy fog is reported (Reference 2.7-1). The highest monthly averages occur October through January with 3.9 to 4.3 days per month, respectively, where heavy fog is reported. The lowest are in June and July, where only 1.1 and 1.2 days per month, respectively, have reports of heavy fog.

2.7.4.2 Wind Direction and Wind Speeds

Wind direction and speed are two of the main components that define the dispersion characteristics of a site. Wind speed and direction can be classified on macro, synoptic, meso, or micro spatial scales. Macro and synoptic scales typically cover areas of 100 km^2 to 10,000 km^2. The influences on these two scales include features such as oceans and other large bodies of water, continents, and mountain ranges.

Meso- and micro-scale features better represent the general wind characteristics of the RBS and surrounding region. Meso-scale features typically cover areas of 1 km^2 to 100 km^2 and are influenced by such things as local vegetation and river valleys. Micro-scale features are spatially 1 km^2 or less and include the proximity of the RBS on-site meteorological tower to the proposed cooling tower, trees, and general site-specific land use characteristics of the immediate location.

The influence of these smaller scale features may be seen by evaluating local wind data both at the RBS and the nearby Ryan Airport. Table 2.7-24 presents the mean monthly and annual wind speeds at the RBS and Ryan Airport. The mean annual wind speed for the 30-ft. and 150-ft. level at RBS is 3.85 mph and 7.26 mph, respectively. The mean annual wind speed at Ryan Airport is 5.73 mph at a 30-ft. level. The large difference in the wind speeds between Ryan Airport and the 30-ft. level at the RBS can be explained by the macro- and micro-scale features such as the land use characteristics of the site. Ryan Airport lies in an urban area that has primarily been cleared of trees and provides a broader sample of prevailing wind direction and speed of the region. The RBS is surrounded by both deciduous and evergreen forests (Figure 2.2-1 of Section 2.2 of the ER), which have the effect of reducing wind speeds near and below the height of their canopy, up to ten times the height of the object.

Figures 2.7-15 through 2.7-27 contain the 30-ft. annual and monthly wind roses presenting the distribution of wind speed at 22.5-degree intervals for Ryan Airport during the most recent 5-year period (Reference 2.7-42).

The annual wind rose plot in Figure 2.7-15 shows that winds at Ryan Airport blow predominantly from a range of northeasterly and southerly directions. According to the 2006 LCD, the prevailing wind direction for Ryan Airport is from 50 degrees (northeast) (Reference 2.7-1). Monthly wind roses for Ryan Airport are presented in Figures 2.7-16 through 2.7-27. The transition is apparent from dominant northerly and easterly winds during the winter months to southerly wind directions during the spring months as the Bermuda High begins to influence the region. During June, July, and August, the number of calm hours increases, and the wind directions often become light and variable. Ryan Airport considers calm hours as those with wind speeds less than 3 knots. Northeasterly and easterly wind directions become more dominant during September and for the rest of the fall months before wind speeds increase and become more variable during December.

Annual and monthly wind roses for the 30-ft. level at RBS are depicted in Figures 2.7-28 through 2.7-40. These figures show wind speeds and directions at 22.5-degree intervals by direction at the RBS for the December 2004 through November 2006 time period.

Figure 2.7-28 indicates that annually winds are most often northerly, occurring approximately 11 percent of the time. Southeasterly wind is the second most common direction for the 30-ft. level at the RBS. There is an apparent lack of easterly winds annually at the RBS when compared to Ryan Airport at the same level. A likely explanation is the effect of trees blocking the wind directly to the east of the RBS on-site meteorological tower. Also noticeable are the high occurrence of winds that are less than 4 knots. Calm hours are counted when wind speeds are less than 1 knot at the RBS, explaining the large drop in percentage when compared to annual calm hours at Ryan Airport. Figures 2.7-29 through 2.7-40 present the monthly wind roses for the RBS. During January through May, the wind blows dominantly from the north, south, and southeast directions. The number of calm hours drastically increases during June, with overall lighter wind speeds and more variable wind directions continuing through August. During September, northerly and southerly winds are dominant at the RBS. Northerly and southeasterly continue to be dominant wind directions from October through December.

Figure 2.7-41 presents the annual wind rose at the 150-ft. level for the RBS. There is an apparent similarity between the RBS 150-ft. annual wind rose and Ryan Airport annual wind rose. East winds remain lower at the RBS in comparison to Ryan Airport; however, they are much more frequent than at the 30-ft. level. The annual 150-ft. wind rose for the RBS shows that winds most often blow from an east-southeast direction, with a secondary maximum wind direction out of the northeast. The wind speeds, as expected, are somewhat higher at all directions as compared to the lower 30-ft. tower. Monthly wind roses are represented by Figures 2.7-42 through 2.7-53. From January through March, the wind blows dominantly from the east-southeast and north directions. During April and May, south winds are most common. As expected, wind speeds become lighter and wind directions are more variable during June, July, and August. Northeast winds occur most frequently during September and October, before dominant east-southeast and north winds return in November and December.

2.7.4.3 Wind Persistence

Persistence of wind direction is a measurement of the duration of the transport of air from a specific direction to locations downwind. It reflects the possible amount of time that radiation or any other type of pollution may travel in the same or a similar direction. The dilution potential of the pollutant as it moves downstream of its source is directly proportional to wind speed. Higher wind speeds lead to increased dilution, while lower wind speeds create less dilution.

Tables 2.7-25 through 2.7-48 show the persistence of wind direction and speed at both the 30-ft. and 150-ft. tower levels, respectively, for 22.5-degree (single) and 67.5-degree (three adjoining) wind sector widths for various wind speeds at the RBS during the 24-month period of December 2004 through November 2006. The longest recorded single sector persistence was from the north (70 hr.) for the 30-ft. level and from the north-northwest direction (26 hr.) for the 150-ft.

level. For three adjoining sectors, the 30-ft. level and 150-ft. level recorded the longest persistence from the north-northwest (139 hr.) and south (88 hr.), respectively. Tables containing summaries of wind persistence for all wind speeds indicate that winds are most likely to be persistent from the north direction at the 30-ft. level and from the east-southeast at the 150-ft. level. In addition, the final row in the tables displays the average persistent hours for each wind direction and provides a method for determining which direction winds are most likely to persist longer. For the 30-ft. level, the wind is most likely to persist longer from the southeast and north directions for single and three adjoining sector widths, respectively. A persistent wind is most likely to last longer at the 150-ft. level for east-southeast and north-northeast wind directions for single sector and three adjoining sector widths, respectively.

Tables 2.7-49 through 2.7-60 present the persistence of wind direction and speed at the 30-ft. level for the single sector and three adjoining sectors for various wind speeds at Ryan Airport during the 2002 through 2006 time period (Reference 2.7-42). At the 30-ft. level (the only level at Ryan Airport), the longest persistent wind blew from the south and lasted 23 hr. for a single sector. For three adjoining sectors, the longest persistent wind lasted 88 hr. from the south. Tables 2.7-49 and 2.7-60 present wind persistence summaries for various wind speeds for the single sector and three adjoining sector widths, respectively. The most likely direction for a wind to be persistent for both sector widths is east, but a wind is most likely to persist longer when blowing from the south. Previously, in Subsection 2.7.4.2, the noticeable lack of east winds at the RBS was discussed. It is possible that winds may likely be more easterly for the upper and lower instruments if trees had no effect on the on-site meteorological tower. However, it is reasonable to assume that winds are most likely to be persistent regardless of speed from the east or east-southeast direction and persist longer from the southeast, east-southeast, north, and north-northeast directions at the RBS.

2.7.4.4 Atmospheric Stability

Atmospheric diffusion, independent of the effects of wind speed, is proportional to the stability of the atmosphere and has a large effect on potential vertical and horizontal dispersion of radiation or any other type of pollutant in the ambient air. Atmospheric stability can generally be classified as unstable, neutral, and stable. During stable conditions, diffusion is at its lowest levels, while under unstable conditions, diffusion is at its highest levels. Pasquill-Gifford developed seven categories measuring atmospheric stability that are accepted and used by the NRC. The various categories can be determined by the difference in temperature (ΔT) between two temperature measurement levels normalized to 100 m (328 ft.). As defined in Regulatory Guide 1.23, the following categories of atmospheric stability reflect the ΔT in degrees Celsius (°C) per 100 m:

Class A	Extremely Unstable	$\Delta T/\Delta Z \leq -1.9°C$
Class B	Moderately Unstable	$-1.9°C < \Delta T/\Delta Z \leq -1.7°C$
Class C	Slightly Unstable	$-1.7 °C < \Delta T/\Delta Z \leq -1.5°C$
Class D	Neutral Stability	$-1.5°C < \Delta T/\Delta Z \leq -0.5°C$
Class E	Slightly Stable	$-0.5°C < \Delta T/\Delta Z \leq +1.5°C$
Class F	Moderately Stable	$+1.5 < \Delta T/\Delta Z \leq +4.0°C$
Class G	Extremely Stable	$+4.0°C < \Delta T/\Delta Z$

Table 2.7-61 presents mean annual and monthly wind speeds for the 30-ft. level at the RBS for each of the Pasquill-Gifford stability categories. Annually, the mean wind speeds are highest when the RBS is slightly unstable, while mean wind speeds are the lowest under extremely stable conditions, characteristic of high-pressure systems. Table 2.7-61 also contains the annual and monthly distribution of stability summaries. The RBS experienced slightly stable conditions 50 percent of the total number of hours during the 2-year period. Unstable conditions (Classes A, B, and C combined) occurred only 1.8 percent of the total hours.

Table 2.7-62 through 2.7-77 present the annual Joint Frequency Distributions (JFDs) of wind speed and direction by stability category at the 30-ft. and 150-ft. measurement levels of the RBS on-site meteorological tower for the December 2004 to November 2006 time period, respectively. It is noticeable from the JFD for the 30-ft. level that for stable conditions (Classes E, F, and G), the observations with wind speeds less than 4 mph occur most frequently, implying that stable conditions generally are associated with light winds. Tables for the 150-ft. tower suggest that for stable conditions, wind speeds are most frequently from 4 to 8 mph. These data indicate that the frictional effect of the trees that surround the on-site meteorological station has an effect of lowering wind speeds as height is decreased from the 150-ft. level to the 30-ft. level. Therefore, wind data from the 30-ft. level are representative of air dispersion conditions at the RBS below the height of the trees.

2.7.4.5 Topographic Description and Potential Modifications

The RBS is located in the southern part of West Feliciana Parish and is located above the Mississippi River floodplain in an area of heavily forested small rolling hills. Figures 2.7-54 and 2.7-55 show topographic features within 5 and 50 mi., respectively, of the RBS. The general site elevation is roughly less than 100 ft. Elevation drastically increases for compass directions between north-northwest clockwise to east. Areas to the west, south, and southeast contain elevations that are much lower than the RBS. Figure 2.7-56 shows the terrain elevation profiles for each of the sixteen 22.5-degree compass directions to a distance of 5 mi. from the site. The Mississippi River valley is located at a distance approximately 1.5 mi. southwest of the RBS. Figure 2.7-57 presents similar terrain profiles out to 50 mi. from the RBS.

The proposed unit for the RBS would be located just southwest of the existing nuclear unit (Figures 2.1-3 and 2.1-4 in Section 2.1 of the ER). Portions of the proposed unit would be located in a general undeveloped area that would require additional grading and clearing of trees. Consideration is also being given to the construction of a new on-site meteorological tower prior to the operation of the Unit 3. Any new meteorological tower would be constructed in accordance with Regulatory Guide 1.23. Any influence of the grading and clearing of trees during construction of a new facility or a new meteorological tower would be limited to the RBS Unit 3 site and the immediate surrounding area. This would lead to a minimal change in the overall topography around the RBS and, thus, would not represent a significant alteration to the flat-to-gently-rolling topographic character of the area and region around the site.

2.7.5 SHORT-TERM DIFFUSION ESTIMATES

2.7.5.1 Basis

To evaluate the potential health effects of design basis accidents (DBAs) at RBS Unit 3, a hypothetical accident was postulated to predict upper-limit concentrations and doses that might occur in the event of a containment release to the atmosphere. Site-specific meteorological data covering the 8-year period of record from 2000 through 2007 were used to quantitatively evaluate such a hypothetical accident at the site. On-site data provide representative measurements of local dispersion conditions appropriate for the RBS site, and an 8-year period of record is considered to be reasonably representative of long-term conditions.

According to 10 CFR 100, it is necessary to consider the doses for various time periods immediately following the onset of a postulated containment release at the exclusion area boundary (EAB) and for the duration of exposure for the low population zone (LPZ). Meteorological data have been used to determine various postulated accident conditions, as specified in Regulatory Guide 1.145, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants." Compared to an elevated release, a ground-level release usually results in higher ground-level concentrations at downwind receptors. Since the ground-level release scenario provides a bounding case, elevated releases were not considered.

The PAVAN computer program, as described in NUREG/CR-2858, *PAVAN: An Atmospheric Dispersion Program for Evaluating Design Basis Accidental Releases of Radioactive Materials from Nuclear Power Stations* (Reference 2.7-43), was used to estimate downwind ground-level air concentrations (χ/Q) at the EAB and LPZ for potential accidental releases of radioactive material to the atmosphere. The χ/Q values were estimated for various time periods ranging up to 30 days. This assessment is required by 10 CFR 100.

The EAB for RBS Unit 3 is shown in Figure 2.1-1, which is a circle centered at the Reactor Building with a radius of 2364 ft.

The RBS Unit 3 LPZ is the same as the RBS Unit 1 LPZ, which is a 2.5-mi. radius circle centered at Unit 1. This sharing of the Unit 1 LPZ results in a different distance to the LPZ in each direction from Unit 3. The distance between the proposed RBS Unit 3 and the existing RBS Unit 1 vessel centers is 775 ft. To be conservative in the atmospheric dispersion analysis, the LPZ distance used in all directions was 2.5 mi. less the 775 ft. offset distance.

The PAVAN program implements the guidance provided in Regulatory Guide 1.145. Primarily, the code computes χ/Q values at the EAB and LPZ for each combination of wind speed and atmospheric stability class for each of 16 downwind direction sectors (e.g., north, north-northeast, northeast, etc.). The χ/Q values calculated for each direction sector are then ranked in descending order, and an associated cumulative frequency distribution is derived based on the frequency distribution of wind speeds and stabilities for the complementary upwind direction sector. The χ/Q value that is equaled or exceeded 0.5 percent of the total time becomes the maximum sector-dependent χ/Q value.

The calculated χ/Q values are also ranked independently of wind direction into a cumulative frequency distribution for the entire site. The PAVAN program then selects the χ/Qs that are equaled or exceeded 5 percent of the total time.

The larger of the two values (i.e., the maximum sector-dependent 0.5 percent χ/Q or the overall site 5 percent χ/Q value) is used to represent the χ/Q value for a 0 to 2-hr. time period. To determine χ/Q values for longer time periods, the program calculates an annual average χ/Q value using the procedure described in Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors." The program then uses logarithmic interpolation between the 0 to 2-hr. χ/Q values for each sector and the corresponding annual average χ/Q values to calculate the values for intermediate time periods (e.g., 0 to 8 hr., 8 to 24 hr., 1 to 4 days, and 4 to 30 days).

The PAVAN model has been configured conservatively to calculate off-site χ/Q values, assuming no credit for building wake effects.

The PAVAN model input data are presented below:

- Meteorological data: 8-year (2000 to 2007) composite on-site JFDs of wind speed, wind direction, and atmospheric stability.
- Type of release: Ground-level.
- Wind sensor height: 9.144 m.
- Vertical temperature difference: (between 30 and 150 ft.).
- Number of wind speed categories: 13.
- Release height: 10 m. (default height).
- Distances from release point to EAB for all downwind sectors.
- Distances from release point to LPZ for all downwind sectors.

2.7.5.2 PAVAN Modeling Results

The PAVAN modeling results for the maximum sector χ/Q values at the EAB and the LPZ relative to the 0 to 2-hr. time period, the annual average time period, and other intermediate time intervals evaluated by the PAVAN model are presented as follows:

Location	**0-2 hr. χ/Q (sec/m3)**	**0-8 hr. χ/Q (sec/m3)**	**8-24 hr. χ/Q (sec/m3)**	**1-4 days χ/Q (sec/m3)**	**4-30 days χ/Q (sec/m3)**	**Annual Average χ/Q (sec/m3)**
EAB	8.12E-04	NA	NA	NA	NA	NA
LPZ	NA	8.23E-05	5.76E-05	2.66E-05	8.75E-06	2.25E-06

The PAVAN-predicted maximum 0 to 2-hr. EAB χ/Q (8.12E-04 sec/m^3) is lower than the corresponding DCD EAB χ/Q value (2.00E-03 sec/m^3). Similarly, the PAVAN-predicted maximum LPZ χ/Q values are lower than the corresponding DCD LPZ χ/Q values.

2.7.6 LONG-TERM DIFFUSION ESTIMATES

2.7.6.1 Basis

The NRC-sponsored XOQDOQ computer program, as described in *XOQDOQ: Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations*, NUREG/CR-2919 (Reference 2.7-44), is used to estimate the χ/Q values that are due to routine releases of gaseous effluents to the atmosphere. The XOQDOQ computer code has the primary function of calculating annual average χ/Q values and annual average relative deposition (D/Q) values at receptors of interest (e.g., at the site boundary and at the nearest residence, vegetable garden, etc.). The χ/Q and D/Q values due to intermittent releases, which occur during routine operation, may also be evaluated using the XOQDOQ model.

The XOQDOQ dispersion model implements the assumptions outlined in Regulatory Guide 1.111. The program assumes that the material released to the atmosphere follows a Gaussian distribution around the plume centerline. In estimating concentrations for longer time periods, the Gaussian distribution is assumed to be evenly distributed within a given directional sector. A straight-line trajectory is assumed between the release point and all receptors.

The following input data and assumptions have been used in the XOQDOQ modeling analysis:

- Meteorological data: 8 year (2000 to 2007) composite on-site JFDs of wind speed, wind direction, and atmospheric stability.
- Type of release: ground-level (Radwaste Building Stack); mixed-mode (Reactor Building/ Fuel Building and Turbine Building Stacks).
- Wind sensor height: 9.144 m.
- Vertical temperature difference: between 30 to 150 ft.
- Number of wind speed categories: 13.
- Release height: 10 m (default height) for ground-level release; 52.62 m for Reactor Building/Fuel Building Stack (mixed-mode); 71.3 m for Turbine Building Stack (mixed-mode).
- Adjacent building height: N/A for ground level release; 48.05 m for Reactor Building/Fuel Building Stack (mixed-mode); 52.0 m for Turbine Building Stack (mixed-mode).
- Average Vent Velocity: N/A for ground level release; 17.78 m/s for Reactor Building/Fuel Building Stack (mixed-mode); 17.78 m/s for Turbine Building Stack (mixed-mode).

- Inside Vent Diameter: N/A for ground level release; 2.40 m for Reactor Building/Fuel Building Stack (mixed-mode); 1.95 m for Turbine Building Stack (mixed-mode).
- Distances from release point to site boundary for all downwind sectors.
- No residential milk or meat animals have been identified within 5 mi. of the RBS site.

The building area input is conservatively set to 0 to neglect the building wake credit for the mixed-mode releases. The building area for the ground level release is set to 350 m^2.

The distances from the release point to the site boundary in each downwind sector are presented in Table 2.7-78. While three separate release points are considered, each is assumed to be located at the reactor centerline for the purposes of calculating the distance from the release to the site boundary.

2.7.6.2 XOQDOQ Modeling Results

Tables 2.7-79, 2.7-80, and 2.7-81 summarize the maximum relative concentration and relative deposition (i.e., χ/Q and D/Q) values predicted by the XOQDOQ model for the site boundary due to routine releases of gaseous effluents, assuming a ground-level release release and mixed-mode releases from the Reactor Building/Fuel Building Stack and the Turbine Building Stack. The listed χ/Q values reflect several plume depletion scenarios that account for radioactive decay (i.e., no decay and the default half-life decay periods of 2.26 and 8 days).

The maximum annual average χ/Q values (with no decay along with the direction and distance of the receptor locations relative to the RBS Unit 3 site) for the site boundary are as follows:

- 2.1E-05 sec/m^3 occurring at a distance of 1158 m for the site boundary in the ESE sector and also at a distance of 1219 m for the site boundary in the NW sector for a ground-level release.
- 6.0E-07 sec/m^3 occurring at a distance of 1219 m for the site boundary in the N sector for a mixed-mode release from the Reactor Building/Fuel Building Stack.
- 5.3E-07 sec/m^3 occurring at a distance of 1219 m for the site boundary in the N sector for a mixed-mode release from the Turbine Building Stack.

Tables 2.7-82 and 2.7-83 summarize annual average χ/Q values (no decay) and D/Q values, respectively, at the XOQDOQ model's 22 standard radial distances between 0.25 and 50 mi. and for the model's 10 distance-segment boundaries between 0.5 and 50 mi. downwind along each of the 16 standard direction radials (i.e., separated by 22.5 degrees) for a ground-level release. Tables 2.7-84 and 2.7-85 provide the same information for a mixed-mode release from the Reactor Building/Fuel Building Stack, while Tables 2.7-86 and 2.7-87 provide the results at the standard radial distances for a mixed-mode release from the Turbine Building Stack.

2.7.7 REFERENCES

2.7-1 National Climatic Data Center, "Local Climatological Data Annual Summary with Comparative Data for Baton Rouge, Louisiana," pp. 3-7, January 2007.

2.7-2 Southern Regional Climate Center, "Climate Synopsis for Louisiana," 2007, Website, http://www.srcc.lsu.edu/southernClimate/atlas/ladescription, accessed August 3, 2007.

2.7-3 Wang, Julian X. L. and J. K. Angell, "Air Stagnation Climatology for the United States (1948-1998)," *NOAA/Air Resources Laboratory ATLAS No. 1*, April 1999, Website, http://www.arl.noaa.gov/pubs/online/atlas.pdf, accessed August 1, 2007.

2.7-4 Climate Prediction Center, "Storm Track Climatology," 2002, Website, http://www.cpc.noaa.gov/products/precip/CWlink/stormtracks/strack_NH.shtml, accessed July 30, 2007.

2.7-5 Landreneau, D., *Atlantic Tropical Storm and Hurricanes Affecting the United States: 1899-1999*, Technical Memorandum NWS SR-206, National Weather Service Office-Lake Charles, Louisiana, NOAA, December 2001, Website, http://www.srh.noaa.gov/ssd/techmemo/sr206.htm, accessed July 30, 2007.

2.7-6 National Climatic Data Center, "Local Climatological Data Annual Summary with Comparative Data for New Orleans, Louisiana," pp. 3-7, January 2007.

2.7-7 National Climatic Data Center, "Local Climatological Data Annual Summary with Comparative Data for Lake Charles, Louisiana," pp. 3-7, January 2007.

2.7-8 University of Washington, "COOP Southeast Stations," Joint Institute for the Study of Atmosphere and Ocean, June 2007, Website, http://jisao.washington.edu/greg/southeast/states/LA/LA_map.html, accessed July 30, 2007.

2.7-9 National Climatic Data Center, "Local Climatological Data Annual Summary with Comparative Data for Baton Rouge, Louisiana," pp. 1-2, 1978.

2.7-10 National Climatic Data Center, "NCDC Online Climate Store, United States Cooperative Observer Program (COOP)," (Purchased 50 Years of COOP Climatic Data for 4 Stations, 2007), August 4, 2007.

2.7-11 National Climatic Data Center, Hourly Data for Baton Rouge, Louisiana, *Solar and Meteorological Surface Observational Network 1961-1990* CD-ROM, Version 1.0, September 1993.

2.7-12 National Climatic Data Center, Hourly Data for Baton Rouge, Louisiana, *Hourly United States Weather Observations 1991-1995* CD-ROM, September 1997.

2.7-13 National Climatic Data Center, *Online Climate Atlas of the United States*, 2005, Website, http://gis.ncdc.noaa.gov/website/ims-climatls/index.html, accessed July 30, 2007.

2.7-14 National Climatic Data Center, "Climatography of the United States No. 81 for Louisiana 1971-2000," Revised February 2002, Website, http://cdo.ncdc.noaa.gov/cgi-bin/climatenormals/climatenormals.pl?directive=prod_select2&prodtype=CLIM81&subrnum=, accessed August 9, 2007.

2.7-15 National Climatic Data Center Storm Data, "Louisiana & Mississippi, Record 1-Day, 2-Day and 3-Day Snowfall," 2007, Website, http://www.ncdc.noaa.gov/ussc/pagemap.html, accessed July 31, 2007.

2.7-16 Palmer, W. C., *Meteorological Drought*, U.S. Weather Bureau, Research Paper No. 45, 1965.

2.7-17 National Climatic Data Center, "Louisiana Palmer Drought Index, January 1900 to February 2000," 2001, Website, www1.ncdc.noaa.gov/pub/data/wint/lapdi_pg.gif, accessed October 16, 2007.

2.7-18 U.S. Department of Agriculture, Rural Utilities Service, *Summary of Items of Engineering Interest*, August 1998, Website, http://www.usda.gov/rus/electric/engineering/en-in-98.pdf, accessed August 4, 2007.

2.7-19 National Weather Service, "5-Year Flash Density Map-U.S.," 2001, Website, http://www.lightningsafety.noaa.gov/lightning_map.htm, accessed August 7, 2007.

2.7-20 American Society of Civil Engineers and Structural Engineering Institute, "Minimum Design Loads for Buildings and Other Structures," SEI/ASCE 7-05, Revision of ASCE 7-02, pp. 25-26 and 318, 2006.

2.7-21 National Climatic Data Center, "Summary for Baton Rouge, Louisiana," *Engineering Weather Data, 2000 Interactive Edition*, CD-ROM, Version 1.0, 2001.

2.7-22 National Climatic Data Center Searchable Online Database, "NCDC Storm Events Database," March 2007, Website, http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms, accessed August 2, 2007.

2.7-23 National Oceanic and Atmospheric Administration Online Hurricane Track Software, "Historical Hurricane Tracks," NOAA Coastal Services Center, 2006, Website, http://maps.csc.noaa.gov/hurricanes/, accessed August 3, 2007.

2.7-24 U.S. Nuclear Regulatory Commission, *Tornado Climatology of the Contiguous United States*, NUREG/CR-4461, Rev. 2, February 2007.

2.7-25 Texas Tech University, "Enhanced Fujita Scale (EF-Scale)," Wind Science and Engineering Center, October 2006, Website, http://www.wind.ttu.edu/EFscale.pdf, accessed August 5, 2007.

2.7-26 U.S. Census Bureau, "State and County QuickFacts," 2006, Website, http://quickfacts.census.gov/qfd/, accessed August 5, 2007.

2.7-27 University of Louisiana Monroe, "Louisiana Severe Weather 1955-1995," Data from the Storm Prediction Center, 1996, Website, http://www.ulm.edu/~pani/wx_home.htm, accessed August 2, 2007.

2.7-28 Chagnon, S. A., Jr., "The Scales of Hail," *Journal of Applied Meteorology*, Volume 16: 626-648, June 1977.

2.7-29 Schaefer, J. T., J. J. Levit, S. J. Weiss, D. W. McCarthy, "The Frequency of Large Hail over the Contiguous United States," Storm Prediction Center, 2003, Website, http://www.spc.noaa.gov/publications/schaefer/hailfreq.pdf, accessed August 2, 2007.

2.7-30 Cortinas, J., Jr., B. Bernstein, C. Robbins, and J. Walter Strapp, "An Analysis of Freezing Rain, Freezing Drizzle, and Ice Pellets Across the United States and Canada: 1976-90," *Weather and Forecasting*, Vol. 19, Issue 2, pp. 377-390, April 2004.

2.7-31 Houston, T. G. (National Climatic Data Center) and S. A. Chagnon (Illinois State Climatologist), "Freezing Rain Events in the United States," 2003, Website, http://ams.confex.com/ams/pdfpapers/71872.pdf, accessed August 3, 2001.

2.7-32 U.S. Geological Survey, Hurricane Katrina Wind Speeds, Website, http://store.usgs.gov/mod/images/windspeeds_countyfedla_p.gif, accessed January 16, 2008.

2.7-33 Faiers, G., B. Keim, and R. Muller, *Rainfall Frequency/Magnitude Atlas for the South-Central United States*, Southern Regional Climate Center, 1997, Website, http://www.losc.lsu.edu/tech97_2.pdf, accessed August 5, 2007.

2.7-34 U.S. Environmental Protection Agency, *US EPA Green Book*, 2007, Website, http://www.epa.gov/air/oaqps/greenbk/, accessed July 31, 2007.

2.7-35 U.S. Environmental Protection Agency, "Fact Sheet Final Revisions to the National Ambient Air Quality Standards for Ozone," March 12, 2008, Website, http://www.epa.gov/air/ozonepollution/pdfs/2008_03_factsheet.pdf, accessed March 12, 2008.

2.7-36 Louisiana Department of Air Quality, "Procedures for Modeling 8-hr. Ozone Concentrations in the Baton Rouge 5-Parish Area," pp. 3-8, September 2006, Website, http://www.deq.state.la.us/portal/Portals/0/AirQualityAssessment/Engineering/Ozone/LADEQ_ModelingProtocol_Draft_073106.pdf, accessed July 31, 2007.

2.7-37 National Park Service, "Class I Receptors, National Park Service Database," 2007, Website, http://www2.nature.nps.gov/air/Maps/Receptors/index.cfm, accessed August 1, 2007.

2.7-38 Holzworth, G. C., "Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Throughout the Contiguous United States," U.S. Environmental Protection Agency, Publication No. AP-101, January 1972.

2.7-39 National Climatic Data Center, "Mixing Height Data for Lake Charles, Louisiana, January 2002 through December 2006," 2007.

2.7-40 American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., *2005 ASHRAE Handbook*, 2005.

2.7-41 National Climatic Data Center, "DS 3240-Hourly Precipitation Data," 2007.

2.7-42 National Climatic Data Center, "Integrated Surface Hourly Data," purchased online through NCDC, 2007.

2.7-43 U.S. Nuclear Regulatory Commission, *PAVAN: An Atomospheric Dispersion Program for Evaluating Design Basis Accidental Releases of Radioactive Materials from Nuclear Power Stations*, NUREG/CR-2858, PNL-4413, November 1982.

2.7-44 U.S. Nuclear Regulatory Commission, *XOQDOQ: Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations*, NUREG/CR-2919, PNL-4380, September 1982.

Table 2.7-1
National Weather Service First-Order and Cooperative Observing Stations Surrounding the RBS

Station[a]	State	County	Approximate Distance from RBS (mi.)[b]	Relative Direction to RBS	Elevation (ft.)
New Roads 5ESE	LA	Pointe Coupe	5	SSW	46
Baton Rouge NWS (Ryan Field)	LA	East Baton Rouge	19	SE	67
Woodville 4ESE	MS	Wilkinson	24	NNE	400
Grand Coteau	LA	Saint Laundry	47	WSW	56
Amite	LA	Tangipohoa	48	E	171
New Orleans NWS	LA	Jefferson	84	SE	0
Lake Charles NWS	LA	Calcasieu	115	WSW	9

a) Numeric and letter designators following a station name (e.g., New Roads 5ESE) indicate the station's distance in miles and direction relative to the place name.

b) The Corpscon 6.0.1 conversion program was used to convert Lat/Long (NAD 83) to UTM (NAD 83) for each site location. Distances above are from the current RBS facility to the listed location.

Sources: References 2.7-1, 2.7-6, 2.7-7, and 2.7-8.

Table 2.7-2
Local Climatological Data Summary for Baton Rouge, Louisiana

NORMALS, MEANS, AND EXTREMES
BATON ROUGE (KBTR)

LATITUDE: 30 ° 32'N LONGITUDE: -91 ° 8 'W ELEVATION (FT): GRND: 67 BARO: 70 TIME ZONE: CENTRAL (UTC -6) WBAN: 13970

	ELEMENT	POR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE °F	NORMAL DAILY MAXIMUM	30	60.0	63.9	71.0	77.3	84.0	89.2	90.7	90.9	87.4	79.7	70.1	62.8	77.3
	MEAN DAILY MAXIMUM	77	61.8	63.7	71.3	78.0	84.6	89.5	91.1	91.2	87.0	80.1	70.2	63.8	77.7
	HIGHEST DAILY MAXIMUM	55	84	85	91	93	98	103	101	105	104	97	87	85	105
	YEAR OF OCCURRENCE		2002	1989	1963	2006	1953	1954	1960	2000	2000	2006	1986	1982	AUG 2000
	MEAN OF EXTREME MAXS.	77	77.2	79.2	83.7	87.5	92.1	95.4	96.1	96.4	94.2	89.4	83.6	79.1	87.8
	NORMAL DAILY MINIMUM	30	40.2	43.1	49.6	55.8	64.1	70.2	72.7	71.9	67.5	56.4	47.9	42.1	56.8
	MEAN DAILY MINIMUM	77	41.5	43.3	49.8	56.6	64.4	69.5	72.8	72.2	67.5	57.2	47.5	42.8	57.1
	LOWEST DAILY MINIMUM	55	9	15	20	32	44	53	58	58	43	30	21	8	8
	YEAR OF OCCURRENCE		1985	1996	1980	1987	1954	1984	1967	2004	1967	1993	1976	1989	DEC 1989
	MEAN OF EXTREME MINS.	77	23.3	26.7	32.6	41.4	52.2	61.9	68.6	66.4	55.3	41.1	31.0	24.8	43.8
	NORMAL DRY BULB	30	50.1	53.5	60.3	66.6	74.0	79.7	81.7	81.4	77.5	68.1	59.0	52.4	67.0
	MEAN DRY BULB	77	51.7	53.6	60.5	67.3	74.5	79.6	82.0	81.8	77.3	68.7	58.8	53.3	67.4
	MEAN WET BULB	23	46.9	49.8	55.2	61.2	68.4	73.3	75.4	75.0	70.9	62.6	54.9	48.5	61.8
	MEAN DEW POINT	23	42.5	45.2	50.7	57.0	65.2	71.0	73.2	72.7	68.2	59.1	51.3	44.4	58.4
	NORMAL NO. DAYS WITH:														
	MAXIMUM >= 90	30	0.0	0.0	0.0	0.2	5.6	18.9	23.9	23.2	13.0	1.5	0.0	0.0	86.3
	MAXIMUM <= 32	30	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3
	MINIMUM <= 32	30	8.1	4.2	0.9	*	0.0	0.0	0.0	0.0	0.0	*	1.6	6.3	21.1
	MINIMUM <= 0	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H/C	NORMAL HEATING DEG. DAYS	30	457	326	185	57	4	0	0	0	2	49	212	397	1689
	NORMAL COOLING DEG. DAYS	30	11	15	55	119	298	457	534	523	389	157	48	22	2628
RH	NORMAL (PERCENT)	30	75	72	72	72	74	76	77	78	77	75	76	76	75
	HOUR 00 LST	30	82	80	81	83	86	88	88	89	88	87	87	84	85
	HOUR 06 LST	30	86	85	88	89	91	92	92	93	92	90	89	87	90
	HOUR 12 LST	30	64	60	58	55	58	60	62	61	60	55	60	63	60
	HOUR 18 LST	30	67	61	60	58	62	66	69	70	70	68	71	69	66
S	PERCENT POSSIBLE SUNSHINE														
W/O	MEAN NO. DAYS WITH:														
	HEAVY FOG (VISBY <= 1/4 MI)	43	4.3	2.9	3.2	2.6	2.4	1.1	1.2	1.4	2.0	4.2	3.9	3.9	33.1
	THUNDERSTORMS	59	2.2	3.3	4.5	5.2	6.5	10.3	15.2	12.5	6.5	2.6	2.7	2.4	73.9
CLOUDINESS	MEAN:														
	SUNRISE-SUNSET (OKTAS)	1	6.4	6.4		5.6	5.6	4.4	4.8	2.8	3.2	4.0	4.8	6.4	
	MIDNIGHT-MIDNIGHT (OKTAS)	1	6.4	6.4		5.6	4.8	4.8	4.8	2.8	3.2	4.0	5.6	6.4	
	MEAN NO. DAYS WITH:														
	CLEAR	1	10.0	9.5	8.0	7.0	13.0	7.0	9.0	10.0	3.0	5.0	6.0	2.0	89.5
	PARTLY CLOUDY	2	3.5	5.5	3.0	6.0	6.5	17.5	7.0	8.0	2.0	3.0	3.0	2.0	67.0
	CLOUDY	2	14.5	15.0	7.5	9.0	16.5	10.0	9.0	4.0		8.0	7.0	5.0	
PR	MEAN STATION PRESSURE (IN)	23	30.08	30.04	29.97	29.93	29.90	29.90	29.95	29.92	29.91	29.97	30.03	30.04	29.97
	MEAN SEA-LEVEL PRES. (IN)	23	30.15	30.11	30.04	30.00	29.98	29.97	30.02	30.00	29.99	30.05	30.11	30.15	30.05
WINDS	MEAN SPEED (MPH)	23	7.5	7.9	7.9	7.7	6.7	5.8	5.3	4.9	5.7	5.8	6.6	6.9	6.6
	PREVAIL.DIR (TENS OF DEGS)	35	13	36	19	19	19	19	26	06	05	06	13	12	05
	MAXIMUM 2-MINUTE:														
	SPEED (MPH)	13	39	39	39	36	39	39	37	37	41	37	35	60	60
	DIR. (TENS OF DEGS)		24	17	18	19	22	19	28	31	18	15	17	29	29
	YEAR OF OCCURRENCE		1999	1998	2006	2006	1999	2003	1997	2005	2005	2002	2004	2002	DEC 2002
	MAXIMUM 5-SECOND														
	SPEED (MPH)	13	47	51	49	52	52	52	47	48	53	49	44	78	78
	DIR. (TENS OF DEGS)		23	17	29	18	25	32	28	09	19	24	22	28	28
	YEAR OF OCCURRENCE		1999	1998	1996	2006	1999	2004	1997	2000	2005	2006	1997	2002	DEC 2002
PRECIPITATION	NORMAL (IN)	30	6.19	5.10	5.07	5.56	5.34	5.33	5.96	5.86	4.84	3.81	4.76	5.26	63.08
	MAXIMUM MONTHLY (IN)	55	14.94	14.51	12.73	14.84	14.67	23.18	10.98	14.48	13.95	14.48	13.55	15.94	23.18
	YEAR OF OCCURRENCE		1998	1966	1973	1980	1989	1989	1963	1987	1977	1984	1989	1982	JUN 1989
	MINIMUM MONTHLY (IN)	55	0.52	0.64	0.30	0.38	0.35	0.12	1.94	0.38	0.09	T	0.25	1.83	T
	YEAR OF OCCURRENCE		2003	2000	2006	1976	1998	1979	2005	1999	1953	1978	1967	1996	OCT 1978
	MAXIMUM IN 24 HOURS (IN)	55	9.02	4.72	6.07	12.08	4.96	9.97	4.26	8.31	9.17	8.38	7.29	8.28	12.08
	YEAR OF OCCURRENCE		1993	1979	1973	1967	1954	2001	1969	1987	2005	1964	1989	1982	APR 1967
	NORMAL NO. DAYS WITH:														
	PRECIPITATION >= 0.01	30	10.6	8.3	9.3	7.9	8.0	10.9	12.7	12.3	9.2	5.9	8.9	9.4	113.4
	PRECIPITATION >= 1.00	30	2.1	1.7	1.8	1.8	1.8	1.5	1.8	1.7	1.5	1.4	1.5	1.7	20.3
SNOWFALL	NORMAL (IN)	30	0.*	0.2	0.*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.*	0.*	0.2
	MAXIMUM MONTHLY (IN)	46	0.6	3.2	T	0.0	T	0.0	0.0	0.0	0.0	0.0	T	T	3.2
	YEAR OF OCCURRENCE		1973	1988	1993		1989						1976	1989	FEB 1988
	MAXIMUM IN 24 HOURS (IN)	45	0.5	3.2	T	0.0	T	0.0	0.0	0.0	0.0	0.0	T	T	3.2
	YEAR OF OCCURRENCE'		1973	1988	1993		1989						1976	1989	FEB 1988
	MAXIMUM SNOW DEPTH (IN)	46	2	2	0	0	0	0	0	0	0	0	T	0	2
	YEAR OF OCCURRENCE		1949	1988									1976		FEB 1988
	NORMAL NO. DAYS WITH:														
	SNOWFALL >= 1.0	30	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1

published by: NCDC Asheville, NC 3 30 year Normals (1971-2000)

Source: Reference 2.7-1.

Table 2.7-3
Local Climatological Data Summary for New Orleans, Louisiana

NORMALS, MEANS, AND EXTREMES
NEW ORLEANS (KMSY)

LATITUDE: 29 ° 59'N LONGITUDE: -90 ° 15'W ELEVATION (FT): GRND: 0 BARO: 7 TIME ZONE: CENTRAL (UTC -6) WBAN: 12916

	ELEMENT	POR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE °F	NORMAL DAILY MAXIMUM	30	61.8	65.3	72.1	78.0	84.8	89.4	91.1	91.0	87.1	79.7	71.0	64.5	78.0
	MEAN DAILY MAXIMUM	68	62.2	64.4	71.3	77.8	84.8	89.1	90.8	90.6	86.5	79.7	70.3	64.3	77.7
	HIGHEST DAILY MAXIMUM	60	83	85	89	92	96	100	101	102	101	94	87	84	102
	YEAR OF OCCURRENCE		1982	1972	1982	1987	1953	1954	1981	1980	1980	1998	1997	1995	AUG 1980
	MEAN OF EXTREME MAXS.	68	77.5	79.3	82.4	86.6	91.4	94.5	95.6	95.6	93.2	88.6	83.3	79.7	87.3
	NORMAL DAILY MINIMUM	30	43.4	46.1	52.7	58.4	66.4	72.0	74.2	73.9	70.6	60.2	51.8	45.6	59.6
	MEAN DAILY MINIMUM	68	44.0	46.1	52.4	58.8	66.2	71.5	73.9	73.8	70.3	60.7	51.0	45.7	59.5
	LOWEST DAILY MINIMUM	60	14	16	25	32	41	50	60	60	42	35	24	11	11
	YEAR OF OCCURRENCE		1985	1996	1980	1971	1960	1984	1967	1968	1967	1993	1970	1989	DEC 1989
	MEAN OF EXTREME MINS.	68	26.7	30.3	35.8	44.0	54.3	63.9	69.4	68.5	60.4	44.8	35.1	28.6	46.8
	NORMAL DRY BULB	30	52.6	55.7	62.4	68.2	75.6	80.7	82.7	82.5	78.9	70.0	61.4	55.1	68.8
	MEAN DRY BULB	68	53.1	55.3	61.9	68.4	75.5	80.4	82.4	82.2	78.4	70.2	60.7	55.0	68.6
	MEAN WET BULB	23	49.0	51.9	56.7	62.6	69.5	74.2	76.0	75.9	72.6	64.7	57.2	50.8	63.4
	MEAN DEW POINT	23	44.9	47.9	52.7	58.6	66.4	72.0	73.9	73.7	69.8	61.1	53.5	47.0	60.1
	NORMAL NO. DAYS WITH:														
	MAXIMUM >= 90	30	0.0	0.0	0.0	0.3	3.9	15.8	21.5	22.3	10.2	1.1	0.0	0.0	75.1
	MAXIMUM <= 32	30	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2
	MINIMUM <= 32	30	4.6	2.4	0.4	*	0.0	0.0	0.0	0.0	0.0	0.0	0.7	3.5	11.6
	MINIMUM <= 0	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H/C	NORMAL HEATING DEG. DAYS	30	403	288	150	44	1	0	0	0	0	30	169	332	1417
	NORMAL COOLING DEG. DAYS	30	12	19	62	136	320	466	538	534	413	182	62	29	2773
RH	NORMAL (PERCENT)	30	75	74	73	73	74	78	79	79	77	75	76	77	76
	HOUR 00 LST	30	81	80	81	83	85	87	88	88	86	85	85	83	84
	HOUR 06 LST	30	84	84	85	87	89	90	92	92	89	88	87	85	88
	HOUR 12 LST	30	66	63	61	59	60	64	66	65	65	60	63	65	63
	HOUR 18 LST	30	71	66	65	64	65	68	71	72	72	71	75	74	70
S	PERCENT POSSIBLE SUNSHINE	22	46	50	56	62	62	63	59	61	61	64	54	48	57
W/O	MEAN NO. DAYS WITH:														
	HEAVY FOG (VISBY <= 1/4 MI)	43	5.1	3.6	3.2	1.2	0.5	0.3	0.2	0.3	0.3	1.5	2.9	4.2	23.3
	THUNDERSTORMS	59	2.1	2.8	4.0	4.2	5.7	10.2	15.4	13.1	6.4	2.1	2.3	2.1	70.4
CLOUDNESS	MEAN:														
	SUNRISE-SUNSET (OKTAS)	48	5.4	5.0	5.0	4.6	4.9	4.9	5.1	4.6	4.3	3.6	4.3	5.1	4.7
	MIDNIGHT-MIDNIGHT (OKTAS)	32	5.2	4.8	4.9	4.4	4.2	4.0	4.6	4.3	4.0	3.3	4.0	4.8	4.4
	MEAN NO. DAYS WITH:														
	CLEAR	48	6.9	7.5	7.8	7.9	8.9	8.3	4.6	7.2	9.6	14.3	10.2	7.7	100.9
	PARTLY CLOUDY	48	7.1	6.4	8.0	10.4	11.2	12.5	14.6	13.8	10.6	7.9	8.2	7.4	118.1
	CLOUDY	48	16.9	14.3	15.2	11.7	10.9	9.2	11.8	10.0	9.8	8.9	11.5	15.9	146.1
PR	MEAN STATION PRESSURE (IN)	23	30.13	30.09	30.02	29.98	29.96	29.95	30.00	29.97	29.95	30.02	30.08	30.13	30.02
	MEAN SEA-LEVEL PRES. (IN)	23	30.16	30.12	30.05	30.01	29.99	29.98	30.03	30.00	29.98	30.05	30.11	30.16	30.05
WINDS	MEAN SPEED (MPH)	23	9.1	9.5	9.4	9.3	8.2	6.8	5.9	6.0	7.5	8.0	8.5	8.8	8.1
	PREVAIL.DIR (TENS OF DEGS)	28	36	36	17	17	19	19	25	05	05	05	06	36	19
	MAXIMUM 2-MINUTE:														
	SPEED (MPH)	10	48	43	39	45	44	40	46	40	46	39	39	39	48
	DIR. (TENS OF DEGS)		27	21	19	30	32	25	04	02	01	17	28	24	27
	YEAR OF OCCURRENCE		1998	1998	2006	2004	2004	2004	2005	1997	2002	2002	2004	2000	JAN 1998
	MAXIMUM 5-SECOND														
	SPEED (MPH)	10	63	51	51	55	64	64	55	48	55	51	46	51	64
	DIR. (TENS OF DEGS)		33	21	19	29	02	25	03	04	01	13	21	25	25
	YEAR OF OCCURRENCE		1998	1998	2006	2004	2004	2004	2005	1997	1998	2002	2002	2005	JUN 2004
PRECIPITATION	NORMAL (IN)	30	5.87	5.47	5.24	5.02	4.62	6.83	6.20	6.15	5.55	3.05	5.09	5.07	64.16
	MAXIMUM MONTHLY (IN)	60	19.28	12.59	19.09	16.12	21.18	17.62	13.15	16.12	18.98	13.20	19.81	10.77	21.18
	YEAR OF OCCURRENCE		1998	1983	1948	1980	1995	2001	1991	1977	1998	1985	1989	1967	MAY 1995
	MINIMUM MONTHLY (IN)	60	0.19	0.15	0.24	0.28	0.07	0.23	1.38	1.68	0.24	0.00	0.21	1.46	0.00
	YEAR OF OCCURRENCE		2003	1989	1955	1976	2000	1979	2000	1980	1953	1978	1949	1958	OCT 1978
	MAXIMUM IN 24 HOURS (IN)	60	6.08	5.60	7.87	8.08	12.40	7.40	4.43	4.96	9.55	4.51	12.66	6.81	12.66
	YEAR OF OCCURRENCE		1978	1961	1948	1988	1995	1988	1996	1992	2002	1985	1989	1990	NOV 1989
	NORMAL NO. DAYS WITH:														
	PRECIPITATION >= 0.01	30	10.5	8.4	8.6	7.2	8.0	11.8	13.9	13.2	10.2	5.9	8.6	9.4	115.7
	PRECIPITATION >= 1.00	30	1.9	1.8	2.1	1.5	1.6	2.5	1.7	1.7	1.7	1.0	1.8	1.5	20.8
SNOWFALL	NORMAL (IN)	30	0.*	0.*	0.*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.*	0.0
	MAXIMUM MONTHLY (IN)	51	0.4	2.0	T	T	T	0.0	0.0	0.0	0.0	0.0	T	2.7	2.7
	YEAR OF OCCURRENCE		1985	1958	1993	1996	1989						1950	1963	DEC 1963
	MAXIMUM IN 24 HOURS (IN)	50	0.4	2.0	T	T	T	0.0	0.0	0.0	0.0	0.0	T	2.7	2.7
	YEAR OF OCCURRENCE'		1985	1958	1993	1996	1989						1950	1963	DEC 1963
	MAXIMUM SNOW DEPTH (IN)	48	2	2	0	0	0	0	0	0	0	0	0	1	2
	YEAR OF OCCURRENCE		1964	1958										1989	JAN 1964
	NORMAL NO. DAYS WITH:														
	SNOWFALL >= 1.0	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

published by: NCDC Asheville, NC 3 30 year Normals (1971-2000)

Source: Reference 2.7-6.

Table 2.7-4
Local Climatological Data Summary for Lake Charles, Louisiana

NORMALS, MEANS, AND EXTREMES
LAKE CHARLES (KLCH)

LATITUDE: 30 ° 7 'N LONGITUDE: -93 ° 13'W ELEVATION (FT): GRND: 9 BARO: 17 TIME ZONE: CENTRAL (UTC -6) WBAN: 03937

	ELEMENT	POR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE °F	NORMAL DAILY MAXIMUM	30	60.6	64.5	71.3	77.4	84.1	88.9	91.0	91.3	87.7	80.5	70.6	63.3	77.6
	MEAN DAILY MAXIMUM	45	60.6	64.0	70.9	78.0	84.2	89.0	91.0	91.3	87.7	80.6	71.1	63.4	77.7
	HIGHEST DAILY MAXIMUM	42	82	83	86	95	99	99	102	107	105	94	87	82	107
	YEAR OF OCCURRENCE		2000	1972	1974	1987	2005	1990	1980	2000	2000	2006	1989	1978	AUG 2000
	MEAN OF EXTREME MAXS.	45	76.0	77.1	81.1	86.2	91.0	94.2	95.9	96.6	94.2	89.5	83.4	77.9	86.9
	NORMAL DAILY MINIMUM	30	41.2	44.3	50.8	57.2	65.7	72.1	74.3	73.6	69.1	58.6	49.7	43.3	58.3
	MEAN DAILY MINIMUM	45	42.0	44.7	51.0	58.8	66.1	71.9	74.1	73.4	69.0	58.7	50.1	43.9	58.6
	LOWEST DAILY MINIMUM	42	15	17	23	34	49	56	61	59	47	30	23	11	11
	YEAR OF OCCURRENCE		1985	1996	2002	1971	1996	1984	1967	2004	1967	1993	1976	1989	DEC 1989
	MEAN OF EXTREME MINS.	45	25.3	29.2	34.6	43.2	54.1	63.7	69.5	67.5	56.0	42.8	33.9	27.8	45.6
	NORMAL DRY BULB	30	50.9	54.4	61.0	67.3	74.9	80.5	82.6	82.4	78.4	69.5	60.1	53.3	67.9
	MEAN DRY BULB	45	51.3	54.3	61.0	68.4	75.1	80.5	82.6	82.4	78.3	69.7	60.6	53.7	68.2
	MEAN WET BULB	23	48.2	51.3	56.6	62.7	69.9	74.7	76.7	76.1	71.7	64.0	56.4	49.9	63.2
	MEAN DEW POINT	23	44.6	47.7	53.1	59.3	67.4	72.8	74.7	74.0	69.1	60.9	53.0	46.4	60.3
	NORMAL NO. DAYS WITH:														
	MAXIMUM >= 90	30	0.0	0.0	0.0	0.2	2.8	13.8	23.3	22.9	12.6	1.1	0.0	0.0	76.7
	MAXIMUM <= 32	30	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2
	MINIMUM <= 32	30	5.4	2.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.9	4.1	13.5
	MINIMUM <= 0	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H/C	NORMAL HEATING DEG. DAYS	30	434	304	163	47	1	0	0	0	1	38	191	367	1546
	NORMAL COOLING DEG. DAYS	30	9	13	49	126	312	467	544	534	399	178	54	20	2705
RH	NORMAL (PERCENT)	30	79	78	77	76	79	80	81	81	79	77	79	79	79
	HOUR 00 LST	30	86	85	87	88	91	92	92	93	91	89	88	87	89
	HOUR 06 LST	30	88	88	90	91	93	93	95	95	93	91	90	89	91
	HOUR 12 LST	30	68	64	63	60	63	64	65	63	62	57	62	66	63
	HOUR 18 LST	30	76	71	69	66	69	70	72	72	73	71	76	76	72
S	PERCENT POSSIBLE SUNSHINE	19	62	66	74	76	76	83	83	81	78	75	67	58	73
W/O	MEAN NO. DAYS WITH:														
	HEAVY FOG (VISBY <= 1/4 MI)	43	7.4	5.5	6.3	3.6	2.1	0.8	0.5	0.7	2.0	5.9	5.9	6.5	47.2
	THUNDERSTORMS	45	3.3	2.8	4.1	4.3	6.9	10.2	14.1	13.2	7.8	3.1	3.0	2.7	75.5
CLOUDNESS	MEAN:														
	SUNRISE-SUNSET (OKTAS)							4.0							
	MIDNIGHT-MIDNIGHT (OKTAS)														
	MEAN NO. DAYS WITH:														
	CLEAR	1	1.0	1.0	7.0		11.0	7.0							
	PARTLY CLOUDY			1.0	5.0		6.0	8.0							
	CLOUDY	1	1.0	1.0	3.0		1.0	3.0							
PR	MEAN STATION PRESSURE (IN)	23	30.13	30.09	30.01	29.97	29.94	29.94	29.99	29.97	29.96	30.02	30.08	30.12	30.02
	MEAN SEA-LEVEL PRES. (IN)	23	30.16	30.12	30.05	30.00	29.98	29.97	30.03	30.01	29.99	30.05	30.11	30.15	30.05
WINDS	MEAN SPEED (MPH)	23	9.0	9.4	9.2	9.0	7.9	6.9	5.8	5.5	6.8	7.5	8.3	8.7	7.8
	PREVAIL.DIR (TENS OF DEGS)	32	36	36	19	19	19	19	21	07	05	05	36	36	19
	MAXIMUM 2-MINUTE:														
	SPEED (MPH)	11	32	36	38	43	39	36	36	38	58	36	32	39	58
	DIR. (TENS OF DEGS)		33	16	33	03	33	12	33	02	04	34	31	13	04
	YEAR OF OCCURRENCE		2005	1998	1996	1997	1997	2006	1996	2000	2005	2002	2006	2006	SEP 2005
	MAXIMUM 5-SECOND														
	SPEED (MPH)	11	44	48	46	54	48	44	45	51	74	47	40	46	74
	DIR. (TENS OF DEGS)		18	20	12	02	33	13	32	03	04	35	31	12	04
	YEAR OF OCCURRENCE		1999	1997	2002	1997	1997	2006	1996	2000	2005	2002	2006	2006	SEP 2005
PRECIPITATION	NORMAL (IN)	30	5.52	3.28	3.54	3.64	6.06	6.07	5.13	4.85	5.95	3.94	4.61	4.60	57.19
	MAXIMUM MONTHLY (IN)	45	14.29	7.99	9.24	10.95	20.71	25.33	13.19	17.36	19.96	21.44	11.85	13.27	25.33
	YEAR OF OCCURRENCE		1991	2004	2001	1973	1980	1989	1979	1962	1973	2002	2000	1967	JUN 1989
	MINIMUM MONTHLY (IN)	45	0.78	0.43	0.19	0.40	0.04	0.84	0.48	0.77	0.43	T	0.11	2.02	T
	YEAR OF OCCURRENCE		1971	2001	2006	1999	1998	1969	1962	1999	1989	1963	1967	2000	OCT 1963
	MAXIMUM IN 24 HOURS (IN)	45	5.80	3.40	4.91	5.50	16.88	7.09	6.59	14.10	11.20	7.50	4.02	6.88	16.88
	YEAR OF OCCURRENCE		1991	1997	1973	1973	1980	1981	1987	1962	1979	1996	1993	1971	MAY 1980
	NORMAL NO. DAYS WITH:														
	PRECIPITATION >= 0.01	30	10.2	8.4	8.6	7.3	7.7	9.9	11.3	10.3	9.6	6.6	8.6	9.3	107.8
	PRECIPITATION >= 1.00	30	1.6	1.0	1.2	0.9	1.8	2.1	1.5	1.4	1.7	1.4	1.4	1.3	17.3
SNOWFALL	NORMAL (IN)	30	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.*	0.*	0.3
	MAXIMUM MONTHLY (IN)	34	4.0	1.6	T	T	T	0.0	T	0.0	0.0	0.0	T	0.2	4.0
	YEAR OF OCCURRENCE		1973	1988	1968	1993	1992		1994				1976	1989	JAN 1973
	MAXIMUM IN 24 HOURS (IN)	34	4.0	1.6	T	T	T	0.0	T	0.0	0.0	0.0	T	0.2	4.0
	YEAR OF OCCURRENCE'		1973	1988	1968	1993	1992		1994				1976	1989	JAN 1973
	MAXIMUM SNOW DEPTH (IN)	34	4	0	0	0	0	0	0	0	0	0	0	0	4
	YEAR OF OCCURRENCE		1973												JAN 1973
	NORMAL NO. DAYS WITH:														
	SNOWFALL >= 1.0	30	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1

published by: NCDC Asheville, NC 3 30 year Normals (1971-2000)

Source: Reference 2.7-7.

Table 2.7-5
Climatological Means and Normals for National Weather Service First-Order and Cooperative Observation Stations in the Region Surrounding the RBS

Station	Mean Annual Temperatures (ºF)			Normal Annual Precipitation	
	Daily Maximum	Daily Minimum	Daily Mean	Rainfall (in.)	Snowfall (in.)
New Roads 5ESE	77.9[a]	56.1[a]	67.0[a]	61.14[b]	0.1[a]
Baton Rouge NWS (Ryan Airport)	77.7[c]	57.1[c]	67.4[c]	63.08[c]	0.2[c]
Woodville 4ESE	77.4[a]	55.1[a]	66.3[a]	68.22[b]	0.2[a]
Grand Coteau	78.5[a]	57.0[a]	67.7[a]	63.29[b]	0.2[a]
Amite	78.2[a]	54.9[a]	66.6[a]	65.72[b]	0.3[a]
New Orleans NWS	77.7[d]	59.5[d]	68.6[d]	64.16[d]	0.0[d]
Lake Charles NWS	77.7[e]	58.6[e]	68.2[e]	57.19[e]	0.3[e]

a) Source: Reference 2.7-10.

b) Source: Reference 2.7-14.

c) Source: Reference 2.7-1.

d) Source: Reference 2.7-6.

e) Source: Reference 2.7-7.

Table 2.7-6
Climatological Extremes for National Weather Service First-Order and Cooperative Observation Stations Surrounding the RBS

Parameter	New Roads (5ESE)	Baton Rouge NWS	Woodville (4ESE)	Grand Coteau	Amite	New Orleans NWS	Lake Charles NWS
Maximum Temperature[a]	105ºF[c]	105ºF[d]	108ºF[c]	106ºF[c]	105ºF[c]	102ºF[e]	107ºF[f]
Minimum Temperature[b]	8ºF[c]	8ºF[d]	4ºF[c]	8ºF[c]	5ºF[c]	11ºF[e]	11ºF[f]
Maximum 24-hr. Rainfall (in.)	9.85[c]	12.08[d]	10.82[c]	10.52[c]	8.77[c]	12.66[e]	16.88[f]
Maximum Monthly Rainfall (in.)	21.26[c]	23.18[d]	19.38[c]	19.80[c]	20.99[c]	21.18[e]	25.33[f]
Maximum 24-hr. Snowfall (in.)	3.2[g]	3.2[d]	6.0[g]	5.5[g]	6.0[g]	2.7[e]	4.0[f]
Maximum Monthly Snowfall (in.)	3.2[g]	3.2[d]	6.0[g]	5.6[g]	6.0[g]	2.7[e]	4.0[f]

a) A high temperature of 110ºF was recorded at the old weather station in the southern Baton Rouge business district in August 1909 (Reference 2.7-9).

b) A low temperature of 2ºF was measured in February 1899 on the old Louisiana State University Campus (Reference 2.7-9).

c) Source: Reference 2.7-10.

d) Source: Reference 2.7-1.

e) Source: Reference 2.7-6.

f) Source: Reference 2.7-7.

g) Source: Reference 2.7-15.

Table 2.7-7
Monthly and Annual Dew Point Temperature (°F) Summaries for Ryan Airport in Baton Rouge, Louisiana (1961 - 1995)

	Mean Dew Point	Measured Dew Point Extremes		Mean Dew Point Diurnal Range
		Maximum	Minimum	
January	40.7	71.1	-9.0	13.8
February	42.7	72.0	-2.9	13.0
March	49.8	75.0	10.0	12.2
April	57.0	77.0	21.9	10.0
May	64.1	82.0	33.1	7.8
June	69.9	81.0	36.0	6.4
July	72.5	82.9	44.1	5.8
August	72.0	81.0	50.0	5.8
September	67.8	80.1	33.1	6.9
October	57.4	79.0	10.9	10.0
November	49.9	75.9	6.1	12.2
December	43.7	75.0	-7.1	13.5
Annual	57.3	82.9	-9.0	9.8

Source: References 2.7-11 and 2.7-12.

**Table 2.7-8
Monthly and Annual Mean Mixing Heights (Meters) at
Lake Charles, Louisiana (2002 - 2006)**

Month	Morning	Afternoon
January	353	763
February	404	832
March	364	1048
April	341	1203
May	370	1362
June	319	1430
July	347	1310
August	295	1458
September	296	1406
October	316	1038
November	301	838
December	275	745
Annual	331	1124

Source: Reference 2.7-39.

Table 2.7-9
Temperature Inversion Frequency and Persistence at the RBS (December 2004 - November 2006)

	Annual	
Duration (hr.)	**Number of Observations**	**Percent Probability (%)**
1	170	18.0
2	88	27.2
3	60	33.6
4	51	39.0
5	31	42.2
6	38	46.3
7	25	48.9
8	30	52.1
9	29	55.1
10	25	57.8
11	34	61.4
12	42	65.8
13	69	73.1
14	72	80.7
15	65	87.5
16	37	91.4
17	22	93.8
18	12	95.0
19	10	96.1
20	6	96.7
21	8	97.6
22	6	98.2
23	2	98.4
24	1	98.5
25+	14	100.0

Notes:

1. The longest inversion lasted 63 hours.
2. An inversion was present a total of 8151 hours of a possible 16,609 hours during the 2-year period.
3. Percent probability represents that, if an inversion occurs, its duration would be less than or equal to the number of hours specified.

Table 2.7-10
Monthly Temperature Inversion Frequency and Persistence at the RBS (December 2004 - November 2006)

January		
Duration (hr.)	Number of Observations	Percent Probability (%)
1	13	20.3
2	7	31.3
3	7	42.2
4	4	48.4
5	3	53.1
6	3	57.8
7	2	60.9
8	2	64.1
9	3	68.8
10	1	70.3
11	1	71.9
12	2	75.0
13	1	76.6
14	5	84.4
15	3	89.1
16	3	93.8
17	0	93.8
18	0	93.8
19	0	93.8
20	1	95.3
21	0	95.3
22	2	98.4
23	0	98.4
24	0	98.4
25+	1	100.0

Notes:

1. The longest inversion lasted 27 hours.
2. Percent probability represents that, if an inversion occurs, its duration would be less than or equal to the number of hours specified.

Table 2.7-11
Monthly Temperature Inversion Frequency and Persistence at the RBS (December 2004 - November 2006)

February		
Duration (hr.)	**Number of Observations**	**Percent Probability (%)**
1	12	20.0
2	5	28.3
3	5	36.7
4	6	46.7
5	4	53.3
6	6	63.3
7	1	65.0
8	1	66.7
9	2	70.0
10	1	71.7
11	1	73.3
12	2	76.7
13	2	80.0
14	4	86.7
15	3	91.7
16	1	93.3
17	0	96.3
18	0	93.3
19	1	95.0
20	1	96.7
21	0	96.7
22	1	98.3
23	0	98.3
24	0	98.3
25+	1	100.0

Notes:

1. The longest inversion lasted 48 hours.
2. Percent probability represents that, if an inversion occurs, its duration would be less than or equal to the number of hours specified.

Table 2.7-12
Monthly Temperature Inversion Frequency and Persistence at the RBS (December 2004 - November 2006)

March		
Duration (hr.)	**Number of Observations**	**Percent Probability (%)**
1	14	16.1
2	12	29.9
3	8	39.1
4	7	47.1
5	2	49.4
6	6	56.3
7	5	62.1
8	1	63.2
9	6	70.1
10	1	71.3
11	3	74.7
12	4	49.3
13	5	85.1
14	9	95.4
15	2	97.7
16	0	97.7
17	0	97.7
18	1	98.9
19	0	98.9
20	0	98.9
21	1	100.0
22	--	--
23	--	--
24	--	--
25+	--	--

Notes:

1. The longest inversion lasted 21 hours.
2. Percent probability represents that, if an inversion occurs, its duration would be less than or equal to the number of hours specified.

Table 2.7-13
Monthly Temperature Inversion Frequency and Persistence at the RBS (December 2004 - November 2006)

April		
Duration (hr.)	**Number of Observations**	**Percent Probability (%)**
1	12	16.7
2	4	22.2
3	6	30.6
4	3	34.7
5	1	36.1
6	0	36.1
7	5	43.1
8	4	48.6
9	1	50.0
10	5	56.9
11	2	59.7
12	5	66.7
13	6	75.0
14	7	84.7
15	1	86.1
16	1	87.5
17	0	87.5
18	2	90.3
19	1	91.7
20	0	91.7
21	2	94.4
22	1	95.8
23	0	95.8
24	0	95.8
25+	3	100.0

Notes:
1. The longest inversion lasted 37 hours.
2. Percent probability represents that, if an inversion occurs, its duration would be less than or equal to the number of hours specified.

Table 2.7-14
Monthly Temperature Inversion Frequency and Persistence at the RBS (December 2004 - November 2006)

May		
Duration (hr.)	Number of Observations	Percent Probability (%)
1	12	12.9
2	9	22.6
3	5	28.0
4	4	32.3
5	3	35.5
6	1	36.6
7	2	38.7
8	4	43.0
9	6	49.5
10	3	52.7
11	8	61.3
12	6	67.7
13	8	76.3
14	5	81.7
15	0	81.7
16	5	87.1
17	3	90.3
18	2	92.5
19	2	94.6
20	1	95.7
21	2	97.8
22	1	98.9
23	0	98.9
24	0	98.9
25+	1	100.0

Notes:

1. The longest inversion lasted 28 hours.
2. Percent probability represents that, if an inversion occurs, its duration would be less than or equal to the number of hours specified.

Table 2.7-15
Monthly Temperature Inversion Frequency and Persistence at the RBS (December 2004 - November 2006)

June		
Duration (hr.)	Number of Observations	Percent Probability (%)
1	18	19.6
2	11	31.5
3	3	34.8
4	3	38.0
5	2	40.2
6	6	46.7
7	2	48.9
8	3	52.2
9	3	55.4
10	6	62.0
11	4	66.3
12	9	76.1
13	7	83.7
14	5	89.1
15	3	92.4
16	1	93.5
17	0	93.5
18	0	93.5
19	1	94.6
20	0	94.6
21	2	96.7
22	1	97.8
23	0	97.8
24	0	97.8
25+	2	100.0

Notes:

1. The longest inversion lasted 34 hours.

2. Percent probability represents that, if an inversion occurs, its duration would be less than or equal to the number of hours specified.

Table 2.7-16
Monthly Temperature Inversion Frequency and Persistence at the RBS (December 2004 - November 2006)

July		
Duration (hr.)	**Number of Observations**	**Percent Probability (%)**
1	22	22.2
2	12	34.3
3	7	41.4
4	8	49.5
5	3	52.5
6	5	57.6
7	3	60.6
8	6	66.7
9	5	71.7
10	1	72.7
11	3	75.8
12	3	78.8
13	4	82.8
14	2	84.8
15	1	85.9
16	0	85.9
17	2	87.9
18	2	89.9
19	0	89.9
20	1	90.9
21	0	90.9
22	0	90.9
23	2	92.9
24	1	93.9
25+	6	100.0

Notes:
1. The longest inversion lasted 63 hours.
2. Percent probability represents that, if an inversion occurs, its duration would be less than or equal to the number of hours specified.

Table 2.7-17
Monthly Temperature Inversion Frequency and Persistence at the RBS (December 2004 - November 2006)

August		
Duration (hr.)	Number of Observations	Percent Probability (%)
1	26	24.8
2	12	36.2
3	3	39.0
4	7	45.7
5	3	48.6
6	2	50.5
7	0	50.5
8	3	53.3
9	1	54.3
10	3	57.1
11	5	61.9
12	4	65.7
13	17	81.9
14	9	90.5
15	2	92.4
16	0	92.4
17	4	96.2
18	2	98.1
19	1	99.0
20	0	99.0
21	1	100.0
22	--	--
23	--	--
24	--	--
25+	--	--

Notes:

1. The longest inversion lasted 21 hours.

2. Percent probability represents that, if an inversion occurs, its duration would be less than or equal to the number of hours specified.

Table 2.7-18
Monthly Temperature Inversion Frequency and Persistence at the RBS (December 2004 - November 2006)

September		
Duration (hr.)	Number of Observations	Percent Probability (%)
1	14	19.7
2	6	28.2
3	2	31.0
4	2	33.8
5	2	36.6
6	1	38.0
7	1	39.4
8	1	40.8
9	0	40.8
10	1	42.3
11	2	45.1
12	4	50.7
13	11	66.2
14	11	81.7
15	8	93.0
16	2	95.8
17	1	97.2
18	1	98.6
19	1	100.0
20	--	--
21	--	--
22	--	--
23	--	--
24	--	--
25+	--	--

Notes:

1. The longest inversion lasted 19 hours.
2. Percent probability represents that, if an inversion occurs, its duration would be less than or equal to the number of hours specified.

Table 2.7-19
Monthly Temperature Inversion Frequency and Persistence at the RBS (December 2004 - November 2006)

October		
Duration (hr.)	Number of Observations	Percent Probability (%)
1	14	17.5
2	4	22.5
3	8	32.5
4	4	37.5
5	2	40.0
6	2	42.5
7	0	42.5
8	2	45.0
9	1	46.3
10	1	47.5
11	2	50.0
12	1	51.3
13	3	55.0
14	9	66.3
15	18	88.8
16	2	91.3
17	6	98.8
18	0	98.8
19	1	100.0
20	--	--
21	--	--
22	--	--
23	--	--
24	--	--
25+	--	--

Notes:

1. The longest inversion lasted 19 hours.

2. Percent probability represents that, if an inversion occurs, its duration would be less than or equal to the number of hours specified.

Table 2.7-20
Monthly Temperature Inversion Frequency and Persistence at the RBS (December 2004 - November 2006)

November		
Duration (hr.)	Number of Observations	Percent Probability (%)
1	7	11.7
2	2	15.0
3	1	16.7
4	0	16.7
5	4	23.3
6	5	31.7
7	1	33.3
8	1	35.0
9	0	35.0
10	2	38.3
11	2	41.7
12	1	43.3
13	2	46.7
14	4	53.3
15	11	71.7
16	9	86.7
17	2	90.0
18	2	93.3
19	2	96.7
20	2	100.0
21	--	--
22	--	--
23	--	--
24	--	--
25+	--	--

Notes:
1. The longest inversion lasted 20 hours.
2. Percent probability represents that, if an inversion occurs, its duration would be less than or equal to the number of hours specified.

Table 2.7-21
Monthly Temperature Inversion Frequency and Persistence at the RBS (December 2004 - November 2006)

December		
Duration (hr.)	Number of Observations	Percent Probability (%)
1	6	9.4
2	4	15.6
3	5	23.4
4	3	28.1
5	2	31.3
6	1	32.8
7	3	37.5
8	2	40.6
9	1	42.2
10	0	42.2
11	1	43.8
12	1	45.3
13	3	50.0
14	2	53.1
15	13	73.4
16	13	93.8
17	4	100.0
18	--	--
19	--	--
20	--	--
21	--	--
22	--	--
23	--	--
24	--	--
25+	--	--

Notes:
1. The longest inversion lasted 17 hours.
2. Percent probability represents that, if an inversion occurs, its duration would be less than or equal to the number of hours specified.

Table 2.7-22 (Sheet 1 of 2)
Monthly and Annual Temperature Data (ºF) for Ryan Airport and the RBS
(December 2004 - November 2006)

Period		Upper Level - 150 ft. RBS	Lower Level - 30 ft. RBS(a)	Single Level - 30 ft. Ryan Airport[(a)]
January	Mean	56.2	56.1	56.5
	Maximum	78.0	78.3	81.0
	Minimum	26.5	26.7	27.0
February	Mean	55.0	54.9	55.7
	Maximum	79.9	80.3	82.0
	Minimum	30.7	28.0	27.0
March	Mean	61.3	61.2	61.4
	Maximum	84.8	84.6	84.0
	Minimum	37.8	35.1	34.0
April	Mean	69.4	69.1	69.4
	Maximum	91.7	91.1	91.0
	Minimum	47.7	44.2	41.0
May	Mean	74.2	73.9	74.3
	Maximum	92.6	92.7	93.0
	Minimum	49.4	49.1	48.0
June	Mean	80.6	80.3	80.7
	Maximum	96.5	95.9	99.0
	Minimum	66.9	66.4	63.0
July	Mean	81.2	81.0	81.5
	Maximum	96.1	96.5	97.0
	Minimum	70.7	70.6	70.0
August	Mean	82.1	81.8	82.1
	Maximum	98.2	98.6	98.0
	Minimum	68.2	68.1	68.0
September	Mean	79.4	79.1	78.9
	Maximum	96.3	96.6	97.0
	Minimum	56.3	55.3	55.0

Table 2.7-22 (Sheet 2 of 2)
Monthly and Annual Temperature Data (ºF) for Ryan Airport and the RBS
(December 2004 - November 2006)

Period		Upper Level - 150 ft. RBS	Lower Level - 30 ft. RBS(a)	Single Level - 30 ft. Ryan Airport[a]
October	Mean	68.7	68.3	68.6
	Maximum	94.7	95.2	95.0
	Minimum	42.5	41.0	36.0
November	Mean	60.4	59.9	59.2
	Maximum	83.5	83.7	85.0
	Minimum	31.9	31.2	30.0
December	Mean	50.8	50.4	51.1
	Maximum	78.0	78.4	79.0
	Minimum	26.3	26.1	25.0
Annual	Mean	68.2	67.9	68.4
	Maximum	98.3	98.6	99.0
	Minimum	26.3	26.1	25.0

a) Source: Reference 2.7-42.

Table 2.7-23
Hours with Precipitation and Hourly Rainfall Rate Distribution for Ryan Airport at Baton Rouge, Louisiana (2002 - 2006)

Month	Trace	0.01-0.09 in.	0.10-0.24 in.	0.25-0.49 in.	0.50-0.99 in.	≥1.00 in.	Hours with Precipitation	Number of Observations
January	161	111	44	11	1	1	329	3720
February	250	203	57	20	7	2	539	3389
March	211	87	19	14	4	2	337	3720
April	104	90	28	11	9	3	245	3600
May	116	72	29	11	8	1	237	3720
June	220	155	37	20	9	2	443	3600
July	207	111	28	7	10	2	365	3720
August	146	83	27	13	4	7	280	3720
September	141	102	34	17	12	3	309	3600
October	215	169	41	32	8	1	466	3720
November	142	125	32	22	8	0	329	3600
December	140	109	44	18	7	2	320	3720
Annual	2053	1417	420	196	87	26	4199	43,829
Percent of Total Hours	4.68%	3.23%	0.96%	0.45%	0.20%	0.06%	9.58%	

Source: Reference 2.7-41.

Table 2.7-24
Monthly and Annual Mean Wind Speeds (mph) for
Ryan Airport and RBS (December 2004 - November 2006)

Period	Upper Level - 150 ft. RBS	Lower Level - 30 ft. RBS	Single Level - 30 ft. Ryan Airport[(a)]
January	8.43	4.76	7.24
February	8.34	4.71	7.38
March	8.54	4.86	7.27
April	7.90	4.43	7.18
May	6.59	3.41	5.34
June	5.99	3.19	3.99
July	5.54	2.97	4.77
August	5.49	2.98	4.29
September	7.31	3.62	5.23
October	7.47	3.67	4.79
November	7.66	3.67	5.41
December	7.87	3.98	6.13
Annual	7.26	3.85	5.73

a) Source: Reference 2.7-42.

Table 2.7-25
Wind Direction Persistence Summaries - RBS 30-Ft. Level

December 2004 through November 2006 Lower Tower Number of Occurrences where Winds Blew from the Same 22.5° Direction, All Winds

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	141	144	124	112	76	83	133	108	120	117	67	72	110	105	121	129	55.22
3	72	62	49	32	18	27	61	46	59	39	17	25	22	27	33	60	20.34
4	35	38	22	11	5	9	36	18	27	14	6	15	10	13	23	31	9.81
5	20	19	13	2	0	7	18	12	21	11	1	2	3	4	10	16	4.98
6	12	13	7	4	0	6	10	9	10	6	1	0	1	2	4	14	3.10
7	10	6	3	3	0	2	5	8	7	6	2	0	0	1	2	3	1.82
8	8	2	2	3	1	0	12	6	8	5	0	0	0	1	1	9	1.82
9	6	3	3	1	0	2	1	2	3	2	0	0	0	3	2	2	0.94
10	2	0	1	0	0	0	1	1	3	1	0	0	0	1	0	3	0.41
11	4	1	0	1	0	1	1	1	1	0	0	0	0	0	0	2	0.38
12	4	2	0	0	0	1	2	0	0	0	0	0	0	0	1	1	0.34
13	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0.09
14	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0.09
15	3	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0.19
16	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0.03
17	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0.13
18	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.06
19	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0.03
20	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0.03
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
24	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0.03
25	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0.06
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
42	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0.03
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
48+	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.06
% of Persistent Direction	10.15	9.12	7.05	5.30	3.13	4.32	9.15	6.68	8.12	6.30	2.95	3.57	4.58	4.92	6.17	8.49	
Average Persistent Hours	3.82	3.21	3.04	2.74	2.34	2.96	3.96	3.34	3.36	3.02	2.49	2.54	2.38	2.72	2.84	3.42	

* The longest persistent wind was from the north and lasted 70 hours.

Table 2.7-26
Wind Direction Persistence Summaries - RBS 30-Ft. Level

December 2004 through November 2006 Lower Tower Number of Occurrences where Winds Blew from the Same 22.5º Direction, Winds 3 mph or Greater

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	83	91	47	27	22	32	81	91	106	88	40	47	67	55	50	81	51.48
3	44	43	26	14	2	13	41	31	51	34	10	16	14	9	19	39	20.74
4	29	23	13	6	2	3	24	12	23	10	5	9	7	7	10	18	10.27
5	16	10	10	2	0	2	10	10	20	10	1	0	2	3	7	12	5.87
6	7	5	4	2	0	2	5	10	7	5	1	0	0	3	4	11	3.37
7	10	3	5	1	0	1	5	5	8	6	2	0	0	0	1	2	2.50
8	6	2	2	2	0	0	7	6	6	5	0	0	0	1	1	8	2.35
9	7	1	1	0	0	0	0	2	2	1	0	0	0	1	1	2	0.92
10	2	0	0	0	0	0	3	1	3	1	0	0	0	0	0	3	0.66
11	2	0	0	1	0	0	1	1	1	0	0	0	0	0	0	2	0.41
12	5	1	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0.46
13	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0.10
14	0	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0.20
15	3	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.26
16	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0.05
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0.05
20	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
25	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0.10
26	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05
27	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0.05
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
35	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
% of Persistent Direction	11.0	9.2	5.6	2.8	1.3	2.7	9.6	8.7	11.6	8.2	3.0	3.7	4.6	4.0	4.8	9.1	

Table 2.7-27
Wind Direction Persistence Summaries - RBS 30-Ft. Level

December 2004 through November 2006 Lower Tower Number of Occurrences where Winds Blew from the Same 22.5° Direction, Winds 6 mph or Greater

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	40	8	5	2	1	2	6	27	50	29	4	8	8	15	25	43	**48.15**
3	16	3	4	0	0	0	8	9	23	10	4	3	2	3	7	18	**19.40**
4	14	5	1	1	0	0	4	7	6	7	1	0	0	5	6	12	**12.17**
5	5	2	1	2	0	0	0	5	9	5	1	0	0	3	2	10	**7.94**
6	6	1	0	0	0	0	1	4	2	1	2	0	0	1	1	4	**4.06**
7	2	0	0	1	0	0	0	4	0	5	1	0	0	0	1	1	**2.65**
8	3	0	0	0	0	0	1	4	2	1	0	0	0	0	1	2	**2.47**
9	2	0	0	0	0	0	1	0	1	1	0	0	0	0	1	3	**1.59**
10	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	**0.35**
11	1	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	**0.71**
12	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.18**
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
14	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	**0.18**
15	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	**0.18**
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
% of Persistent Direction	**15.9**	**3.4**	**2.1**	**1.1**	**0.2**	**0.4**	**3.7**	**11.1**	**16.6**	**10.4**	**2.3**	**1.9**	**1.8**	**4.8**	**7.9**	**16.6**	

Table 2.7-28
Wind Direction Persistence Summaries - RBS 30-Ft. Level

December 2004 through November 2006 Lower Tower Number of Occurrences where Winds Blew from the Same 22.5° Direction, Winds 9 mph or Greater

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	3	1	1	1	0	0	2	9	10	5	1	0	1	2	6	7	48.04
3	0	0	0	0	0	0	2	1	6	2	0	0	0	1	1	3	15.69
4	1	0	0	0	0	0	0	2	3	0	1	0	0	0	2	4	12.75
5	1	0	0	0	0	0	0	2	1	3	1	0	0	1	0	1	9.80
6	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	2	4.90
7	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0	0	3.92
8	0	0	0	0	0	0	0	1	2	1	0	0	0	0	0	0	3.92
9	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.98
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
% of Persistent Direction	4.90	0.98	0.98	0.98	0.00	0.00	3.92	18.63	22.55	11.76	2.94	0.00	0.98	3.92	10.78	16.67	

Table 2.7-29
Wind Direction Persistence Summaries - RBS 30-Ft. Level

December 2004 through November 2006 Lower Tower Number of Occurrences where Winds Blew from the Same 22.5° Direction, Winds 12 mph or Greater

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	1	0	0	0	0	0	0	4	4	1	0	0	1	1	0	0	60.00
3	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	15.00
4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	15.00
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
6	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	5.00
7	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	5.00
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
% of Persistent Direction	5.00	0.00	0.00	0.00	0.00	0.00	0.00	35.00	25.00	15.00	0.00	0.00	5.00	5.00	5.00	5.00	

Table 2.7-30
Wind Direction Persistence Summaries - RBS 30-Ft. Level

December 2004 through November 2006 Lower Tower Number of Occurrences where Winds Blew from the Same 22.5° Direction, Winds 15 mph or Greater

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	33.33
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	33.33
5	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	33.33
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
% of Persistent Direction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33.33	33.33	0.00	0.00	0.00	0.00	0.00	0.00	33.33	

Table 2.7-31
Wind Direction Persistence Summaries - RBS 30-Ft. Level

December 2004 through November 2006 Lower Tower Number of Occurrences where Winds Blew from the Same 67.5º Direction, All Winds

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	104	88	102	101	96	77	80	78	84	69	76	72	60	88	104	98	**30.39**
3	55	60	61	59	58	40	53	49	49	45	48	41	50	51	55	58	**18.36**
4	33	36	43	29	35	35	42	35	36	32	21	37	28	36	40	35	**12.20**
5	30	27	37	29	11	26	23	34	30	12	15	23	24	29	22	26	**8.78**
6	18	20	26	13	15	14	24	20	17	16	10	10	12	15	17	18	**5.85**
7	11	25	15	11	2	13	17	18	10	9	4	8	11	6	11	18	**4.17**
8	14	15	9	12	2	8	8	12	12	7	2	7	10	6	11	8	**3.16**
9	12	10	11	4	4	10	6	9	9	11	4	6	10	4	9	9	**2.82**
10	4	6	6	4	5	6	11	4	9	7	4	1	5	7	10	9	**2.16**
11	8	4	4	3	2	1	4	5	6	7	0	0	6	3	4	10	**1.48**
12	10	7	3	2	2	3	3	4	7	4	1	0	4	4	4	7	**1.43**
13	9	7	3	0	0	3	6	7	6	7	1	0	0	3	3	3	**1.28**
14	4	1	7	3	0	2	6	6	6	3	1	0	3	1	6	4	**1.17**
15	2	4	1	1	0	1	5	5	6	3	3	0	1	0	2	5	**0.86**
16	3	3	4	0	0	1	6	7	4	2	0	1	0	3	1	4	**0.86**
17	8	0	0	0	0	0	5	3	3	2	0	0	0	0	3	3	**0.60**
18	4	3	1	0	0	1	3	1	3	0	0	0	1	1	2	3	**0.51**
19	1	4	1	0	0	0	2	2	1	2	1	0	0	2	1	3	**0.44**
20	5	2	0	0	0	0	1	2	1	2	1	0	0	1	1	1	**0.38**
21	2	1	2	0	0	2	0	1	0	0	0	0	0	0	1	0	**0.20**
22	5	2	1	0	0	0	0	0	0	1	0	0	0	1	1	1	**0.26**
23	2	3	0	1	0	0	0	0	1	1	0	0	0	0	0	3	**0.24**
24	0	0	0	0	1	1	2	0	0	0	0	0	0	0	0	0	**0.09**
25	3	4	1	0	0	1	0	0	0	0	0	0	0	0	1	1	**0.24**
26	1	1	1	0	0	0	2	1	1	0	0	0	0	0	1	0	**0.18**
27	3	0	0	0	0	0	2	1	0	0	0	0	0	1	0	0	**0.15**
28	1	2	0	0	0	1	0	0	0	0	0	0	0	0	1	1	**0.13**
29	0	2	0	0	0	0	0	2	1	0	0	0	0	0	0	0	**0.11**
30	1	0	0	0	0	1	2	0	0	0	0	0	0	0	0	1	**0.11**
31	5	2	0	0	0	0	1	0	2	0	0	0	0	2	0	0	**0.26**
32	2	0	0	0	0	0	2	1	0	0	0	0	0	0	0	3	**0.18**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**0.02**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
35	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	**0.07**
36	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.02**
37	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	**0.02**
38	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	**0.07**
39	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	**0.07**
40	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	**0.04**
41	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	**0.02**
42	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	**0.09**
43	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	**0.04**
44	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**0.07**
45	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	**0.02**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
48+	6	2	0	0	0	1	2	2	0	0	0	0	0	0	0	4	**0.38**
% of Persistent Direction	**8.14**	**7.61**	**7.48**	**6.00**	**5.14**	**5.50**	**7.06**	**6.86**	**6.84**	**5.41**	**4.24**	**4.55**	**4.97**	**5.83**	**6.86**	**7.50**	
Average Persistent hours	**7.23**	**6.67**	**4.97**	**4.06**	**3.59**	**5.18**	**6.55**	**6.19**	**6.61**	**5.93**	**3.95**	**3.8**	**4.71**	**4.82**	**5.14**	**6.29**	

*** The longest persistent wind was from the north-northwest and lasted 139 hours.**

Table 2.7-32
Wind Direction Persistence Summaries - RBS 30-Ft. Level

December 2004 through November 2006 Lower Tower Number of Occurrences where Winds Blew from the Same 67.5º Direction, Winds 3 mph or Greater

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	46	49	39	30	16	32	69	55	62	49	50	43	36	49	41	42	**27.57**
3	30	18	25	21	18	16	37	34	55	37	26	25	29	20	32	30	**17.64**
4	21	12	21	6	13	13	28	22	28	22	11	27	21	21	21	20	**11.95**
5	19	9	13	9	3	12	28	30	23	8	9	19	10	11	12	22	**9.23**
6	16	19	12	7	1	5	19	19	12	15	4	8	10	12	4	5	**6.54**
7	9	14	5	3	1	5	10	14	6	9	2	5	14	3	10	8	**4.60**
8	8	6	5	3	1	3	3	13	10	5	2	8	8	4	7	8	**3.66**
9	8	9	6	3	0	3	1	7	11	8	3	0	3	2	3	8	**2.92**
10	10	8	3	2	1	3	6	5	11	9	3	0	3	0	9	10	**3.23**
11	3	6	5	1	1	1	4	3	6	2	0	0	2	0	5	10	**1.91**
12	8	6	1	0	0	1	1	2	4	4	1	0	0	3	3	2	**1.40**
13	10	5	3	1	0	1	3	2	6	5	1	0	0	1	0	4	**1.64**
14	0	4	3	1	0	1	4	3	1	2	0	0	0	0	2	3	**0.93**
15	6	2	0	0	0	0	2	5	3	2	1	0	0	0	1	0	**0.86**
16	2	2	2	0	0	0	2	4	2	0	0	0	0	0	2	2	**0.70**
17	3	0	0	0	0	0	3	3	3	1	0	0	0	1	1	2	**0.66**
18	2	3	1	0	0	0	1	0	2	1	1	0	0	0	0	3	**0.55**
19	1	3	1	0	0	1	1	2	0	1	0	0	0	0	1	1	**0.47**
20	3	0	0	0	0	0	0	2	1	2	0	0	0	0	0	2	**0.39**
21	0	2	2	0	0	0	0	3	0	0	0	0	0	0	0	1	**0.31**
22	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	**0.12**
23	1	4	0	0	0	0	2	0	1	1	0	0	0	0	1	1	**0.43**
24	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**0.04**
25	3	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	**0.23**
26	2	0	1	0	0	0	1	0	1	0	0	0	0	0	0	1	**0.23**
27	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	**0.12**
28	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	**0.08**
29	0	0	0	0	0	1	1	1	1	0	0	0	0	1	0	0	**0.19**
30	1	0	0	0	0	1	2	0	0	0	0	0	0	0	0	1	**0.19**
31	3	0	0	0	0	0	2	0	2	0	0	0	0	0	0	1	**0.31**
32	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	**0.12**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
35	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**0.12**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
37	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	**0.04**
38	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	**0.04**
39	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	**0.12**
40	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	**0.04**
41	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	**0.04**
42	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	**0.12**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
46	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.04**
47	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.04**
48+	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	**0.19**
% of Persistent Direction	**8.61**	**7.20**	**5.80**	**3.39**	**2.18**	**3.97**	**9.03**	**9.03**	**10.01**	**7.20**	**4.44**	**5.26**	**5.30**	**5.02**	**6.07**	**7.48**	

Table 2.7-33
Wind Direction Persistence Summaries - RBS 30-Ft. Level

December 2004 through November 2006 Lower Tower Number of Occurrences where Winds Blew from the Same 67.5° Direction, Winds 6 mph or Greater

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	31	4	8	1	0	3	7	22	27	21	4	4	5	9	13	24	**25.81**
3	19	1	6	1	1	1	10	9	30	11	5	1	7	6	8	10	**17.77**
4	10	3	1	1	0	0	2	15	10	10	1	4	0	9	9	10	**11.99**
5	7	4	1	1	0	0	3	7	11	4	2	1	4	4	5	15	**9.73**
6	11	4	1	1	0	0	2	3	10	2	4	2	1	2	3	6	**7.33**
7	3	8	0	2	0	1	0	8	4	5	1	1	0	1	4	11	**6.91**
8	8	1	1	0	0	0	3	2	7	4	0	0	0	0	6	4	**5.08**
9	5	2	0	0	0	0	1	0	4	2	0	0	0	0	2	4	**2.82**
10	4	0	0	0	0	1	1	3	3	2	1	0	0	0	4	6	**3.53**
11	2	1	0	0	0	0	2	2	1	3	0	0	0	0	1	2	**1.97**
12	1	0	0	0	0	0	0	2	1	3	2	0	0	1	0	2	**1.69**
13	2	0	0	0	0	0	0	1	4	0	0	0	0	1	1	3	**1.69**
14	0	0	0	0	0	0	0	2	2	0	0	0	0	1	2	0	**0.99**
15	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	**0.56**
16	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	**0.56**
17	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	**0.42**
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
19	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	**0.14**
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	**0.14**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**0.14**
24	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	**0.14**
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
27	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	**0.14**
28	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	**0.14**
29	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	**0.28**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
% of Persistent Direction	**14.81**	**3.95**	**2.68**	**0.99**	**0.14**	**0.85**	**4.51**	**11.42**	**16.64**	**9.45**	**2.82**	**1.83**	**2.40**	**4.94**	**8.60**	**13.96**	

Table 2.7-34
Wind Direction Persistence Summaries - RBS 30-Ft. Level

December 2004 through November 2006 Lower Tower Number of Occurrences where Winds Blew from the Same 67.5° Direction, Winds 9 mph or Greater

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	2	1	1	0	0	0	0	3	3	6	2	0	0	6	4	3	25.41
3	1	0	0	1	0	0	1	1	3	1	0	0	1	2	4	4	15.57
4	0	0	0	0	0	0	0	5	3	0	0	0	0	0	4	3	12.30
5	2	0	0	0	0	0	0	1	2	3	1	0	0	1	1	4	12.30
6	0	0	0	0	0	0	1	0	3	1	1	0	0	0	3	4	10.66
7	0	0	0	0	0	1	0	2	2	2	0	0	0	1	1	0	7.38
8	1	0	0	0	0	0	0	3	3	1	0	0	0	0	0	0	6.56
9	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1.64
10	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	2.46
11	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0.82
12	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1.64
13	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1.64
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
15	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0.82
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
22	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.82
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
% of Persistent Direction	4.92	0.82	0.82	0.82	0.00	0.82	3.28	16.39	18.85	11.48	3.28	0.00	0.82	8.20	14.75	14.75	

Table 2.7-35
Wind Direction Persistence Summaries - RBS 30-Ft. Level

December 2004 through November 2006 Lower Tower Number of Occurrences where Winds Blew from the Same 67.5º Direction, Winds 12 mph or Greater

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	0	0	0	0	0	0	0	4	1	1	0	0	1	1	1	0	36.00
3	0	0	0	0	0	0	0	2	1	1	0	0	0	0	1	0	20.00
4	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	12.00
5	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	1	16.00
6	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	8.00
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
10	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	8.00
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
% of Persistent Direction	4.00	0.00	0.00	0.00	0.00	0.00	4.00	40.00	16.00	12.00	0.00	0.00	4.00	4.00	12.00	4.00	

Table 2.7-36
Wind Direction Persistence Summaries - RBS 30-Ft. Level

December 2004 through November 2006 Lower Tower Number of Occurrences where Winds Blew from the Same 67.5° Direction, Winds 15 mph or Greater

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
4	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	40.00
5	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	40.00
6	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	20.00
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
% of Persistent Direction	20.00	0.00	0.00	0.00	0.00	0.00	20.00	20.00	20.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00	

Table 2.7-37
Wind Direction Persistence Summaries - RBS 150-Ft. Level

December 2004 through November 2006 Upper Tower Number of Occurrences where Winds Blew from the Same 22.5º Direction, All Winds

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	109	133	124	108	80	118	132	96	148	118	82	95	93	89	87	94	**49.02**
3	48	59	54	52	24	68	61	52	62	48	28	39	51	29	36	44	**21.70**
4	33	33	51	31	11	43	26	19	22	29	15	20	15	12	14	30	**11.61**
5	16	23	28	12	4	22	21	11	15	15	7	5	10	7	6	10	**6.09**
6	8	13	17	9	4	19	7	11	7	8	0	2	5	6	5	6	**3.65**
7	5	7	15	7	1	9	4	5	8	6	2	2	2	2	2	4	**2.33**
8	10	5	5	4	1	9	3	8	5	3	1	0	2	0	2	7	**1.87**
9	3	3	3	3	0	7	2	1	5	5	0	0	0	1	1	2	**1.03**
10	2	3	7	3	0	4	2	1	4	4	0	0	0	0	2	2	**0.98**
11	3	1	1	2	0	6	2	1	1	1	0	0	0	0	0	0	**0.52**
12	4	2	1	1	0	1	0	0	1	1	0	0	1	1	0	1	**0.40**
13	2	0	2	0	0	1	0	0	0	0	0	0	0	0	0	1	**0.17**
14	0	0	0	0	0	1	0	1	2	1	1	0	0	0	0	1	**0.20**
15	1	1	0	0	0	3	0	1	1	0	0	0	0	0	0	0	**0.20**
16	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	**0.06**
17	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**0.06**
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
19	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	**0.03**
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
21	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**0.03**
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
24	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**0.03**
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**0.03**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
% of Persistent Direction	**7.04**	**8.13**	**8.85**	**6.70**	**3.59**	**9.02**	**7.47**	**5.95**	**8.10**	**6.87**	**3.91**	**4.68**	**5.14**	**4.25**	**4.45**	**5.83**	
Average Persistent hours	**3.77**	**3.41**	**3.72**	**3.45**	**2.68**	**4.08**	**3.12**	**3.4**	**3.37**	**3.38**	**2.79**	**2.69**	**2.91**	**2.96**	**2.95**	**3.51**	

*** The longest persistent wind was from the north-northwest and lasted 26 hours.**

Table 2.7-38
Wind Direction Persistence Summaries - RBS 150-Ft. Level

December 2004 through November 2006 Upper Tower Number of Occurrences where Winds Blew from the Same 22.5º Direction, Winds 3 mph or Greater

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	104	130	118	98	69	113	129	90	141	116	76	92	90	86	84	93	**48.57**
3	47	54	50	50	19	62	58	50	59	49	26	38	49	28	34	43	**21.35**
4	33	34	50	29	11	43	26	19	23	28	15	19	13	12	14	30	**11.90**
5	16	22	28	12	4	22	20	11	13	14	7	5	10	7	6	10	**6.17**
6	8	13	17	9	4	19	7	11	7	8	0	2	5	6	5	6	**3.79**
7	5	7	15	7	1	9	4	5	8	6	2	2	2	2	2	4	**2.42**
8	10	5	6	4	1	9	3	8	5	3	1	0	2	0	2	7	**1.97**
9	4	3	2	3	0	7	2	1	5	5	0	0	0	1	1	2	**1.07**
10	1	3	7	3	0	4	2	1	4	4	0	0	0	0	2	2	**0.98**
11	3	1	1	2	0	6	2	1	1	1	0	0	0	0	0	0	**0.54**
12	4	2	1	1	0	1	0	0	2	1	0	0	1	1	0	1	**0.45**
13	2	0	2	0	0	1	0	0	0	0	0	0	0	0	0	1	**0.18**
14	0	0	0	0	0	1	0	1	2	1	1	0	0	0	0	1	**0.21**
15	1	1	0	0	0	3	0	1	0	0	0	0	0	0	0	0	**0.18**
16	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	**0.06**
17	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**0.06**
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
19	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	**0.03**
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
21	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**0.03**
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
24	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**0.03**
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**0.03**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
% of Persistent Direction	**7.1**	**8.2**	**8.9**	**6.5**	**3.2**	**9.0**	**7.5**	**5.9**	**8.1**	**7.0**	**3.8**	**4.7**	**5.1**	**4.3**	**4.5**	**6.0**	

Table 2.7-39
Wind Direction Persistence Summaries - RBS 150-Ft. Level

December 2004 through November 2006 Upper Tower Number of Occurrences where Winds Blew from the Same 22.5° Direction, Winds 6 mph or Greater

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	84	87	70	57	31	76	85	65	99	63	20	36	43	47	52	70	44.09
3	38	42	45	29	11	44	51	23	45	33	13	16	18	16	22	36	21.58
4	30	26	41	20	4	28	23	16	19	18	8	9	4	6	7	25	12.71
5	13	14	22	10	3	16	12	11	9	10	6	2	7	5	6	13	7.12
6	5	10	13	5	1	20	8	11	6	4	0	0	1	3	4	6	4.34
7	6	7	14	5	0	9	2	3	6	6	1	0	3	2	2	3	3.09
8	9	3	6	4	1	6	2	6	4	5	0	0	0	1	2	6	2.46
9	2	3	2	1	0	8	1	1	4	4	0	0	0	0	2	1	1.30
10	1	2	6	3	0	4	2	1	4	2	0	0	0	0	1	2	1.25
11	4	0	0	2	0	5	2	1	0	0	0	0	0	0	0	0	0.63
12	2	2	1	1	0	1	0	0	1	1	0	0	0	1	0	1	0.49
13	2	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0.22
14	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	1	0.22
15	1	1	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0.22
16	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.04
17	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.04
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0.04
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
21	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.04
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
24	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.04
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.04
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
% of Persistent Direction	8.8	8.8	9.8	6.2	2.3	10.0	8.4	6.3	8.9	6.6	2.2	2.8	3.4	3.7	4.4	7.4	

Table 2.7-40
Wind Direction Persistence Summaries - RBS 150-Ft. Level

December 2004 through November 2006 Upper Tower Number of Occurrences where Winds Blew from the Same 22.5° Direction, Winds 9 mph or Greater

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	35	19	49	29	9	50	31	23	34	21	8	8	6	13	20	34	46.70
3	8	9	25	16	3	22	20	12	17	11	5	0	0	6	11	19	22.09
4	5	1	15	8	1	8	8	5	4	7	2	2	0	2	3	8	9.48
5	2	3	12	2	0	9	6	9	3	3	2	0	1	4	3	5	7.68
6	3	4	7	5	0	5	0	6	2	2	0	0	0	1	3	2	4.80
7	2	0	4	4	0	1	1	2	3	4	1	0	0	3	0	2	3.24
8	3	0	0	1	1	5	0	1	0	2	0	0	0	1	1	0	1.80
9	0	0	0	1	0	2	0	1	2	2	0	0	0	0	1	2	1.32
10	0	0	1	2	0	2	0	0	1	1	0	0	0	0	1	1	1.08
11	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0.36
12	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.24
13	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0.24
14	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0.24
15	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0.36
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
17	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.12
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
20	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.12
21	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.12
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
% of Persistent Direction	7.08	4.32	13.57	8.40	1.68	13.21	8.04	7.44	7.92	6.48	2.16	1.20	0.84	3.72	5.16	8.76	

Table 2.7-41
Wind Direction Persistence Summaries - RBS 150-Ft. Level

December 2004 through November 2006 Upper Tower Number of Occurrences where Winds Blew from the Same 22.5° Direction, Winds 12 mph or Greater

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	5	1	7	14	4	5	2	11	6	8	3	0	0	6	12	10	44.98
3	2	1	2	2	0	5	5	4	4	4	1	0	0	6	4	2	20.10
4	0	0	0	3	0	5	0	5	4	1	1	0	0	1	2	2	11.48
5	0	0	0	4	0	2	0	3	0	0	0	0	0	1	3	3	7.66
6	1	0	0	3	0	4	0	2	0	2	0	0	0	3	0	3	8.61
7	0	0	0	1	0	1	0	1	2	0	0	0	0	0	0	0	2.39
8	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	1.44
9	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1.44
10	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	1.44
11	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0.48
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
% of Persistent Direction	3.83	0.96	4.31	13.40	1.91	11.48	3.83	12.92	8.61	8.61	2.39	0.00	0.00	8.13	10.05	9.57	

Table 2.7-42
Wind Direction Persistence Summaries - RBS 150-Ft. Level

December 2004 through November 2006 Upper Tower Number of Occurrences where Winds Blew from the Same 22.5º Direction, Winds 15 mph or Greater

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	1	0	1	1	1	1	2	1	2	1	1	0	0	1	7	3	40.35
3	1	0	0	1	0	0	2	1	4	1	0	0	0	1	2	1	24.56
4	0	0	0	1	0	1	0	1	2	0	0	0	0	2	0	0	12.28
5	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	5.26
6	0	0	0	0	0	2	0	2	0	1	0	0	0	0	0	0	8.77
7	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	3.51
8	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	3.51
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
10	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1.75
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
% of Persistent Direction	3.51	0.00	1.75	8.77	1.75	8.77	8.77	14.04	14.04	7.02	1.75	0.00	0.00	7.02	15.79	7.02	

Table 2.7-43
Wind Direction Persistence Summaries - RBS 150-Ft. Level

December 2004 through November 2006 Upper Tower Number of Occurrences where Winds Blew from the Same 67.5° Direction, All Winds

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	59	52	65	75	75	73	83	76	80	73	69	78	60	58	64	63	**25.60**
3	30	33	38	44	41	47	41	51	54	49	47	35	46	41	40	39	**15.69**
4	32	21	35	36	32	47	30	33	38	31	26	33	27	32	27	28	**11.79**
5	14	25	19	29	15	40	25	32	31	24	15	28	26	21	17	13	**8.68**
6	18	21	19	21	19	29	17	30	25	19	17	16	19	16	12	15	**7.26**
7	7	9	12	10	12	14	25	14	8	11	9	11	11	12	17	9	**4.43**
8	7	16	6	11	11	14	9	16	14	7	4	10	8	5	5	10	**3.55**
9	8	11	14	12	5	14	9	5	12	6	7	5	6	7	5	7	**3.09**
10	10	9	10	7	7	6	13	6	9	7	5	6	10	6	8	7	**2.92**
11	14	4	18	4	7	7	3	6	4	12	4	4	8	5	6	8	**2.65**
12	7	4	11	3	6	9	5	8	6	5	3	2	4	2	2	2	**1.83**
13	4	8	4	7	2	6	3	4	5	3	1	3	2	1	5	4	**1.44**
14	7	7	8	2	3	3	10	4	1	6	0	1	6	2	2	4	**1.53**
15	5	5	7	2	2	2	2	6	4	3	1	2	2	1	0	4	**1.11**
16	2	2	3	2	0	2	3	4	6	3	0	1	2	0	1	2	**0.77**
17	4	4	4	2	1	4	5	3	5	6	0	0	2	1	4	2	**1.09**
18	3	4	5	3	1	4	3	3	5	1	0	1	0	1	1	3	**0.88**
19	2	5	2	3	1	3	2	1	2	2	1	0	0	3	2	3	**0.74**
20	2	0	3	0	0	1	3	0	3	0	3	1	0	1	2	1	**0.46**
21	2	2	2	0	0	0	1	0	1	0	1	0	1	0	0	2	**0.28**
22	1	4	1	1	1	1	2	1	0	1	0	0	1	0	1	0	**0.35**
23	0	3	1	0	0	2	4	1	3	2	0	0	1	0	0	0	**0.39**
24	1	3	2	0	0	1	1	2	1	0	0	0	0	1	1	1	**0.32**
25	1	2	0	0	0	1	2	1	0	0	1	0	0	0	0	1	**0.21**
26	1	2	2	0	1	3	0	1	2	1	0	1	0	0	1	0	**0.35**
27	0	1	2	0	0	0	2	0	0	0	1	0	0	0	1	0	**0.16**
28	2	1	2	0	0	0	3	1	0	0	0	0	0	0	0	2	**0.26**
29	3	1	0	0	1	0	1	1	1	1	0	0	0	1	0	1	**0.26**
30	0	0	0	2	1	0	1	0	0	1	0	0	0	2	1	1	**0.21**
31	0	2	0	0	0	1	1	0	2	0	0	0	0	0	0	1	**0.16**
32	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	2	**0.09**
33	1	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0	**0.12**
34	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.05**
35	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**0.09**
36	2	0	0	0	0	0	1	1	1	0	0	0	0	1	0	1	**0.16**
37	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	1	**0.09**
38	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	**0.07**
39	1	0	0	0	0	2	1	0	0	1	0	0	0	0	0	0	**0.12**
40	1	0	0	0	1	0	0	0	2	1	0	0	0	0	0	0	**0.12**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**0.02**
42	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	**0.02**
43	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	**0.05**
44	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**0.07**
45	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	**0.07**
46	1	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**0.09**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
48+	1	4	2	0	0	1	2	1	1	1	0	0	0	0	0	0	**0.30**
% of Persistent Direction	**5.96**	**6.29**	**6.94**	**6.45**	**5.69**	**7.89**	**7.29**	**7.24**	**7.68**	**6.45**	**4.99**	**5.55**	**5.64**	**5.13**	**5.24**	**5.57**	
Average Persistent Hours	**8.42**	**8.50**	**7.45**	**5.77**	**5.41**	**6.60**	**7.18**	**6.07**	**7.04**	**6.30**	**4.78**	**4.87**	**5.53**	**5.63**	**5.87**	**7.31**	

*** The longest persistent wind was from the east-southeast and lasted 91 hours.**

Table 2.7-44
Wind Direction Persistence Summaries - RBS 150-Ft. Level

December 2004 through November 2006 Upper Tower Number of Occurrences where Winds Blew from the Same 67.5° Direction, Winds 3 mph or Greater

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	58	50	61	69	62	68	83	73	71	71	62	72	53	49	49	58	**24.80**
3	27	26	35	45	38	54	37	52	47	47	45	34	45	39	42	36	**15.95**
4	31	21	34	28	28	49	27	31	37	34	26	34	26	29	25	25	**11.92**
5	13	22	18	31	16	32	25	30	32	21	14	23	23	17	16	13	**8.50**
6	17	19	20	22	15	26	18	28	21	16	15	16	15	16	12	15	**7.15**
7	6	9	13	7	10	13	23	16	10	12	8	9	11	12	15	9	**4.50**
8	6	15	8	11	11	14	9	12	13	4	4	11	8	4	5	10	**3.56**
9	9	12	14	10	3	11	8	5	10	7	7	5	8	7	5	6	**3.12**
10	10	7	8	8	8	5	14	5	8	7	5	7	10	6	8	8	**3.05**
11	14	4	16	5	5	7	3	5	4	10	4	5	8	5	7	8	**2.70**
12	6	5	13	3	4	10	4	8	7	5	3	1	3	2	2	2	**1.92**
13	4	7	4	6	2	5	4	4	5	4	1	2	2	1	5	3	**1.45**
14	7	7	7	2	3	3	7	5	1	6	0	0	6	2	2	4	**1.52**
15	5	5	7	1	2	2	2	5	4	3	1	2	2	1	0	4	**1.13**
16	2	2	3	2	1	3	3	4	6	2	0	1	2	0	1	2	**0.84**
17	4	4	4	2	0	4	5	3	5	5	0	0	2	1	3	2	**1.08**
18	3	4	5	3	1	4	3	3	6	1	0	1	0	1	1	4	**0.98**
19	2	5	2	2	1	3	2	1	1	2	1	0	0	3	2	2	**0.71**
20	2	0	2	0	0	1	3	0	4	0	3	1	0	1	2	1	**0.49**
21	2	2	2	0	0	0	1	0	0	0	1	1	0	0	0	2	**0.27**
22	1	4	1	1	1	0	2	1	0	1	0	0	1	0	1	0	**0.34**
23	0	3	1	0	0	2	5	1	2	2	0	0	1	0	0	0	**0.42**
24	1	3	1	0	0	1	0	2	1	0	0	0	0	1	1	1	**0.29**
25	1	2	0	0	0	0	1	2	1	0	0	1	0	0	0	0	1	**0.22**
26	1	2	2	0	1	3	0	1	2	1	0	0	0	0	1	0	**0.34**
27	0	1	2	0	0	0	2	0	0	0	1	0	0	0	1	0	**0.17**
28	2	1	2	0	0	0	3	1	0	0	0	0	0	0	0	2	**0.27**
29	3	1	0	0	1	0	1	1	1	1	0	0	0	1	0	1	**0.27**
30	0	0	0	2	1	0	2	0	0	1	0	0	0	2	1	1	**0.25**
31	0	2	0	0	0	1	0	0	2	0	0	0	0	0	0	1	**0.15**
32	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	2	**0.10**
33	1	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0	**0.12**
34	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.05**
35	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**0.10**
36	2	0	0	0	0	0	1	1	1	0	0	0	0	1	0	1	**0.17**
37	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	1	**0.10**
38	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	**0.07**
39	1	0	0	0	0	2	1	0	0	1	0	0	0	0	0	0	**0.12**
40	1	0	0	0	1	0	0	0	2	1	0	0	0	0	0	0	**0.12**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**0.02**
42	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	**0.02**
43	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	**0.05**
44	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**0.07**
45	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	**0.07**
46	1	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**0.10**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
48+	1	4	2	0	0	1	2	1	1	1	0	0	0	0	0	0	**0.32**
% of Persistent Direction	**6.09**	**6.27**	**7.10**	**6.44**	**5.28**	**8.06**	**7.45**	**7.37**	**7.59**	**6.56**	**4.96**	**5.55**	**5.58**	**4.96**	**5.11**	**5.60**	

Table 2.7-45
Wind Direction Persistence Summaries - RBS 150-Ft. Level

December 2004 through November 2006 Upper Tower Number of Occurrences where Winds Blew from the Same 67.5º Direction, Winds 6 mph or Greater

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	35	42	47	41	27	54	63	52	50	52	22	24	28	36	30	41	**25.23**
3	34	18	27	23	16	34	37	38	33	19	14	16	19	19	26	21	**15.43**
4	21	15	32	13	14	24	20	20	25	20	7	16	13	12	19	19	**11.36**
5	10	22	9	13	9	17	13	15	21	14	4	12	13	6	12	15	**8.03**
6	14	15	16	15	6	21	11	16	9	5	4	9	11	4	8	10	**6.82**
7	8	12	8	6	3	9	9	7	3	6	3	5	3	4	13	4	**4.03**
8	7	11	8	9	8	9	11	10	10	7	2	3	3	2	3	10	**4.43**
9	11	12	8	11	1	11	4	5	7	2	2	0	1	3	4	8	**3.53**
10	9	6	9	2	4	3	10	3	7	5	2	2	1	2	6	7	**3.06**
11	5	6	12	1	3	4	2	1	4	4	2	1	3	1	3	5	**2.23**
12	6	3	10	3	1	3	3	3	4	3	1	0	1	2	4	4	**2.00**
13	3	7	7	2	0	7	2	4	3	3	2	0	1	2	1	2	**1.80**
14	2	6	2	0	4	6	2	3	1	5	1	0	0	0	1	2	**1.37**
15	2	4	3	1	0	3	3	4	4	2	2	1	3	2	1	4	**1.53**
16	3	3	2	1	1	3	4	2	5	1	0	1	0	1	1	2	**1.18**
17	4	2	3	1	0	3	4	3	1	1	0	0	0	1	2	1	**1.02**
18	2	3	4	2	0	3	2	2	3	1	1	0	0	2	1	2	**1.10**
19	1	0	1	0	0	0	3	0	1	3	0	0	0	1	1	0	**0.43**
20	3	1	0	0	0	1	1	0	1	1	0	0	0	1	0	1	**0.39**
21	2	1	0	1	1	0	0	0	0	1	0	0	0	0	0	1	**0.27**
22	1	3	2	0	0	1	2	1	0	0	0	0	1	0	0	0	**0.43**
23	3	1	0	0	0	0	4	1	1	0	0	0	0	0	0	0	**0.39**
24	1	3	0	0	1	0	0	2	2	0	0	0	0	0	1	3	**0.51**
25	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	**0.16**
26	1	0	2	0	0	2	1	0	1	0	0	0	1	0	1	1	**0.39**
27	0	3	1	0	0	0	2	0	0	0	1	0	0	0	1	0	**0.31**
28	1	1	2	0	0	0	1	1	1	0	0	0	0	2	0	1	**0.39**
29	1	1	0	1	1	0	1	1	1	0	0	0	0	1	0	1	**0.35**
30	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	**0.12**
31	0	1	0	0	0	1	0	0	2	0	0	0	0	0	0	1	**0.20**
32	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	1	**0.16**
33	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**0.04**
34	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	**0.12**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	**0.08**
36	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	**0.16**
37	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	**0.08**
38	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	**0.12**
39	1	0	0	0	0	2	1	0	0	1	0	0	0	0	0	0	**0.20**
40	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	**0.08**
41	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	**0.04**
42	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	**0.04**
43	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**0.12**
44	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.04**
45	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.04**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
48+	0	0	2	0	0	1	2	1	0	0	0	0	0	0	0	0	**0.24**
% of Persistent Direction	**7.72**	**8.07**	**8.54**	**5.84**	**3.96**	**8.77**	**8.62**	**7.68**	**8.03**	**6.19**	**2.74**	**3.53**	**4.00**	**4.11**	**5.48**	**6.74**	

Table 2.7-46
Wind Direction Persistence Summaries - RBS 150-Ft. Level

December 2004 through November 2006 Upper Tower Number of Occurrences where Winds Blew from the Same 67.5º Direction, Winds 9 mph or Greater

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	27	16	42	20	11	43	27	24	19	12	4	5	7	7	14	20	30.50
3	9	9	19	11	5	17	14	10	10	12	4	1	1	4	11	10	15.05
4	11	9	16	11	7	11	10	10	5	7	1	2	3	4	8	10	12.79
5	6	7	10	7	1	10	9	4	6	3	0	0	2	4	3	10	8.39
6	4	9	8	4	0	3	4	6	7	0	4	0	2	2	5	6	6.55
7	2	5	5	5	0	3	1	3	4	6	2	2	1	4	1	6	5.12
8	2	3	5	5	3	3	1	0	6	3	0	1	0	1	4	3	4.09
9	2	2	8	1	1	3	3	2	2	1	0	0	0	1	1	6	3.38
10	1	2	5	2	1	4	2	2	2	1	1	0	0	2	4	2	3.17
11	0	0	3	2	0	3	2	0	1	3	0	0	0	0	1	0	1.54
12	2	1	1	0	1	3	0	2	1	1	2	0	0	0	2	2	1.84
13	1	0	3	0	0	1	3	1	3	3	1	0	0	1	0	0	1.74
14	1	0	1	0	2	0	1	2	2	0	0	0	0	1	1	0	1.13
15	0	0	0	0	0	1	1	3	0	0	0	0	1	2	1	0	0.92
16	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0.10
17	0	1	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0.41
18	1	0	0	0	0	0	0	1	1	2	0	0	0	0	1	0	0.61
19	0	0	0	1	1	0	0	1	1	0	0	0	0	0	1	1	0.61
20	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.10
21	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0.20
22	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.10
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.10
24	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0.10
25	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0.20
26	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0.20
27	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0.20
28	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0.10
29	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0.31
30	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0.20
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
32	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.10
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.10
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
% of Persistent Direction	7.06	6.55	13.20	7.27	3.48	11.46	8.29	7.47	7.57	5.53	1.94	1.13	1.74	3.48	5.94	7.88	

Table 2.7-47
Wind Direction Persistence Summaries - RBS 150-Ft. Level

December 2004 through November 2006 Upper Tower Number of Occurrences where Winds Blew from the Same 67.5° Direction, Winds 12 mph or Greater

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	6	1	10	12	7	5	2	7	4	4	2	1	0	3	7	5	30.16
3	1	1	2	2	0	5	0	3	2	6	0	0	0	4	3	3	12.70
4	0	0	0	4	0	6	0	6	3	1	0	0	2	0	5	4	12.30
5	1	0	0	3	1	4	0	2	2	0	1	0	0	4	3	6	10.71
6	2	1	2	3	2	2	0	1	0	2	1	0	1	2	1	5	9.92
7	0	0	1	2	0	2	1	0	3	1	0	0	0	1	4	2	6.75
8	0	0	0	0	2	0	2	0	5	2	1	0	0	1	2	0	5.95
9	0	0	1	0	0	1	2	2	0	1	0	0	0	0	1	0	3.17
10	0	0	0	0	0	1	1	2	0	0	0	0	0	1	0	0	1.98
11	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1.19
12	0	0	0	0	0	0	2	1	1	0	0	0	0	0	0	0	1.59
13	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	1.19
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0.40
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
18	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.40
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
22	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0.79
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
25	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0.40
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
27	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.40
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
% of Persistent Direction	3.97	1.19	6.75	10.71	4.76	11.51	3.97	10.71	8.73	6.75	1.98	0.40	1.19	6.75	10.71	9.92	

Table 2.7-48
Wind Direction Persistence Summaries - RBS 150-Ft. Level

December 2004 through November 2006 Upper Tower Number of Occurrences where Winds Blew from the Same 67.5º Direction, Winds 15 mph or Greater

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	1	0	0	1	0	2	1	2	2	2	0	0	0	1	3	2	25.37
3	0	0	0	0	0	0	0	1	4	1	1	0	0	1	2	1	16.42
4	0	1	0	1	0	2	0	2	0	0	0	0	0	2	0	2	14.93
5	1	0	1	0	0	0	0	1	1	0	0	0	0	0	1	0	7.46
6	0	0	0	1	0	0	2	1	2	1	0	0	0	1	1	0	13.43
7	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2.99
8	0	0	0	0	1	0	2	1	1	1	0	0	0	0	1	0	10.45
9	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	4.48
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
12	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1.49
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
14	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1.49
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
21	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1.49
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
% of Persistent Direction	2.99	1.49	2.99	5.97	1.49	8.96	8.96	16.42	14.93	7.46	1.49	0.00	0.00	7.46	11.94	7.46	

Table 2.7-49
Wind Direction Persistence Summaries - 30-Ft. Level

2002 through 2006 Ryan Airport Number of Occurrences where Winds Blew from the Same 22.5° Direction, All Winds[a]

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	341	240	272	329	422	252	219	214	243	158	159	149	202	134	103	61	59.12
3	94	90	101	99	163	82	79	89	126	65	46	48	81	41	18	14	20.89
4	37	33	40	42	87	30	25	41	76	29	24	21	38	26	12	7	9.60
5	31	12	16	19	39	17	18	17	34	16	8	5	18	8	5	3	4.50
6	12	5	10	12	28	11	3	10	15	5	6	2	8	4	4	1	2.30
7	6	3	6	3	24	3	3	6	14	6	1	4	8	1	1	0	1.50
8	1	4	3	1	8	3	1	0	11	2	0	2	3	1	1	0	0.69
9	6	1	1	2	8	0	0	2	8	2	0	1	2	0	1	0	0.57
10	2	0	1	2	2	2	0	1	3	0	0	0	0	0	0	0	0.22
11	0	0	0	0	3	0	0	0	3	0	0	0	1	0	0	0	0.12
12	0	0	0	0	3	1	0	0	6	0	0	0	0	0	0	0	0.17
13	0	0	0	0	1	1	0	3	3	0	0	0	0	0	0	0	0.14
14	0	0	0	0	1	0	0	0	1	0	0	0	2	0	0	0	0.07
15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0.02
16	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0.07
17	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0.02
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
23	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0.02
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
% of Persistent Direction	8.96	6.56	7.61	8.60	13.42	6.79	5.88	6.47	9.19	4.78	4.12	3.92	6.15	3.63	2.45	1.45	
Average Persistent Hours	2.76	2.66	2.74	2.67	3.21	2.76	2.62	2.91	3.49	2.87	2.6	2.66	2.99	2.67	2.63	2.48	

* The longest persistent wind was from the south and lasted 23 hours.

a) Hourly wind speeds of 3 knots or less (3.45 mph) are reported as calm hours.

Source: Reference 2.7-42.

Table 2.7-50
Wind Direction Persistence Summaries - 30-Ft. Level

2002 through 2006 Ryan Airport Number of Occurrences where Winds Blew from the Same 22.5° Direction, Winds 3 mph or Greater[(a)]

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	341	240	272	329	422	252	219	214	243	158	159	149	202	134	103	61	59.12
3	94	90	101	99	163	82	79	89	126	65	46	48	81	41	18	14	20.89
4	37	33	40	42	87	30	25	41	76	29	24	21	38	26	12	7	9.60
5	31	12	16	19	39	17	18	17	34	16	8	5	18	8	5	3	4.50
6	12	5	10	12	28	11	3	10	15	5	6	2	8	4	4	1	2.30
7	6	3	6	3	24	3	3	6	14	6	1	4	8	1	1	0	1.50
8	1	4	3	1	8	3	1	0	11	2	0	2	3	1	1	0	0.69
9	6	1	1	2	8	0	0	2	8	2	0	1	2	0	1	0	0.57
10	2	0	1	2	2	2	0	1	3	0	0	0	0	0	0	0	0.22
11	0	0	0	0	3	0	0	0	3	0	0	0	1	0	0	0	0.12
12	0	0	0	0	3	1	0	0	6	0	0	0	0	0	0	0	0.17
13	0	0	0	0	1	1	0	3	3	0	0	0	0	0	0	0	0.14
14	0	0	0	0	1	0	0	0	1	0	0	0	2	0	0	0	0.07
15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0.02
16	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0.07
17	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0.02
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
23	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0.02
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
% of Persistent Direction	8.96	6.56	7.61	8.60	13.42	6.79	5.88	6.47	9.19	4.78	4.12	3.92	6.15	3.63	2.45	1.45	

a) Hourly wind speeds of 3 knots or less (3.45 mph) are reported as calm hours.

Source: Reference 2.7-42.

Table 2.7-51
Wind Direction Persistence Summaries - 30-Ft. Level

2002 through 2006 Ryan Airport Number of Occurrences where Winds Blew from the Same 22.5° Direction, Winds 6 mph or Greater[(a)]

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	129	106	121	136	202	145	128	155	203	124	116	103	115	82	70	49	57.54
3	45	47	44	53	77	48	44	61	104	61	32	28	43	19	13	10	21.14
4	27	8	13	23	50	24	17	26	60	25	17	18	19	17	11	6	10.47
5	15	5	6	8	19	10	11	15	32	16	8	4	6	6	4	2	4.84
6	7	2	5	7	16	7	2	9	9	5	3	0	4	4	3	0	2.41
7	1	1	2	0	10	2	1	4	13	6	1	3	3	0	1	0	1.39
8	1	1	0	0	2	2	1	0	8	1	0	0	2	1	1	0	0.58
9	2	0	0	2	2	0	0	3	7	2	0	1	1	0	1	0	0.61
10	2	0	1	0	2	0	0	0	2	0	0	0	1	0	0	0	0.23
11	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0.12
12	0	0	0	0	2	1	0	0	6	0	0	0	0	0	0	0	0.26
13	0	0	0	0	1	1	0	2	2	0	0	0	0	0	0	0	0.17
14	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0.09
15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0.03
16	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0.06
17	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0.03
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
23	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0.03
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
% of Persistent Direction	6.64	4.93	5.57	6.64	11.28	6.96	5.92	7.98	13.05	6.96	5.13	4.55	5.68	3.74	3.02	1.94	

a) Hourly wind speeds of 3 knots or less (3.45 mph) are reported as calm hours.

Source: Reference 2.7-42.

Table 2.7-52
Wind Direction Persistence Summaries - 30-Ft. Level

December 2004 through November 2006 Ryan Airport Number of Occurrences where Winds Blew from the Same 22.5º Direction, Winds 9 mph or Greater[(a)]

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	66	65	58	74	102	79	70	89	151	91	62	64	60	53	40	24	**57.83**
3	21	9	14	29	47	21	26	50	74	48	20	16	25	13	8	6	**21.51**
4	12	2	6	10	13	20	5	16	36	20	9	8	13	8	8	2	**9.47**
5	5	0	5	3	8	4	5	10	29	16	5	2	4	4	3	0	**5.19**
6	1	1	2	2	10	3	2	6	8	3	3	0	4	1	1	0	**2.37**
7	1	0	1	0	1	3	0	3	12	1	1	2	2	0	0	0	**1.36**
8	1	0	0	0	0	0	0	0	6	2	0	0	0	1	2	0	**0.60**
9	0	0	0	0	1	0	0	2	5	1	0	1	2	0	0	0	**0.60**
10	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	**0.10**
11	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	**0.15**
12	0	0	0	0	1	0	0	0	4	0	0	0	1	0	0	0	**0.30**
13	0	0	0	0	2	1	0	2	1	0	0	0	0	0	0	0	**0.30**
14	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	**0.10**
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
16	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**0.05**
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
22	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	**0.05**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
% of Persistent Direction	**5.39**	**3.88**	**4.33**	**5.94**	**9.42**	**6.60**	**5.44**	**8.97**	**16.73**	**9.17**	**5.04**	**4.69**	**5.64**	**4.03**	**3.12**	**1.61**	

a) Hourly wind speeds of 3 knots or less (3.45 mph) are reported as calm hours.

Source: Reference 2.7-42.

Table 2.7-53
Wind Direction Persistence Summaries - 30-Ft. Level

2002 through 2006 Ryan Airport Number of Occurrences where Winds Blew from the Same 22.5° Direction, Winds 12 mph or Greater[(a)]

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	16	5	11	17	23	27	21	42	93	46	27	18	25	22	12	3	59.30
3	4	1	3	3	13	3	7	23	33	20	5	5	11	4	2	2	20.20
4	2	1	2	0	4	2	2	5	26	11	5	2	5	0	1	0	9.88
5	0	0	1	0	3	1	0	1	11	6	2	2	1	1	1	0	4.36
6	0	0	1	0	0	1	0	3	7	1	0	0	3	2	0	0	2.62
7	0	0	0	0	0	0	0	2	6	0	0	0	0	0	0	0	1.16
8	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0.44
9	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0.58
10	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0.15
11	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0.44
12	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0.29
13	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0.44
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
17	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0.15
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
% of Persistent Direction	3.20	1.02	2.62	2.91	6.25	5.09	4.36	11.19	27.33	12.21	5.67	3.92	6.83	4.22	2.47	0.73	

a) Hourly wind speeds of 3 knots or less (3.45 mph) are reported as calm hours.

Source: Reference 2.7-42.

Table 2.7-54
Wind Direction Persistence Summaries - 30-Ft. Level

2002 through 2006 Ryan Airport Number of Occurrences where Winds Blew from the Same 22.5º Direction, Winds 15 mph or Greater[(a)]

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	5	2	1	2	2	5	6	17	37	20	5	4	8	5	3	1	53.71
3	0	0	1	2	2	2	4	10	23	10	4	3	6	1	0	0	29.69
4	0	0	0	0	0	2	0	1	8	2	1	0	2	0	1	0	7.42
5	0	0	2	0	0	0	0	1	5	1	1	0	1	0	0	0	4.80
6	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	1.75
7	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0.87
8	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0.44
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
10	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0.44
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
13	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0.87
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
% of Persistent Direction	2.18	0.87	1.75	1.75	1.75	3.93	4.37	13.10	35.81	14.41	4.80	3.06	7.42	2.62	1.75	0.44	

a) Hourly wind speeds of 3 knots or less (3.45 mph) are reported as calm hours.

Source: Reference 2.7-42.

Table 2.7-55
Wind Direction Persistence Summaries - 30-Ft. Level

2002 Thru 2006 Ryan Airport Number of Occurrences where Winds Blew from the Same 67.5° Direction, All Winds[(a)]

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	210	230	250	313	317	208	211	155	165	104	172	137	174	136	120	74	34.77
3	98	99	169	145	175	124	93	105	104	73	73	79	99	61	43	47	18.54
4	50	85	96	102	115	79	67	77	87	54	51	40	51	34	31	27	12.22
5	40	57	61	68	67	53	52	46	53	49	36	34	35	23	18	17	8.28
6	25	38	40	53	58	37	32	37	27	26	22	26	27	14	10	10	5.63
7	14	23	23	31	31	23	27	34	26	17	13	18	17	14	9	11	3.87
8	7	24	24	22	24	24	20	27	23	10	10	11	9	13	9	7	3.08
9	13	18	20	31	29	12	13	15	20	10	9	6	14	5	6	5	2.64
10	6	9	9	22	16	14	14	6	10	8	12	6	10	3	3	1	1.74
11	6	10	16	6	16	12	6	12	11	16	5	10	6	6	3	3	1.68
12	3	5	15	8	15	8	6	7	6	5	4	5	3	5	4	1	1.17
13	1	4	6	13	7	5	7	5	17	4	4	3	5	4	1	4	1.05
14	6	3	5	4	8	6	5	2	4	6	2	5	4	2	0	3	0.76
15	1	6	1	6	12	4	2	10	11	4	2	2	0	1	1	5	0.79
16	3	0	6	6	9	6	1	3	7	3	2	2	3	3	0	1	0.64
17	1	3	2	3	6	3	0	1	6	5	2	2	0	2	2	0	0.44
18	2	2	5	3	7	2	1	3	4	8	2	2	4	0	1	0	0.54
19	0	0	0	5	3	5	1	5	3	1	0	0	0	0	1	0	0.28
20	0	1	0	2	2	5	4	2	5	1	1	0	0	2	1	0	0.30
21	1	1	0	2	2	1	1	2	1	2	0	3	0	2	0	0	0.21
22	1	0	0	3	4	0	1	3	2	0	1	1	0	1	0	0	0.20
23	0	0	0	1	0	0	0	1	2	0	0	2	2	1	0	1	0.12
24	2	1	0	1	0	0	0	1	1	1	0	0	2	1	0	0	0.12
25	0	1	2	0	0	1	0	1	1	2	1	0	1	0	0	0	0.12
26	1	0	1	1	2	1	0	0	2	0	0	0	0	0	0	0	0.09
27	0	0	0	0	0	1	1	1	1	2	0	1	0	0	0	0	0.08
28	0	0	0	0	2	0	0	2	1	2	1	0	1	0	0	0	0.11
29	1	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0.05
30	0	0	0	1	0	0	0	1	1	1	1	0	0	0	0	0	0.06
31	0	0	0	0	1	0	0	1	1	0	0	0	1	0	0	0	0.05
32	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0.04
33	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0.01
34	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0.02
35	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0.02
36	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0.02
37	0	0	0	1	1	2	0	0	0	0	1	0	0	0	0	0	0.06
38	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0.02
39	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.01
40	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0.01
41	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0.01
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.01
44	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0.01
45	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.01
46	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.01
47	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0.01
48+	0	0	0	2	0	1	0	1	1	0	0	0	0	0	0	0	0.06
% of Persistent Direction	5.75	7.24	8.78	10.01	10.94	7.47	6.61	6.67	7.12	4.84	4.99	4.62	5.47	3.89	3.07	2.54	
Average Persistent Hours	4.18	4.43	4.49	4.86	5.23	5.11	4.6	5.69	6.03	5.84	4.52	4.79	4.54	4.57	4.04	4.53	

*** The longest persistent wind was from the south and lasted 88 hours.**

a) Hourly wind speeds of 3 knots or less (3.45 mph) are reported as calm hours.

Source: Reference 2.7-42.

Table 2.7-56
Wind Direction Persistence Summaries - 30-Ft. Level

2002 Thru 2006 Ryan Airport Number of Occurrences where Winds Blew from the Same 67.5° Direction, Winds 3 mph or Greater[a]

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	210	230	250	313	317	208	211	155	165	104	172	137	174	136	120	74	34.77
3	98	99	169	145	175	124	93	105	104	73	73	79	99	61	43	47	18.54
4	50	85	96	102	115	79	67	77	87	54	51	40	51	34	31	27	12.22
5	40	57	61	68	67	53	52	46	53	49	36	34	35	23	18	17	8.28
6	25	38	40	53	58	37	32	37	27	26	22	26	27	14	10	10	5.63
7	14	23	23	31	31	23	27	34	26	17	13	18	17	14	9	11	3.87
8	7	24	24	22	24	24	20	27	23	10	10	11	9	13	9	7	3.08
9	13	18	20	31	29	12	13	15	20	10	9	6	14	5	6	5	2.64
10	6	9	9	22	16	14	14	6	10	8	12	6	10	3	3	1	1.74
11	6	10	16	6	16	12	6	12	11	16	5	10	6	6	3	3	1.68
12	3	5	15	8	15	8	6	7	6	5	4	5	3	5	4	1	1.17
13	1	4	6	13	7	5	7	5	17	4	4	3	5	4	1	4	1.05
14	6	3	5	4	8	6	5	2	4	6	2	5	4	2	0	3	0.76
15	1	6	1	6	12	4	2	10	11	4	2	2	0	1	1	5	0.79
16	3	0	6	6	9	6	1	3	7	3	2	2	3	3	0	1	0.64
17	1	3	2	3	6	3	0	1	6	5	2	2	0	2	2	0	0.44
18	2	2	5	3	7	2	1	3	4	8	2	2	4	0	1	0	0.54
19	0	0	0	5	3	5	1	5	3	1	0	0	0	0	1	0	0.28
20	0	1	0	2	2	5	4	2	5	1	1	0	0	2	1	0	0.30
21	1	1	0	2	2	1	1	2	1	2	0	3	0	2	0	0	0.21
22	1	0	0	3	4	0	1	3	2	0	1	1	0	1	0	0	0.20
23	0	0	0	1	0	0	0	1	2	0	0	2	2	1	0	1	0.12
24	2	1	0	1	0	0	0	1	1	1	0	0	2	1	0	0	0.12
25	0	1	2	0	0	1	0	1	1	2	1	0	1	0	0	0	0.12
26	1	0	1	1	2	1	0	0	2	0	0	0	0	0	0	0	0.09
27	0	0	0	0	0	1	1	1	1	2	0	1	0	0	0	0	0.08
28	0	0	0	0	2	0	0	2	1	2	1	0	1	0	0	0	0.11
29	1	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0.05
30	0	0	0	1	0	0	0	1	1	1	1	0	0	0	0	0	0.06
31	0	0	0	0	1	0	0	1	1	0	0	0	1	0	0	0	0.05
32	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0.04
33	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0.01
34	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0.02
35	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0.02
36	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0.02
37	0	0	0	1	1	2	0	0	0	0	1	0	0	0	0	0	0.06
38	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0.02
39	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.01
40	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0.01
41	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0.01
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.01
44	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0.01
45	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.01
46	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.01
47	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0.01
48+	0	0	0	2	0	1	0	1	1	0	0	0	0	0	0	0	0.06
% of Persistent Direction	5.75	7.24	8.78	10.01	10.94	7.47	6.61	6.67	7.12	4.84	4.99	4.62	5.47	3.89	3.07	2.54	

a) Hourly wind speeds of 3 knots or less (3.45 mph) are reported as calm hours.

Source: Reference 2.7-42.

Table 2.7-57
Wind Direction Persistence Summaries - 30-Ft. Level

2002 Thru 2006 Ryan Airport Number of Occurrences where Winds Blew from the Same 67.5° Direction, Winds 6 mph or Greater[(a)]

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	102	97	112	126	147	144	121	129	143	92	117	93	105	80	70	52	**33.94**
3	60	53	90	71	109	68	57	79	86	60	50	53	59	34	35	30	**19.50**
4	41	42	44	48	60	47	51	46	58	38	39	30	30	23	26	23	**12.67**
5	13	32	15	34	37	36	30	36	44	45	28	25	19	14	11	14	**8.50**
6	16	16	14	17	29	20	27	27	27	21	14	18	22	11	9	5	**5.75**
7	7	10	14	12	21	19	19	21	26	14	9	9	5	9	7	12	**4.20**
8	6	4	8	9	16	9	10	18	20	17	10	6	11	8	8	5	**3.24**
9	6	11	8	16	16	8	6	12	12	7	9	8	3	3	2	7	**2.63**
10	6	3	7	7	4	9	7	5	12	1	4	4	8	5	3	4	**1.75**
11	5	5	5	7	8	3	1	7	14	10	3	1	3	1	2	1	**1.49**
12	1	2	3	4	3	3	2	3	5	5	3	3	0	5	0	1	**0.84**
13	1	3	0	3	3	1	3	8	12	5	1	0	2	4	2	3	**1.00**
14	0	2	0	0	0	2	4	3	5	5	5	4	0	0	0	0	**0.59**
15	0	1	0	3	3	2	2	5	7	2	1	1	1	2	1	3	**0.67**
16	2	1	1	1	4	4	1	2	4	1	2	1	2	0	1	0	**0.53**
17	1	0	1	2	2	2	0	1	6	6	0	2	0	0	1	0	**0.47**
18	0	0	2	3	5	0	0	4	2	4	1	0	1	0	1	0	**0.45**
19	1	0	0	1	0	0	0	5	3	2	0	1	1	0	1	0	**0.29**
20	0	0	0	1	1	2	2	1	2	1	0	1	0	0	0	0	**0.22**
21	0	0	1	0	0	0	0	3	1	1	0	0	0	2	0	0	**0.16**
22	1	0	0	1	3	1	1	1	1	0	1	0	1	0	0	0	**0.22**
23	1	0	0	0	0	0	0	0	3	0	0	0	1	1	0	0	**0.12**
24	0	0	0	0	1	0	1	0	1	3	0	0	1	0	0	0	**0.14**
25	0	0	1	0	0	1	0	1	1	0	0	0	0	0	0	0	**0.08**
26	0	0	0	2	0	0	0	0	3	0	0	0	0	0	0	0	**0.10**
27	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	**0.08**
28	0	0	0	1	1	0	0	2	1	1	0	0	0	0	0	0	**0.12**
29	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	**0.04**
30	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**0.02**
31	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**0.02**
32	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	**0.04**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
35	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	**0.02**
36	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	**0.02**
37	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**0.02**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
40	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	**0.02**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
45	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	**0.04**
46	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	**0.04**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**
% of Persistent Direction	**5.30**	**5.53**	**6.40**	**7.26**	**9.34**	**7.49**	**6.79**	**8.32**	**9.87**	**6.71**	**5.87**	**5.10**	**5.40**	**3.96**	**3.53**	**3.14**	

a) Hourly wind speeds of 3 knots or less (3.45 mph) are reported as calm hours.

Source: Reference 2.7-42.

Table 2.7-58
Wind Direction Persistence Summaries - 30-Ft. Level

2002 Thru 2006 Ryan Airport Number of Occurrences where Winds Blew from the Same 67.5° Direction, Winds 9 mph or Greater[(a)]

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	69	61	53	67	91	71	97	71	95	64	74	64	56	57	38	34	36.30
3	38	23	28	34	58	48	36	47	56	52	25	35	30	23	14	22	19.45
4	21	16	23	25	23	29	26	29	56	31	25	17	18	14	20	8	13.02
5	10	8	11	14	14	11	16	20	32	26	17	9	13	12	6	10	7.83
6	6	8	7	12	9	10	15	17	18	14	8	8	13	4	6	4	5.43
7	4	3	2	9	9	7	7	19	24	8	3	7	7	4	7	3	4.20
8	3	4	2	1	11	2	4	13	12	11	4	3	3	5	3	4	2.90
9	1	3	2	4	5	6	3	5	16	6	3	2	2	1	0	3	2.12
10	0	1	2	1	1	5	4	6	6	10	4	1	4	4	5	1	1.88
11	1	0	2	4	1	1	0	3	9	7	2	2	0	0	0	0	1.09
12	0	0	1	0	2	0	1	2	8	4	2	1	0	2	0	1	0.82
13	0	0	1	0	2	1	2	4	8	3	0	1	2	2	2	0	0.96
14	0	0	0	0	1	2	5	2	8	2	3	3	1	0	1	0	0.96
15	0	0	0	3	3	1	1	5	3	0	0	0	1	1	0	0	0.62
16	0	0	0	0	1	1	0	2	3	3	0	1	0	0	0	0	0.38
17	0	0	1	2	2	0	0	1	2	3	1	1	1	0	0	0	0.48
18	0	0	1	0	2	0	0	3	3	3	0	0	1	0	0	0	0.44
19	0	0	0	1	0	0	0	3	1	1	0	0	2	0	0	0	0.27
20	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0.14
21	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0.10
22	0	0	0	0	0	0	0	1	2	0	1	0	0	0	0	0	0.14
23	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0.03
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
26	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0.07
27	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0.03
28	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0.10
29	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.03
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.03
36	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0.07
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0.03
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.03
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
46	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.03
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
% of Persistent Direction	5.26	4.34	4.65	6.05	8.07	6.70	7.45	8.89	12.58	8.54	5.91	5.30	5.26	4.44	3.49	3.08	

a) Hourly wind speeds of 3 knots or less (3.45 mph) are reported as calm hours.

Source: Reference 2.7-42.

Table 2.7-59
Wind Direction Persistence Summaries - 30-Ft. Level

2002 Thru 2006 Ryan Airport Number of Occurrences where Winds Blew from the Same 67.5° Direction, Winds 12 mph or Greater[(a)]

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	13	6	21	22	26	22	27	30	84	40	28	20	20	18	13	7	39.78
3	6	2	4	9	10	14	12	24	32	21	12	7	11	8	3	3	17.84
4	6	2	2	2	7	7	11	16	24	22	9	4	8	1	6	1	12.83
5	0	0	2	0	3	3	4	8	19	14	3	3	3	5	2	3	7.21
6	0	1	0	1	3	6	4	15	6	7	5	2	4	4	1	0	5.91
7	0	0	0	0	1	1	2	7	6	7	3	0	1	1	1	0	3.01
8	0	0	0	1	2	0	0	8	7	5	1	2	4	2	1	0	3.31
9	0	0	1	0	0	0	4	3	13	5	2	0	1	0	0	0	2.91
10	0	0	0	1	1	1	1	2	6	3	3	0	1	1	1	0	2.10
11	0	0	0	0	0	0	0	3	4	1	0	2	1	0	0	0	1.10
12	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	1	0.50
13	0	0	0	0	0	0	0	4	5	1	0	0	1	0	0	0	1.10
14	0	0	0	0	0	0	1	1	2	0	0	1	0	0	0	0	0.50
15	0	0	1	0	1	0	0	3	1	1	0	0	0	0	0	0	0.70
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
17	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0.30
18	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0.20
19	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0.30
20	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0.30
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
22	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.10
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
% of Persistent Direction	2.51	1.10	3.11	3.71	5.51	5.51	6.61	12.73	21.64	12.83	6.71	4.11	5.61	4.01	2.81	1.50	

a) Hourly wind speeds of 3 knots or less (3.45 mph) are reported as calm hours.

Source: Reference 2.7-42.

Table 2.7-60
Wind Direction Persistence Summaries - 30-Ft. Level

2002 Thru 2006 Ryan Airport Number of Occurrences where Winds Blew from the Same 67.5° Direction, Winds 15 mph or Greater[(a)]

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of Persistent Occurrences
2	3	3	2	2	2	6	6	10	30	16	14	5	6	4	4	1	36.54
3	2	0	2	1	2	1	6	6	22	14	3	2	5	0	0	1	21.47
4	1	1	0	0	1	2	3	8	13	6	3	1	4	2	2	0	15.06
5	0	0	2	0	0	1	1	6	10	6	2	2	3	0	0	0	10.58
6	0	0	0	1	0	0	0	7	6	4	0	1	0	0	0	0	6.09
7	0	0	0	0	0	0	0	2	4	1	0	1	0	1	0	0	2.88
8	0	0	0	0	0	0	0	0	3	2	1	0	0	0	0	0	1.92
9	0	0	0	0	0	0	1	0	3	1	1	0	0	0	0	0	1.92
10	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0.64
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
12	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0.32
13	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0.96
14	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0.96
15	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0.32
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
17	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.32
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
48+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
% of Persistent Direction	1.92	1.28	1.92	1.60	2.24	3.53	5.77	13.46	30.13	16.03	7.69	3.85	5.77	2.24	1.92	0.64	

a) Hourly wind speeds of 3 knots or less (3.45 mph) are reported as calm hours.

Source: Reference 2.7-42.

Table 2.7-61
Monthly and Annual Vertical Stability Class and Mean 30-Ft. Wind Speed Distributions for the RBS (December 2004 - November 2006)

Period	Vertical Stability Categories						
	A	B	C	D	E	F	G
January							
Frequency (%)	0.0	0.5	0.8	33.4	53.6	6.4	5.3
Wind Speed (knots)	0.00	3.59	4.91	4.87	4.22	1.91	1.31
February							
Frequency (%)	0.1	0.1	0.6	38.2	49.4	6.5	5.1
Wind Speed (knots)	5.54	4.72	5.21	4.94	3.95	2.19	1.40
March							
Frequency (%)	0.1	0.6	0.9	31.5	54.3	7.0	5.6
Wind Speed (knots)	4.68	4.81	5.56	5.24	4.19	1.94	1.29
April							
Frequency (%)	0.0	0.0	0.1	24.8	55.2	13.6	6.3
Wind Speed (knots)	0.00	0.00	4.85	5.48	3.77	2.52	1.00
May							
Frequency (%)	0.1	0.1	0.5	22.3	52.1	18.4	6.7
Wind Speed (knots)	5.78	4.31	4.71	4.11	3.03	2.00	1.18
June							
Frequency (%)	0.0	0.1	0.2	18.5	54.5	22.0	4.7
Wind Speed (knots)	0.00	1.04	1.19	3.84	2.90	1.96	1.16
July							
Frequency (%)	0.1	0.0	0.1	19.8	60.8	17.9	1.2
Wind Speed (knots)	4.02	0.00	4.97	3.80	2.41	1.87	1.13
August							
Frequency (%)	0.4	0.1	0.4	23.5	52.5	19.9	3.2
Wind Speed (knots)	4.38	3.20	4.86	3.93	2.53	1.32	1.04
September							
Frequency (%)	1.2	0.5	1.9	27.5	48.2	12.8	8.0
Wind Speed (knots)	4.67	4.98	4.99	4.40	3.02	1.69	1.20
October							
Frequency (%)	2.1	0.9	1.9	27.2	37.5	15.6	14.8
Wind Speed (knots)	4.83	4.96	4.73	4.67	3.30	1.81	1.14
November							
Frequency (%)	3.2	0.4	1.3	23.0	42.8	12.6	16.6
Wind Speed (knots)	4.2	5.92	5.27	4.87	3.27	1.79	1.28
December							
Frequency (%)	1.9	0.7	0.6	31.5	39.6	11.0	14.7
Wind Speed (knots)	4.73	3.71	4.10	5.00	3.45	1.78	1.25
Annual							
Frequency (%)	0.7	0.3	0.8	26.8	50.1	13.6	7.7
Wind Speed (knots)	4.57	4.47	4.87	4.67	3.33	1.87	1.21

Table 2.7-62
Annual JFD of Wind Direction, Wind Speed, and Stability Class

RBS Site
December 2004 - November 2006
30-Ft. Tower

All Pasquill Stability Categories

Wind Speed (mph)[(a)]	Wind Direction From																
	E	ENE	ESE	N	NE	NNE	NNW	NW	S	SE	SSE	SSW	SW	W	WNW	WSW	All Directions
Calm	1	4		9	6	12	4	3		2				1	2		44
Calm-2	287	362	255	372	355	308	353	396	84	170	106	84	106	193	277	137	3845
2-4	249	327	382	615	394	635	320	223	308	737	331	321	222	231	277	207	5779
4-6	48	133	122	505	298	371	319	171	443	511	320	267	135	223	155	204	4225
6-8		31	8	343	54	85	254	123	261	91	188	156	47	46	66	51	1804
8-10	2	6	2	61	5	6	110	64	88	12	86	81	18	1	41	2	585
10-13				4			33	24	55	4	58	25	9	2	13		227
13-17				2			1	5	7	1	15	2					33
17-21						1	4		2		2	1					10
21+			1														1
All Speeds	587	863	770	1911	1112	1418	1398	1009	1248	1528	1106	937	537	697	831	601	16,553

a) Calm represents wind speeds less than or equal to 0.50 mph.

Number of Calms: 44
Number of Variables: 0
Number of Observations: 16,554

Table 2.7-63
Annual JFD of Wind Direction, Wind Speed, and Stability Class

RBS Site
December 2004 - November 2006
30-Ft. Tower

Pasquill Stability Class A
Extremely Unstable (ΔT < 1.9°C/100m)

Wind Speed (mph)[a]	Wind Direction From																
	E	ENE	ESE	N	NE	NNE	NNW	NW	S	SE	SSE	SSW	SW	W	WNW	WSW	All Directions
Calm																	0
Calm-2																	0
2-4	8	4	3	1	3				1	4							24
4-6	3	7	8	5	11	14	7			17	2					1	75
6-8			2	3	4	5				6	1			1	2		24
8-10																	0
10-13																	0
13-17																	0
17-21																	0
21+			1														1
All Speeds	11	11	14	9	18	19	7	0	1	27	3	0	0	1	2	1	124

a) Calm represents wind speeds less than or equal to 0.50 mph.

Number of Calms: 0
Number of Variables: 0
Number of Observations: 124

Table 2.7-64
Annual JFD of Wind Direction, Wind Speed, and Stability Class

RBS Site
December 2004 - November 2006
30-Ft. Tower

Pasquill Stability Class B
Moderately Unstable (-1.9°C/100m < ∆T < -1.7°C/100m)

Wind Speed (mph)[a]	Wind Direction From																
	E	ENE	ESE	N	NE	NNE	NNW	NW	S	SE	SSE	SSW	SW	W	WNW	WSW	All Directions
Calm						1											1
Calm-2		1		1													2
2-4			1				1			3						1	6
4-6	2	3	2	2	9	4	1		1	3				1			28
6-8		2		4		2		1	1	3	1				1		15
8-10				1						1							2
10-13																	0
13-17																	0
17-21																	0
21+																	0
All Speeds	2	6	3	8	9	7	2	1	2	10	1	0	0	1	1	1	54

a) Calm represents wind speeds less than or equal to 0.50 mph.

Number of Calms: 1
Number of Variables: 0
Number of Observations: 54

Table 2.7-65
Annual JFD of Wind Direction, Wind Speed, and Stability Class

RBS Site
December 2004 - November 2006
30-Ft. Tower

Pasquill Stability Class C
Slightly Unstable (-1.7°C/100m < ΔT < -1.5°C/100m)

Wind Speed (mph)[a]	Wind Direction From																
	E	ENE	ESE	N	NE	NNE	NNW	NW	S	SE	SSE	SSW	SW	W	WNW	WSW	All Directions
Calm																	0
Calm-2	1		1				1			1							4
2-4		1	1		1	1			1	3				1		1	10
4-6	2	10	11	6	15	5	1	1	5	6	2		1		1	4	70
6-8		1	1	8	6	13	3	2	1	4	1				1	2	43
8-10						1											1
10-13																	0
13-17																	0
17-21									1								1
21+																	0
All Speeds	3	12	14	14	22	20	5	3	8	14	3	0	1	1	2	7	129

a) Calm represents wind speeds less than or equal to 0.50 mph.

Number of Calms: 0
Number of Variables: 0
Number of Observations: 129

Table 2.7-66
Annual JFD of Wind Direction, Wind Speed, and Stability Class

RBS Site
December 2004 - November 2006
30-Ft. Tower

Pasquill Stability Class D
Neutral (-1.5°C/100m < ΔT < -0.5°C/100m)

Wind Speed (mph)[(a)]	Wind Direction From																
	E	ENE	ESE	N	NE	NNE	NNW	NW	S	SE	SSE	SSW	SW	W	WNW	WSW	All Directions
Calm																	0
Calm-2	9	6	9	5	2	3	3	2		3	1	3	4	4	7	2	63
2-4	75	66	114	91	94	105	44	36	22	122	38	54	49	75	44	44	1073
4-6	20	76	50	268	115	205	162	93	133	207	127	92	50	134	83	120	1935
6-8		9	2	199	18	49	155	73	99	39	82	53	24	30	48	25	905
8-10			1	38	2	3	81	45	35	4	44	30	11	1	36	2	333
10-13							27	21	19	3	19	14	7	2	11		123
13-17							1	5	1		6	1					14
17-21						1					1	1					3
21+																	0
All Speeds	104	157	176	601	231	366	473	275	309	378	318	248	145	246	229	193	4449

a) Calm represents wind speeds less than or equal to 0.50 mph.

Number of Calms: 0
Number of Variables: 0
Number of Observations: 4449

Table 2.7-67
Annual JFD of Wind Direction, Wind Speed, and Stability Class

RBS Site
December 2004 - November 2006
30-Ft. Tower

Pasquill Stability Class E
Slightly Stable (-0.5°C/100m < ∆T < 1.5°C/100m)

Wind Speed (mph)[a]	Wind Direction From																
	E	ENE	ESE	N	NE	NNE	NNW	NW	S	SE	SSE	SSW	SW	W	WNW	WSW	All Directions
Calm					1	1				1							3
Calm-2	135	104	170	82	92	72	59	71	57	123	70	49	65	75	81	84	1389
2-4	131	200	221	336	253	448	177	144	248	543	255	242	147	136	187	133	3801
4-6	21	36	48	221	144	143	144	74	252	275	165	135	66	84	67	66	1941
6-8		19	3	129	26	15	96	47	141	39	101	91	19	15	14	23	778
8-10	2	6	1	22	3	2	29	19	52	7	42	51	7		5		248
10-13				4			6	3	36	1	39	11	2		2		104
13-17				2					6	1	9	1					19
17-21							4		1		1						6
21+																	0
All Speeds	289	365	443	796	519	681	515	358	793	990	682	580	306	310	356	306	8289

a) Calm represents wind speeds less than or equal to 0.50 mph.

Number of Calms: 3
Number of Variables: 0
Number of Observations: 8289

Table 2.7-68
Annual JFD of Wind Direction, Wind Speed, and Stability Class

RBS Site
December 2004 - November 2006
30-Ft. Tower

Pasquill Stability Class F
Moderately Stable (1.5°C/100m < ∆T < 4.0°C/100m)

Wind Speed (mph)[a]	Wind Direction From																
	E	ENE	ESE	N	NE	NNE	NNW	NW	S	SE	SSE	SSW	SW	W	WNW	WSW	All Directions
Calm	1			5	4	6	2	2						1	1		22
Calm-2	95	100	64	127	97	117	120	153	23	38	30	29	33	82	126	38	1272
2-4	25	32	39	156	40	78	78	29	35	57	37	25	25	18	41	25	740
4-6		1	3	3	4		4	3	52	3	24	40	18	4	4	13	176
6-8						1			19		2	12	4			1	39
8-10									1								1
10-13																	0
13-17																	0
17-21																	0
21+																	0
All Speeds	121	133	106	291	145	202	204	187	130	98	93	106	80	105	172	77	2250

a) Calm represents wind speeds less than or equal to 0.50 mph.

Number of Calms: 18
Number of Variables: 0
Number of Observations: 2250

Table 2.7-69
Annual JFD of Wind Direction, Wind Speed, and Stability Class

RBS Site
December 2004 - November 2006
30-Ft. Tower

Pasquill Stability Class G
Extremely Stable (∆T > 4.0°C/100m)

Wind Speed (mph)[a]	Wind Direction From																
	E	ENE	ESE	N	NE	NNE	NNW	NW	S	SE	SSE	SSW	SW	W	WNW	WSW	All Directions
Calm		4		4	1	4	2	1		1					1		18
Calm-2	47	151	11	157	164	116	170	170	4	5	5	3	4	32	63	13	1115
2-4	10	24	3	31	3	3	20	14	1	5	1		1	1	5	3	125
4-6																	0
6-8																	0
8-10																	0
10-13																	0
13-17																	0
17-21																	0
21+																	0
All Speeds	57	179	14	192	168	123	192	185	5	11	6	3	5	33	69	16	1258

a) Calm represents wind speeds less than or equal to 0.50 mph.

Number of Calms: 22
Number of Variables: 0
Number of Observations: 1259

Table 2.7-70
Annual JFD of Wind Direction, Wind Speed, and Stability Class

RBS Site
December 2004 - November 2006
150-Ft. Tower

All Pasquill Stability Classes

Wind Speed (mph)[(a)]	Wind Direction From																
	E	ENE	ESE	N	NE	NNE	NNW	NW	S	SE	SSE	SSW	SW	W	WNW	WSW	All Directions
Calm				1		1				1							3
Calm-2	15	14	11	10	13	8	5	12	6	8	9	11	11	7	9	15	164
2-4	156	147	130	78	103	93	81	87	125	101	107	95	97	134	96	121	1751
4-6	202	253	274	204	260	284	142	165	296	248	249	321	269	344	209	297	4017
6-8	128	244	425	452	348	494	291	207	421	367	286	324	153	256	190	180	4766
8-10	78	180	407	328	444	288	255	118	288	322	199	170	57	69	96	63	3362
10-13	47	172	263	129	217	83	150	98	119	121	144	133	42	24	76	25	1843
13-17	12	60	73	14	17	6	54	45	54	25	64	56	11	3	38	1	533
17-21		13	6	1	2		4	7	7	10	16	5			7		78
21+	2	6	7	2	2		2	2	5	4	7	1			3		43
All Speeds	640	1089	1596	1219	1406	1257	984	741	1321	1207	1081	1116	640	837	724	702	16,560

a) Calm represents wind speeds less than or equal to 0.50 mph.

Number of Calms: 3
Number of Variables: 0
Number of Observations: 16,560

Table 2.7-71
Annual JFD of Wind Direction, Wind Speed, and Stability Class

RBS Site
December 2004 - November 2006
150-Ft. Tower

Pasquill Stability Class A
Extremely Unstable (ΔT < -1.9°C/100m)

Wind Speed (mph)[a]	Wind Direction From																
	E	ENE	ESE	N	NE	NNE	NNW	NW	S	SE	SSE	SSW	SW	W	WNW	WSW	All Directions
Calm																	0
Calm-2																	0
2-4	1	1	1														3
4-6	2	4	5		1					1							13
6-8	6	4	3		14	5				3	1					1	37
8-10	4	10	9	1	8	5				2				1			40
10-13	4	5	5		5	2				2				1	1		25
13-17		1	2		2												5
17-21																	0
21+			1														1
All Speeds	17	25	26	1	30	12	0	0	0	8	1	0	0	2	1	1	124

a) Calm represents wind speeds less than or equal to 0.50 mph.

Number of Calms: 0
Number of Variables: 0
Number of Observations: 124

Table 2.7-72
Annual JFD of Wind Direction, Wind Speed, and Stability Class

RBS Site
December 2004 - November 2006
150-Ft. Tower

Pasquill Stability Class B
Moderately Unstable (-1.9°C/100m < ∆T < -1.7°C/100m)

Wind Speed (mph)[(a)]	Wind Direction From																
	E	ENE	ESE	N	NE	NNE	NNW	NW	S	SE	SSE	SSW	SW	W	WNW	WSW	All Directions
Calm										1							1
Calm-2							1										1
2-4		1	1							1							3
4-6		1	1		2	1				1	1			1		1	9
6-8		1			2	1											4
8-10	2	3	3		4	5				1	2						20
10-13		5	4		1	2		1						1			14
13-17		1															1
17-21			1														1
21+																	0
All Speeds	2	12	10	0	9	9	1	1	0	4	3	0	0	2	0	1	54

a) Calm represents wind speeds less than or equal to 0.50 mph.

Number of Calms: 1
Number of Variables: 0
Number of Observations: 54

Table 2.7-73
Annual JFD of Wind Direction, Wind Speed, and Stability Class

RBS Site
December 2004 - November 2006
150-Ft. Tower

Pasquill Stability Class C
Slightly Unstable (-1.7°C/100m < ΔT < -1.5°C/100m)

Wind Speed (mph)[a]	Wind Direction From																
	E	ENE	ESE	N	NE	NNE	NNW	NW	S	SE	SSE	SSW	SW	W	WNW	WSW	All Directions
Calm																	0
Calm-2		1															1
2-4	1									1							2
4-6	1		3	2							1	1		1		2	11
6-8		3	1	2	4	4	1	1	3	3					1	4	27
8-10	7	5	2	4	6	6	1	2	3	5					1	2	44
10-13	3	9	4	1	10	4		2		1							34
13-17		1	2		3	2				1							9
17-21																	0
21+									1								1
All Speeds	12	19	12	9	23	16	2	5	7	11	1	1	0	1	2	8	129

a) Calm represents wind speeds less than or equal to 0.50 mph.

Number of Calms: 0
Number of Variables: 0
Number of Observations: 129

Table 2.7-74
Annual JFD of Wind Direction, Wind Speed, and Stability Class

RBS Site
December 2004 - November 2006
150-Ft. Tower

Pasquill Stability Class D
Neutral (-1.5°C/100m < ∆T < -0.5°C/100m)

Wind Speed (mph)[a]	Wind Direction From																
	E	ENE	ESE	N	NE	NNE	NNW	NW	S	SE	SSE	SSW	SW	W	WNW	WSW	All Directions
Calm																	0
Calm-2		1	1	1	1					1			1		1		7
2-4	23	13	15	17	24	22	16	13	11	5	8	9	12	19	12	22	241
4-6	42	53	65	69	76	89	47	35	42	46	39	58	60	100	45	70	936
6-8	38	62	96	153	96	149	92	67	100	68	59	55	27	105	49	84	1300
8-10	18	53	104	128	81	72	114	52	85	58	66	43	18	38	37	32	999
10-13	10	46	58	69	46	37	94	53	41	28	57	37	18	14	58	11	677
13-17	3	18	19	5	6		39	32	21	12	25	27	9	3	28	1	248
17-21			1		1		4	6	2	2	2	4			6		28
21+	1		2							2	4	1			2		12
All Speeds	135	246	361	442	331	369	406	258	302	222	260	234	145	279	238	220	4448

a) Calm represents wind speeds less than or equal to 0.50 mph.

Number of Calms: 0
Number of Variables: 0
Number of Observations: 4448

Table 2.7-75
Annual JFD of Wind Direction, Wind Speed, and Stability Class

RBS Site
December 2004 - November 2006
150-Ft. Tower

Pasquill Stability Class E
Slightly Stable (-0.5°C/100m < ∆T < 1.5°C/100m)

Wind Speed (mph)[a]	Wind Direction From																
	E	ENE	ESE	N	NE	NNE	NNW	NW	S	SE	SSE	SSW	SW	W	WNW	WSW	All Directions
Calm																	0
Calm-2	3	6	7	6	5	2	1	3	3	3	5	3	1	2	2	6	58
2-4	79	86	58	28	63	43	42	41	53	46	39	43	40	59	54	56	830
4-6	95	139	138	92	123	131	57	78	153	131	115	161	125	147	82	137	1904
6-8	54	119	264	220	133	241	128	63	248	201	148	216	99	93	71	67	2365
8-10	39	82	209	147	231	149	104	58	188	201	122	116	39	27	43	28	1783
10-13	24	98	167	59	123	30	56	42	78	84	85	96	24	8	17	14	1005
13-17	9	36	50	9	6	3	15	13	33	12	39	29	2		10		266
17-21		13	4	1	1			1	5	8	14	1			1		49
21+	1	6	4	2	2		2	2	4	2	3				1		29
All Speeds	304	585	901	564	687	599	405	301	765	688	570	665	330	336	281	308	8289

a) Calm represents wind speeds less than or equal to 0.50 mph.

Number of Calms: 0
Number of Variables: 0
Number of Observations: 8289

Table 2.7-76
Annual JFD of Wind Direction, Wind Speed, and Stability Class

RBS Site
December 2004 - November 2006
150-Ft. Tower

Pasquill Stability Class F
Moderately Stable (1.5°C/100m < ∆T < 4.0°C/100m)

Wind Speed (mph)[(a)]	Wind Direction From																
	E	ENE	ESE	N	NE	NNE	NNW	NW	S	SE	SSE	SSW	SW	W	WNW	WSW	All Directions
Calm																	0
Calm-2	6	3	2	1	3	1	2	7	2	2	2	5	3	3	3	5	50
2-4	29	27	37	19	9	12	14	21	40	34	43	29	35	37	22	31	439
4-6	33	39	50	23	28	30	18	26	69	41	57	71	63	55	43	58	704
6-8	13	28	46	47	59	55	32	34	62	56	51	44	20	22	32	8	609
8-10	7	23	59	38	89	46	18	2	12	41	8	11		3	8	1	366
10-13	6	8	18		30	8				6	2						78
13-17		3				1											4
17-21																	0
21+																	0
All Speeds	94	131	212	128	218	153	84	90	185	180	163	160	121	120	108	103	2250

a) Calm represents wind speeds less than or equal to 0.50 mph.

Number of Calms: 0
Number of Variables: 0
Number of Observations: 2250

Table 2.7-77
Annual JFD of Wind Direction, Wind Speed, and Stability Class

RBS Site
December 2004 - November 2006
150-Ft. Tower

Pasquill Stability Class G
Extremely Stable (ΔT > 4.0°C/100m)

Wind Speed (mph)[a]	Wind Direction From																
	E	ENE	ESE	N	NE	NNE	NNW	NW	S	SE	SSE	SSW	SW	W	WNW	WSW	All Directions
Calm																	0
Calm-2	6	3	1	2	4	5	1	2	1	2	2	3	5	2	3	4	46
2-4	22	19	18	14	7	16	9	12	21	14	16	14	10	18	8	12	230
4-6	29	17	12	17	30	33	20	26	32	28	36	30	21	40	39	29	439
6-8	17	27	15	30	40	39	38	42	8	36	27	9	7	36	37	16	424
8-10	1	4	21	10	25	5	18	4		14	1				7		110
10-13		1	7		2												10
13-17																	0
17-21																	0
21+																	0
All Speeds	75	71	74	73	108	98	86	86	62	94	82	56	43	96	94	61	1259

a) Calm represents wind speeds less than or equal to 0.50 mph.

Number of Calms: 0
Number of Variables: 0
Number of Observations: 1259

Table 2.7-78
Distance to Site Boundary

Downwind Sector	Distance to Site Boundary, m
S	1737
SSW	3535
SW	3108
WSW	1554
W	1554
WNW	1798
NW	1219
NNW	1280
N	1219
NNE	1066
NE	1066
ENE	1127
E	1341
ESE	1158
SE	1524
SSE	1676

Table 2.7-79
Site Boundary χ/Q and D/Q Factors for Ground-Level Release

Direction	No Decay, Undepleted χ/Q (sec/m^3)	2.260-Day Decay, Undepleted χ/Q (sec/m^3)	8.000-Day Decay, Depleted χ/Q (sec/m^3)	D/Q (m^{-2})
S	1.5E-05	1.4E-05	1.3E-05	1.6E-08
SSW	2.7E-06	2.6E-06	2.2E-06	2.2E-09
SW	3.5E-06	3.3E-06	2.8E-06	2.5E-09
WSW	1.5E-05	1.5E-05	1.3E-05	1.1E-08
W	9.5E-06	9.3E-06	8.3E-06	7.9E-09
WNW	5.7E-06	5.6E-06	5.0E-06	7.5E-09
NW	2.1E-05	2.1E-05	1.9E-05	4.4E-08
NNW	1.2E-05	1.2E-05	1.1E-05	2.9E-08
N	1.2E-05	1.1E-05	1.0E-05	3.2E-08
NNE	1.2E-05	1.2E-05	1.1E-05	2.5E-08
NE	9.6E-06	9.5E-06	8.6E-06	1.5E-08
ENE	1.0E-05	1.0E-05	9.0E-06	1.5E-08
E	9.1E-06	9.0E-06	8.0E-06	1.1E-08
ESE	2.1E-05	2.0E-05	1.8E-05	2.0E-08
SE	1.6E-05	1.6E-05	1.4E-05	1.4E-08
SSE	1.3E-05	1.3E-05	1.1E-05	1.3E-08

Table 2.7-80
Site Boundary χ/Q and D/Q Factors for Mixed-Mode Release from the Reactor Building/Fuel Building Stack

Direction	No Decay, Undepleted χ/Q (sec/m^3)	2.260-Day Decay, Undepleted χ/Q (sec/m^3)	8.000-Day Decay, Depleted χ/Q (sec/m^3)	D/Q (m^{-2})
S	4.1E-07	4.1E-07	4.0E-07	4.2E-09
SSW	1.5E-07	1.5E-07	1.5E-07	6.0E-10
SW	1.4E-07	1.4E-07	1.4E-07	6.2E-10
WSW	1.6E-07	1.6E-07	1.5E-07	1.7E-09
W	1.2E-07	1.2E-07	1.2E-07	1.1E-09
WNW	2.0E-07	2.0E-07	2.0E-07	1.5E-09
NW	5.6E-07	5.6E-07	5.3E-07	8.5E-09
NNW	5.4E-07	5.4E-07	5.1E-07	7.8E-09
N	6.0E-07	6.0E-07	5.6E-07	8.9E-09
NNE	2.7E-07	2.7E-07	2.5E-07	3.9E-09
NE	1.4E-07	1.4E-07	1.4E-07	2.6E-09
ENE	1.4E-07	1.4E-07	1.3E-07	2.4E-09
E	1.7E-07	1.7E-07	1.6E-07	2.5E-09
ESE	1.8E-07	1.8E-07	1.8E-07	3.3E-09
SE	1.8E-07	1.8E-07	1.7E-07	2.9E-09
SSE	2.5E-07	2.5E-07	2.3E-07	3.6E-09

Table 2.7-81
Site Boundary χ/Q and D/Q Factors for Mixed-Mode Release from the Turbine Building Stack

Direction	No Decay, Undepleted χ/Q (sec/m^3)	2.260-Day Decay, Undepleted χ/Q (sec/m^3)	8.000-Day Decay, Depleted χ/Q (sec/m^3)	D/Q (m^{-2})
S	2.9E-07	2.9E-07	2.7E-07	3.6E-09
SSW	1.0E-07	1.0E-07	1.0E-07	5.6E-10
SW	9.7E-08	9.6E-08	9.3E-08	5.9E-10
WSW	1.0E-07	1.0E-07	9.9E-08	1.6E-09
W	7.3E-08	7.3E-08	7.0E-08	1.1E-09
WNW	1.2E-07	1.2E-07	1.2E-07	1.4E-09
NW	4.8E-07	4.8E-07	4.5E-07	7.5E-09
NNW	4.5E-07	4.5E-07	4.2E-07	6.9E-09
N	5.3E-07	5.3E-07	4.9E-07	7.9E-09
NNE	2.7E-07	2.7E-07	2.5E-07	3.6E-09
NE	1.3E-07	1.3E-07	1.2E-07	2.2E-09
ENE	1.3E-07	1.3E-07	1.2E-07	2.5E-09
E	1.3E-07	1.3E-07	1.2E-07	2.1E-09
ESE	1.5E-07	1.5E-07	1.4E-07	2.7E-09
SE	1.4E-07	1.4E-07	1.3E-07	2.5E-09
SSE	1.9E-07	1.9E-07	1.8E-07	3.1E-09

Table 2.7-82 (Sheet 1 of 2)
Annual Average χ/Q Values (No Decay) for Ground-Level Release

USNRC COMPUTER CODE - XOQDOQ, VERSION 2.0 RUN DATE: 5-23-2008 14: 3
RBS COL
GROUND LEVEL/RADWASTE BUILDING
NO DECAY, UNDEPLETED
CORRECTED USING STANDARD OPEN TERRAIN FACTORS

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) — DISTANCE IN MILES FROM THE SITE

SECTOR	.250	.500	.750	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500
S	2.647E-04	7.675E-05	3.705E-05	1.775E-05	6.768E-06	3.596E-06	2.263E-06	1.575E-06	1.173E-06	9.160E-07	7.410E-07
SSW	2.418E-04	7.012E-05	3.384E-05	1.621E-05	6.184E-06	3.287E-06	2.068E-06	1.440E-06	1.073E-06	8.378E-07	6.779E-07
SW	2.376E-04	6.880E-05	3.314E-05	1.588E-05	6.066E-06	3.229E-06	2.034E-06	1.418E-06	1.057E-06	8.266E-07	6.693E-07
WSW	2.111E-04	6.113E-05	2.945E-05	1.412E-05	5.395E-06	2.873E-06	1.811E-06	1.263E-06	9.422E-07	7.368E-07	5.967E-07
W	1.291E-04	3.759E-05	1.822E-05	8.723E-06	3.317E-06	1.759E-06	1.104E-06	7.671E-07	5.703E-07	4.446E-07	3.592E-07
WNW	1.105E-04	3.230E-05	1.578E-05	7.538E-06	2.848E-06	1.500E-06	9.362E-07	6.472E-07	4.790E-07	3.719E-07	2.993E-07
NW	1.524E-04	4.463E-05	2.189E-05	1.044E-05	3.928E-06	2.060E-06	1.281E-06	8.827E-07	6.513E-07	5.044E-07	4.050E-07
NNW	9.643E-05	2.821E-05	1.382E-05	6.596E-06	2.482E-06	1.302E-06	8.098E-07	5.581E-07	4.119E-07	3.190E-07	2.562E-07
N	8.204E-05	2.401E-05	1.178E-05	5.618E-06	2.110E-06	1.105E-06	6.857E-07	4.719E-07	3.477E-07	2.690E-07	2.158E-07
NNE	6.705E-05	1.964E-05	9.630E-06	4.597E-06	1.730E-06	9.075E-07	5.644E-07	3.890E-07	2.870E-07	2.223E-07	1.785E-07
NE	5.421E-05	1.585E-05	7.748E-06	3.699E-06	1.394E-06	7.325E-07	4.562E-07	3.148E-07	2.326E-07	1.804E-07	1.450E-07
ENE	6.353E-05	1.850E-05	9.007E-06	4.303E-06	1.626E-06	8.567E-07	5.349E-07	3.700E-07	2.739E-07	2.128E-07	1.713E-07
E	8.447E-05	2.458E-05	1.193E-05	5.706E-06	2.162E-06	1.142E-06	7.146E-07	4.953E-07	3.673E-07	2.858E-07	2.304E-07
ESE	1.358E-04	3.946E-05	1.909E-05	9.144E-06	3.481E-06	1.847E-06	1.160E-06	8.067E-07	6.000E-07	4.681E-07	3.783E-07
SE	2.146E-04	6.215E-05	2.992E-05	1.435E-05	5.483E-06	2.920E-06	1.841E-06	1.284E-06	9.575E-07	7.487E-07	6.064E-07
S	2.647E-04	7.675E-05	3.705E-05	1.775E-05	6.768E-06	3.596E-06	2.263E-06	1.575E-06	1.173E-06	9.160E-07	7.410E-07
SSE	2.186E-04	6.331E-05	3.051E-05	1.463E-05	5.583E-06	2.970E-06	1.871E-06	1.304E-06	9.714E-07	7.591E-07	6.145E-07

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) — DISTANCE IN MILES FROM THE SITE

SECTOR	5.000	7.500	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000
S	6.159E-07	3.232E-07	2.132E-07	1.258E-07	8.703E-08	6.557E-08	5.212E-08	4.297E-08	3.638E-08	3.143E-08	2.759E-08
SSW	5.636E-07	2.958E-07	1.953E-07	1.153E-07	7.977E-08	6.012E-08	4.779E-08	3.941E-08	3.337E-08	2.883E-08	2.531E-08
SW	5.568E-07	2.932E-07	1.939E-07	1.149E-07	7.965E-08	6.013E-08	4.787E-08	3.952E-08	3.350E-08	2.897E-08	2.545E-08
WSW	4.966E-07	2.616E-07	1.732E-07	1.026E-07	7.118E-08	5.375E-08	4.279E-08	3.533E-08	2.995E-08	2.591E-08	2.276E-08
W	2.982E-07	1.557E-07	1.023E-07	6.003E-08	4.135E-08	3.105E-08	2.461E-08	2.025E-08	1.711E-08	1.475E-08	1.293E-08
WNW	2.477E-07	1.276E-07	8.303E-08	4.803E-08	3.274E-08	2.439E-08	1.920E-08	1.570E-08	1.320E-08	1.134E-08	9.895E-09
NW	3.344E-07	1.708E-07	1.104E-07	6.327E-08	4.285E-08	3.175E-08	2.489E-08	2.028E-08	1.699E-08	1.455E-08	1.266E-08
NNW	2.116E-07	1.081E-07	6.995E-08	4.012E-08	2.719E-08	2.016E-08	1.581E-08	1.289E-08	1.081E-08	9.255E-09	8.060E-09
N	1.780E-07	9.061E-08	5.846E-08	3.339E-08	2.256E-08	1.669E-08	1.307E-08	1.064E-08	8.904E-09	7.617E-09	6.627E-09
NNE	1.474E-07	7.528E-08	4.869E-08	2.791E-08	1.891E-08	1.401E-08	1.099E-08	8.953E-09	7.505E-09	6.426E-09	5.596E-09
NE	1.198E-07	6.145E-08	3.987E-08	2.296E-08	1.561E-08	1.160E-08	9.115E-09	7.443E-09	6.249E-09	5.359E-09	4.673E-09

Table 2.7-82 (Sheet 2 of 2)
Annual Average χ/Q Values (No Decay) for Ground-Level Release

ENE	1.418E-07	7.323E-08	4.775E-08	2.771E-08	1.894E-08	1.414E-08	1.115E-08	9.135E-09	7.691E-09	6.613E-09	5.779E-09
E	1.910E-07	9.908E-08	6.483E-08	3.781E-08	2.594E-08	1.942E-08	1.535E-08	1.260E-08	1.063E-08	9.152E-09	8.010E-09
ESE	3.142E-07	1.643E-07	1.082E-07	6.360E-08	4.388E-08	3.300E-08	2.618E-08	2.156E-08	1.823E-08	1.573E-08	1.380E-08
SE	5.046E-07	2.659E-07	1.760E-07	1.043E-07	7.235E-08	5.463E-08	4.350E-08	3.592E-08	3.045E-08	2.634E-08	2.314E-08
SSE	5.111E-07	2.688E-07	1.776E-07	1.051E-07	7.281E-08	5.494E-08	4.371E-08	3.607E-08	3.057E-08	2.643E-08	2.321E-08

VENT AND BUILDING PARAMETERS:

RELEASE HEIGHT	(METERS)	10.00	REP. WIND HEIGHT	(METERS)	10.0
DIAMETER	(METERS)	.00	BUILDING HEIGHT	(METERS)	.0
EXIT VELOCITY	(METERS)	.00	BLDG.MIN.CRS.SEC.AREA	(SQ.METERS)	350.0
			HEAT EMISSION RATE	(CAL/SEC)	.0

ALL GROUND-LEVEL RELEASES

USNRC COMPUTER CODE - XOQDOQ, VERSION 2.0 RUN DATE:5-23-2008 14: 3

RBS COL

GROUND RELEASE

NO DECAY, UNDEPLETED

CHI/Q (SEC/METER CUBED)FOR EACH SEGMENT

SEGMENT BOUNDARIES IN MILES FROM THE SITE

DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	3.729E-05	7.799E-06	2.343E-06	1.190E-06	7.465E-07	3.394E-07	1.280E-07	6.591E-08	4.307E-08	3.148E-08
SSW	3.407E-05	7.125E-06	2.142E-06	1.088E-06	6.829E-07	3.106E-07	1.173E-07	6.043E-08	3.950E-08	2.887E-08
SW	3.339E-05	6.987E-06	2.106E-06	1.073E-06	6.742E-07	3.077E-07	1.168E-07	6.043E-08	3.961E-08	2.901E-08
WSW	2.967E-05	6.212E-06	1.875E-06	9.557E-07	6.011E-07	2.745E-07	1.043E-07	5.401E-08	3.542E-08	2.594E-08
W	1.830E-05	3.826E-06	1.144E-06	5.787E-07	3.619E-07	1.636E-07	6.112E-08	3.122E-08	2.030E-08	1.478E-08
WNW	1.579E-05	3.291E-06	9.709E-07	4.863E-07	3.017E-07	1.345E-07	4.901E-08	2.454E-08	1.575E-08	1.136E-08
NW	2.185E-05	4.545E-06	1.329E-06	6.615E-07	4.083E-07	1.803E-07	6.467E-08	3.196E-08	2.034E-08	1.457E-08
NNW	1.381E-05	2.872E-06	8.404E-07	4.183E-07	2.583E-07	1.141E-07	4.100E-08	2.029E-08	1.293E-08	9.272E-09
N	1.176E-05	2.443E-06	7.119E-07	3.532E-07	2.176E-07	9.575E-08	3.415E-08	1.681E-08	1.067E-08	7.632E-09
NNE	9.618E-06	2.001E-06	5.857E-07	2.915E-07	1.800E-07	7.949E-08	2.853E-08	1.411E-08	8.982E-09	6.438E-09
NE	7.748E-06	1.612E-06	4.733E-07	2.362E-07	1.461E-07	6.483E-08	2.345E-08	1.167E-08	7.466E-09	5.369E-09
ENE	9.026E-06	1.879E-06	5.547E-07	2.781E-07	1.727E-07	7.715E-08	2.826E-08	1.422E-08	9.161E-09	6.624E-09
E	1.198E-05	2.496E-06	7.408E-07	3.728E-07	2.322E-07	1.043E-07	3.854E-08	1.953E-08	1.264E-08	9.167E-09
ESE	1.920E-05	4.013E-06	1.202E-06	6.088E-07	3.812E-07	1.727E-07	6.474E-08	3.318E-08	2.161E-08	1.576E-08
SE	3.016E-05	6.314E-06	1.906E-06	9.712E-07	6.109E-07	2.790E-07	1.060E-07	5.490E-08	3.600E-08	2.637E-08
SSE	3.074E-05	6.431E-06	1.937E-06	9.854E-07	6.190E-07	2.821E-07	1.069E-07	5.521E-08	3.616E-08	2.646E-08

Table 2.7-83 (Sheet 1 of 2)
Annual Average D/Q Values for Ground-Level Release

USNRC COMPUTER CODE - XOQDOQ, VERSION 2.0 RUN DATE: 5-23-2008 14: 3

RBS COL

GROUND LEVEL/RADWASTE BUILDING

CORRECTED USING STANDARD OPEN TERRAIN FACTORS

********************* RELATIVE DEPOSITION PER UNIT AREA (M**-2) AT FIXED POINTS BY DOWNWIND SECTORS ********************

DIRECTION FROM SITE	DISTANCES IN MILES										
	.25	.50	.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
S	2.330E-07	7.879E-08	4.045E-08	1.923E-08	6.908E-09	3.426E-09	2.017E-09	1.321E-09	9.294E-10	6.888E-10	5.308E-10
SSW	1.858E-07	6.283E-08	3.226E-08	1.534E-08	5.509E-09	2.732E-09	1.609E-09	1.053E-09	7.412E-10	5.493E-10	4.233E-10
SW	1.543E-07	5.218E-08	2.679E-08	1.274E-08	4.575E-09	2.269E-09	1.336E-09	8.748E-10	6.155E-10	4.562E-10	3.515E-10
WSW	1.223E-07	4.137E-08	2.124E-08	1.010E-08	3.627E-09	1.799E-09	1.059E-09	6.936E-10	4.880E-10	3.617E-10	2.787E-10
W	8.754E-08	2.960E-08	1.520E-08	7.226E-09	2.596E-09	1.287E-09	7.579E-10	4.963E-10	3.492E-10	2.588E-10	1.994E-10
WNW	1.210E-07	4.091E-08	2.100E-08	9.986E-09	3.587E-09	1.779E-09	1.047E-09	6.858E-10	4.826E-10	3.576E-10	2.756E-10
NW	2.558E-07	8.650E-08	4.441E-08	2.112E-08	7.585E-09	3.761E-09	2.215E-09	1.450E-09	1.020E-09	7.562E-10	5.828E-10
NNW	1.943E-07	6.570E-08	3.373E-08	1.604E-08	5.760E-09	2.857E-09	1.682E-09	1.101E-09	7.750E-10	5.743E-10	4.426E-10
N	1.890E-07	6.391E-08	3.281E-08	1.560E-08	5.604E-09	2.779E-09	1.636E-09	1.071E-09	7.539E-10	5.587E-10	4.306E-10
NNE	1.155E-07	3.907E-08	2.006E-08	9.536E-09	3.426E-09	1.699E-09	1.000E-09	6.550E-10	4.609E-10	3.415E-10	2.632E-10
NE	7.187E-08	2.430E-08	1.248E-08	5.933E-09	2.131E-09	1.057E-09	6.223E-10	4.075E-10	2.867E-10	2.125E-10	1.637E-10
ENE	7.548E-08	2.552E-08	1.310E-08	6.230E-09	2.238E-09	1.110E-09	6.535E-10	4.279E-10	3.011E-10	2.231E-10	1.719E-10
E	8.595E-08	2.906E-08	1.492E-08	7.095E-09	2.548E-09	1.264E-09	7.441E-10	4.873E-10	3.429E-10	2.541E-10	1.958E-10
ESE	1.064E-07	3.598E-08	1.848E-08	8.783E-09	3.155E-09	1.565E-09	9.213E-10	6.033E-10	4.245E-10	3.146E-10	2.424E-10
SE	1.422E-07	4.809E-08	2.469E-08	1.174E-08	4.217E-09	2.091E-09	1.231E-09	8.062E-10	5.673E-10	4.204E-10	3.240E-10
SSE	1.755E-07	5.935E-08	3.047E-08	1.449E-08	5.204E-09	2.581E-09	1.520E-09	9.951E-10	7.002E-10	5.189E-10	3.999E-10

DIRECTION FROM SITE	DISTANCES IN MILES										
	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
S	4.217E-10	1.873E-10	1.135E-10	5.735E-11	3.471E-11	2.327E-11	1.668E-11	1.252E-11	9.737E-12	7.778E-12	6.349E-12
SSW	3.363E-10	1.494E-10	9.049E-11	4.574E-11	2.768E-11	1.856E-11	1.330E-11	9.987E-12	7.765E-12	6.203E-12	5.063E-12
SW	2.793E-10	1.241E-10	7.515E-11	3.798E-11	2.299E-11	1.541E-11	1.105E-11	8.294E-12	6.449E-12	5.151E-12	4.205E-12
WSW	2.214E-10	9.837E-11	5.959E-11	3.012E-11	1.823E-11	1.222E-11	8.758E-12	6.576E-12	5.113E-12	4.084E-12	3.334E-12
W	1.584E-10	7.038E-11	4.264E-11	2.155E-11	1.304E-11	8.745E-12	6.266E-12	4.705E-12	3.659E-12	2.922E-12	2.385E-12
WNW	2.190E-10	9.727E-11	5.892E-11	2.978E-11	1.803E-11	1.209E-11	8.660E-12	6.503E-12	5.056E-12	4.039E-12	3.297E-12
NW	4.630E-10	2.057E-10	1.246E-10	6.297E-11	3.811E-11	2.555E-11	1.831E-11	1.375E-11	1.069E-11	8.540E-12	6.970E-12
NNW	3.516E-10	1.562E-10	9.462E-11	4.783E-11	2.895E-11	1.941E-11	1.391E-11	1.044E-11	8.119E-12	6.486E-12	5.294E-12
N	3.421E-10	1.520E-10	9.205E-11	4.653E-11	2.816E-11	1.888E-11	1.353E-11	1.016E-11	7.899E-12	6.309E-12	5.150E-12

Table 2.7-83 (Sheet 2 of 2)
Annual Average D/Q Values for Ground-Level Release

NNE	2.091E-10	9.289E-11	5.627E-11	2.844E-11	1.721E-11	1.154E-11	8.270E-12	6.210E-12	4.828E-12	3.857E-12	3.148E-12
NE	1.301E-10	5.779E-11	3.501E-11	1.769E-11	1.071E-11	7.180E-12	5.145E-12	3.863E-12	3.004E-12	2.399E-12	1.959E-12
ENE	1.366E-10	6.068E-11	3.676E-11	1.858E-11	1.125E-11	7.540E-12	5.403E-12	4.057E-12	3.154E-12	2.520E-12	2.057E-12
E	1.556E-10	6.910E-11	4.186E-11	2.116E-11	1.281E-11	8.586E-12	6.152E-12	4.620E-12	3.592E-12	2.869E-12	2.342E-12
ESE	1.926E-10	8.555E-11	5.182E-11	2.619E-11	1.585E-11	1.063E-11	7.617E-12	5.720E-12	4.447E-12	3.552E-12	2.900E-12
SE	2.574E-10	1.143E-10	6.926E-11	3.501E-11	2.119E-11	1.421E-11	1.018E-11	7.644E-12	5.944E-12	4.748E-12	3.875E-12
SSE	3.177E-10	1.411E-10	8.549E-11	4.321E-11	2.615E-11	1.753E-11	1.256E-11	9.434E-12	7.335E-12	5.860E-12	4.783E-12

USNRC COMPUTER CODE - XOQDOQ, VERSION 2.0 RUN DATE: 5-23-2008 14: 3

RBS COL

GROUND LEVEL/RADWASTE BUILDING

****************** RELATIVE DEPOSITION PER UNIT AREA (M**-2) BY DOWNWIND SECTORS *****************

SEGMENT BOUNDARIES IN MILES

DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	3.954E-08	8.099E-09	2.114E-09	9.496E-10	5.372E-10	2.066E-10	5.976E-11	2.369E-11	1.265E-11	7.829E-12
SSW	3.153E-08	6.459E-09	1.686E-09	7.573E-10	4.284E-10	1.647E-10	4.766E-11	1.889E-11	1.009E-11	6.244E-12
SW	2.619E-08	5.364E-09	1.400E-09	6.289E-10	3.558E-10	1.368E-10	3.958E-11	1.569E-11	8.377E-12	5.185E-12
WSW	2.076E-08	4.253E-09	1.110E-09	4.986E-10	2.821E-10	1.085E-10	3.138E-11	1.244E-11	6.642E-12	4.111E-12
W	1.486E-08	3.043E-09	7.944E-10	3.568E-10	2.018E-10	7.762E-11	2.245E-11	8.900E-12	4.753E-12	2.942E-12
WNW	2.053E-08	4.205E-09	1.098E-09	4.931E-10	2.789E-10	1.073E-10	3.103E-11	1.230E-11	6.568E-12	4.065E-12
NW	4.341E-08	8.892E-09	2.321E-09	1.043E-09	5.898E-10	2.268E-10	6.562E-11	2.601E-11	1.389E-11	8.596E-12
NNW	3.297E-08	6.753E-09	1.763E-09	7.918E-10	4.479E-10	1.723E-10	4.983E-11	1.975E-11	1.055E-11	6.528E-12
N	3.207E-08	6.570E-09	1.715E-09	7.703E-10	4.358E-10	1.676E-10	4.848E-11	1.921E-11	1.026E-11	6.351E-12
NNE	1.961E-08	4.016E-09	1.048E-09	4.709E-10	2.664E-10	1.024E-10	2.964E-11	1.175E-11	6.272E-12	3.882E-12
NE	1.220E-08	2.498E-09	6.522E-10	2.929E-10	1.657E-10	6.373E-11	1.844E-11	7.307E-12	3.902E-12	2.415E-12
ENE	1.281E-08	2.624E-09	6.849E-10	3.076E-10	1.740E-10	6.692E-11	1.936E-11	7.673E-12	4.098E-12	2.536E-12
E	1.459E-08	2.988E-09	7.800E-10	3.503E-10	1.982E-10	7.621E-11	2.205E-11	8.738E-12	4.666E-12	2.888E-12
ESE	1.806E-08	3.699E-09	9.656E-10	4.337E-10	2.453E-10	9.435E-11	2.729E-11	1.082E-11	5.777E-12	3.576E-12
SE	2.414E-08	4.944E-09	1.291E-09	5.796E-10	3.279E-10	1.261E-10	3.648E-11	1.446E-11	7.721E-12	4.779E-12
SSE	2.979E-08	6.101E-09	1.593E-09	7.154E-10	4.047E-10	1.556E-10	4.502E-11	1.784E-11	9.529E-12	5.898E-12

VENT AND BUILDING PARAMETERS:

RELEASE HEIGHT	(METERS)	10.00	REP. WIND HEIGHT	(METERS)	10.0
DIAMETER	(METERS)	.00	BUILDING HEIGHT	(METERS)	.0
EXIT VELOCITY	(METERS)	.00	BLDG.MIN.CRS.SEC.AREA	(SQ.METERS)	350.0
			HEAT EMISSION RATE	(CAL/SEC)	.0

Table 2.7-84 (Sheet 1 of 3)
Annual Average χ/Q Values (No Decay) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack

USNRC COMPUTER CODE - XOQDOQ, VERSION 2.0 RUN DATE: 5-23-2008 14: 3
RBS COL
REACTOR BUILDING/FUEL BUILDING STACK
NO DECAY, UNDEPLETED
CORRECTED USING STANDARD OPEN TERRAIN FACTORS

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) — DISTANCE IN MILES FROM THE SITE

SECTOR	.250	.500	.750	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500
S	1.150E-06	5.353E-07	4.969E-07	4.408E-07	2.903E-07	2.059E-07	1.552E-07	1.226E-07	1.003E-07	8.441E-08	7.260E-08
SSW	7.856E-07	3.639E-07	3.343E-07	3.237E-07	2.327E-07	1.715E-07	1.318E-07	1.053E-07	8.675E-08	7.333E-08	6.327E-08
SW	7.184E-07	3.290E-07	2.808E-07	2.599E-07	1.845E-07	1.361E-07	1.051E-07	8.440E-08	6.998E-08	5.951E-08	5.164E-08
WSW	4.100E-07	1.792E-07	1.569E-07	1.616E-07	1.277E-07	9.989E-08	8.017E-08	6.627E-08	5.618E-08	4.864E-08	4.283E-08
W	2.007E-07	1.061E-07	1.059E-07	1.264E-07	1.096E-07	8.862E-08	7.194E-08	5.956E-08	5.033E-08	4.333E-08	3.788E-08
WNW	4.672E-07	2.129E-07	1.943E-07	2.125E-07	1.716E-07	1.332E-07	1.050E-07	8.495E-08	7.040E-08	5.956E-08	5.129E-08
NW	1.490E-06	6.376E-07	5.612E-07	5.404E-07	3.827E-07	2.766E-07	2.084E-07	1.632E-07	1.320E-07	1.095E-07	1.040E-07
NNW	1.580E-06	6.729E-07	5.635E-07	4.670E-07	3.195E-07	2.326E-07	1.663E-07	1.259E-07	1.060E-07	9.134E-08	7.583E-08
N	1.776E-06	7.368E-07	5.984E-07	4.790E-07	2.882E-07	1.931E-07	1.597E-07	1.348E-07	1.106E-07	9.309E-08	7.643E-08
NNE	8.296E-07	3.384E-07	2.610E-07	2.079E-07	1.775E-07	1.496E-07	1.084E-07	8.280E-08	7.035E-08	6.100E-08	5.378E-08
NE	3.212E-07	1.583E-07	1.505E-07	1.483E-07	1.082E-07	7.996E-08	7.315E-08	6.665E-08	5.295E-08	4.339E-08	3.642E-08
ENE	3.202E-07	1.704E-07	1.370E-07	1.131E-07	1.054E-07	9.550E-08	7.151E-08	5.593E-08	4.917E-08	4.403E-08	4.005E-08
E	3.192E-07	1.856E-07	1.753E-07	1.636E-07	1.166E-07	8.643E-08	6.675E-08	5.344E-08	4.407E-08	3.721E-08	3.203E-08
ESE	3.579E-07	1.920E-07	1.885E-07	1.812E-07	1.318E-07	9.936E-08	7.791E-08	6.324E-08	5.280E-08	4.509E-08	3.922E-08
SE	5.630E-07	2.673E-07	2.203E-07	1.744E-07	1.339E-07	1.108E-07	8.605E-08	6.991E-08	5.871E-08	5.055E-08	4.437E-08
SSE	9.013E-07	4.098E-07	3.324E-07	2.570E-07	1.667E-07	1.191E-07	9.053E-08	7.207E-08	5.942E-08	5.033E-08	4.354E-08

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) — DISTANCE IN MILES FROM THE SITE

SECTOR	5.000	7.500	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000
S	6.356E-08	3.979E-08	2.923E-08	1.968E-08	1.478E-08	1.181E-08	9.806E-09	8.373E-09	7.297E-09	6.459E-09	5.789E-09
SSW	5.551E-08	3.493E-08	2.571E-08	1.735E-08	1.305E-08	1.043E-08	8.671E-09	7.410E-09	6.462E-09	5.724E-09	5.133E-09
SW	4.556E-08	2.936E-08	2.199E-08	1.520E-08	1.161E-08	9.392E-09	7.878E-09	6.780E-09	5.947E-09	5.294E-09	4.768E-09
WSW	3.825E-08	2.562E-08	1.958E-08	1.381E-08	1.066E-08	8.665E-09	7.292E-09	6.289E-09	5.524E-09	4.923E-09	4.437E-09
W	3.358E-08	2.167E-08	1.606E-08	1.082E-08	8.091E-09	6.423E-09	5.304E-09	4.505E-09	3.907E-09	3.443E-09	3.073E-09
WNW	4.485E-08	2.744E-08	1.959E-08	1.253E-08	9.042E-09	6.990E-09	5.653E-09	4.718E-09	4.032E-09	3.509E-09	3.097E-09
NW	9.888E-08	5.547E-08	3.768E-08	2.276E-08	1.586E-08	1.197E-08	9.504E-09	7.820E-09	6.604E-09	5.689E-09	4.978E-09
NNW	6.433E-08	3.577E-08	2.420E-08	1.456E-08	1.014E-08	7.645E-09	6.070E-09	4.994E-09	4.217E-09	3.633E-09	3.180E-09
N	6.425E-08	3.466E-08	2.305E-08	1.359E-08	9.347E-09	6.991E-09	5.515E-09	4.515E-09	3.797E-09	3.259E-09	2.844E-09
NNE	4.808E-08	2.643E-08	1.777E-08	1.062E-08	7.358E-09	5.532E-09	4.382E-09	3.599E-09	3.034E-09	2.611E-09	2.282E-09
NE	3.119E-08	1.787E-08	1.230E-08	7.554E-09	5.322E-09	4.048E-09	3.234E-09	2.674E-09	2.268E-09	1.961E-09	1.721E-09

Table 2.7-84 (Sheet 2 of 3)
Annual Average χ/Q Values (No Decay) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack

ENE	3.691E-08	2.106E-08	1.450E-08	8.930E-09	6.315E-09	4.821E-09	3.864E-09	3.205E-09	2.725E-09	2.362E-09	2.078E-09
E	2.803E-08	1.732E-08	1.250E-08	8.160E-09	5.981E-09	4.682E-09	3.826E-09	3.222E-09	2.775E-09	2.431E-09	2.159E-09
ESE	3.464E-08	2.220E-08	1.645E-08	1.112E-08	8.342E-09	6.643E-09	5.501E-09	4.683E-09	4.069E-09	3.593E-09	3.212E-09
SE	3.955E-08	2.646E-08	2.026E-08	1.434E-08	1.108E-08	9.022E-09	7.599E-09	6.557E-09	5.762E-09	5.135E-09	4.629E-09
SSE	3.834E-08	2.460E-08	1.842E-08	1.276E-08	9.784E-09	7.933E-09	6.670E-09	5.751E-09	5.053E-09	4.505E-09	4.063E-09

VENT AND BUILDING PARAMETERS:

RELEASE HEIGHT	(METERS)	52.62	REP. WIND HEIGHT	(METERS)	52.6
DIAMETER	(METERS)	2.40	BUILDING HEIGHT	(METERS)	48.0
EXIT VELOCITY	(METERS)	17.78	BLDG.MIN.CRS.SEC.AREA	(SQ.METERS)	.0
			HEAT EMISSION RATE	(CAL/SEC)	.0

AT THE RELEASE HEIGHT:			/	AT THE MEASURED WIND HEIGHT		(9.1 METERS)		
VENT RELEASE MODE	WIND SPEED	(METERS/SEC)	/	VENT RELEASE MODE	WIND SPEED	(METERS/SEC)	WIND SPEED	(METERS/SEC)
			/		STABLE CONDITIONS		UNSTABLE/NEUTRAL CONDITIONS	
ELEVATED	LESS THAN	3.556	/	ELEVATED	LESS THAN	1.482	LESS THAN	2.296
MIXED	BETWEEN	3.556 AND 17.780	/	MIXED	BETWEEN	1.482 AND 7.410	BETWEEN	2.296 AND 11.478
GROUND LEVEL	ABOVE	17.780	/	GROUND LEVEL	ABOVE	7.410	ABOVE	11.478
USNRC COMPUTER CODE	- XOQDOQ,	VERSION 2.0	/	RUN DATE:	5-23-2008	14: 3		

USNRC COMPUTER CODE - XOQDOQ, VERSION 2.0 RUN DATE:5-23-2008 14: 3

RBS COL

REACTOR BUILDING/FUEL BUILDING STACK

NO DECAY, UNDEPLETED

CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT SEGMENT BOUNDARIES IN MILES FROM THE SITE

DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	4.805E-07	2.862E-07	1.557E-07	1.006E-07	7.275E-08	4.038E-08	1.963E-08	1.180E-08	8.373E-09	6.459E-09
SSW	3.362E-07	2.257E-07	1.318E-07	8.693E-08	6.338E-08	3.541E-08	1.729E-08	1.042E-08	7.409E-09	5.724E-09
SW	2.822E-07	1.797E-07	1.051E-07	7.011E-08	5.172E-08	2.969E-08	1.511E-08	9.379E-09	6.776E-09	5.292E-09
WSW	1.639E-07	1.229E-07	7.987E-08	5.619E-08	4.285E-08	2.574E-08	1.369E-08	8.647E-09	6.284E-09	4.921E-09
W	1.151E-07	1.040E-07	7.143E-08	5.030E-08	3.790E-08	2.182E-08	1.077E-08	6.420E-09	4.505E-09	3.443E-09
WNW	2.065E-07	1.636E-07	1.045E-07	7.043E-08	5.136E-08	2.782E-08	1.255E-08	7.002E-09	4.724E-09	3.511E-09
NW	5.689E-07	3.706E-07	2.085E-07	1.323E-07	1.037E-07	5.721E-08	2.301E-08	1.202E-08	7.838E-09	5.697E-09
NNW	5.449E-07	3.137E-07	1.678E-07	1.061E-07	7.617E-08	3.697E-08	1.474E-08	7.679E-09	5.005E-09	3.638E-09
N	5.761E-07	2.883E-07	1.587E-07	1.108E-07	7.686E-08	3.608E-08	1.381E-08	7.029E-09	4.527E-09	3.265E-09

Table 2.7-84 (Sheet 3 of 3)
Annual Average χ/Q Values (No Decay) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack

NNE	2.546E-07	1.719E-07	1.092E-07	7.034E-08	5.381E-08	2.740E-08	1.076E-08	5.559E-09	3.607E-09	2.615E-09
NE	1.513E-07	1.046E-07	7.237E-08	5.322E-08	3.655E-08	1.835E-08	7.617E-09	4.062E-09	2.679E-09	1.963E-09
ENE	1.338E-07	1.027E-07	7.167E-08	4.914E-08	4.007E-08	2.167E-08	9.005E-09	4.837E-09	3.211E-09	2.365E-09
E	1.724E-07	1.136E-07	6.667E-08	4.413E-08	3.208E-08	1.756E-08	8.157E-09	4.686E-09	3.224E-09	2.432E-09
ESE	1.861E-07	1.284E-07	7.776E-08	5.285E-08	3.927E-08	2.241E-08	1.107E-08	6.640E-09	4.683E-09	3.593E-09
SE	2.103E-07	1.326E-07	8.618E-08	5.880E-08	4.441E-08	2.661E-08	1.421E-08	9.003E-09	6.552E-09	5.133E-09
SSE	3.161E-07	1.656E-07	9.076E-08	5.957E-08	4.363E-08	2.491E-08	1.270E-08	7.922E-09	5.748E-09	4.504E-09

AVERAGE EFFECTIVE STACK HEIGHT IN METERS FOR EACH SEGMENT

DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	7.128E+01	6.820E+01	6.822E+01	6.822E+01	6.822E+01	6.822E+01	6.822E+01	6.822E+01	6.822E+01	6.822E+01
SSW	7.416E+01	7.108E+01	7.110E+01	7.111E+01	7.111E+01	7.111E+01	7.111E+01	7.111E+01	7.111E+01	7.111E+01
SW	7.614E+01	7.305E+01	7.307E+01	7.308E+01	7.308E+01	7.308E+01	7.308E+01	7.308E+01	7.308E+01	7.308E+01
WSW	7.658E+01	7.356E+01	7.363E+01	7.365E+01	7.365E+01	7.365E+01	7.365E+01	7.365E+01	7.365E+01	7.365E+01
W	8.043E+01	7.740E+01	7.747E+01	7.749E+01	7.749E+01	7.749E+01	7.749E+01	7.749E+01	7.749E+01	7.749E+01
WNW	7.917E+01	7.610E+01	7.612E+01	7.613E+01	7.613E+01	7.613E+01	7.613E+01	7.613E+01	7.613E+01	7.613E+01
NW	7.440E+01	7.132E+01	7.134E+01	7.134E+01	6.329E+01	5.634E+01	5.634E+01	5.634E+01	5.634E+01	5.634E+01
NNW	6.916E+01	6.178E+01	5.906E+01	5.468E+01	5.107E+01	5.107E+01	5.107E+01	5.107E+01	5.107E+01	5.107E+01
N	6.836E+01	6.527E+01	5.678E+01	4.590E+01	4.228E+01	4.228E+01	4.228E+01	4.228E+01	4.228E+01	4.228E+01
NNE	7.867E+01	6.799E+01	6.218E+01	5.780E+01	4.989E+01	4.618E+01	4.618E+01	4.618E+01	4.618E+01	4.618E+01
NE	7.788E+01	7.488E+01	6.646E+01	5.998E+01	5.998E+01	5.998E+01	5.998E+01	5.998E+01	5.998E+01	5.998E+01
ENE	8.489E+01	7.418E+01	6.835E+01	6.397E+01	5.606E+01	5.236E+01	5.236E+01	5.236E+01	5.236E+01	5.236E+01
E	7.848E+01	7.540E+01	7.541E+01	7.542E+01	7.542E+01	7.542E+01	7.542E+01	7.542E+01	7.542E+01	7.542E+01
ESE	7.520E+01	7.212E+01	7.214E+01	7.214E+01	7.214E+01	7.214E+01	7.214E+01	7.214E+01	7.214E+01	7.214E+01
SE	7.832E+01	7.193E+01	6.885E+01	6.886E+01	6.886E+01	6.886E+01	6.886E+01	6.886E+01	6.886E+01	6.886E+01
SSE	7.713E+01	7.560E+01	7.561E+01	7.562E+01	7.562E+01	7.562E+01	7.562E+01	7.562E+01	7.562E+01	7.562E+01

Table 2.7-85 (Sheet 1 of 3)
Annual Average D/Q Values (No Decay) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack

USNRC COMPUTER CODE - XOQDOQ, VERSION 2.0 RUN DATE: 5-23-2008 14: 3

RBS COL

REACTOR BUILDING/FUEL BUILDING STACK

CORRECTED USING STANDARD OPEN TERRAIN FACTORS

********************** RELATIVE DEPOSITION PER UNIT AREA (M**-2) AT FIXED POINTS BY DOWNWIND SECTORS ********************

DISTANCE IN MILES

DIRECTION FROM SITE	.25	.50	.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
S	1.789E-08	1.273E-08	8.533E-09	4.895E-09	2.131E-09	1.168E-09	7.327E-10	5.022E-10	3.652E-10	2.773E-10	2.175E-10
SSW	1.061E-08	8.240E-09	5.346E-09	3.045E-09	1.311E-09	7.304E-10	4.650E-10	3.219E-10	2.358E-10	1.799E-10	1.415E-10
SW	8.813E-09	6.841E-09	4.406E-09	2.479E-09	1.043E-09	5.793E-10	3.686E-10	2.553E-10	1.871E-10	1.429E-10	1.125E-10
WSW	5.596E-09	4.365E-09	2.828E-09	1.598E-09	6.738E-10	3.758E-10	2.399E-10	1.665E-10	1.222E-10	9.341E-11	7.360E-11
W	3.174E-09	2.473E-09	1.713E-09	1.021E-09	4.465E-10	2.577E-10	1.682E-10	1.184E-10	8.767E-11	6.733E-11	5.319E-11
WNW	6.496E-09	5.030E-09	3.321E-09	1.910E-09	8.166E-10	4.608E-10	2.964E-10	2.067E-10	1.521E-10	1.164E-10	9.182E-11
NW	1.756E-08	1.340E-08	8.571E-09	4.835E-09	2.065E-09	1.146E-09	7.279E-10	5.032E-10	3.683E-10	2.808E-10	2.321E-10
NNW	2.084E-08	1.348E-08	8.754E-09	4.893E-09	2.078E-09	1.180E-09	7.257E-10	4.914E-10	3.562E-10	2.956E-10	2.402E-10
N	2.314E-08	1.417E-08	9.065E-09	5.018E-09	2.115E-09	1.136E-09	7.296E-10	5.209E-10	3.902E-10	3.149E-10	2.613E-10
NNE	9.496E-09	5.053E-09	4.243E-09	2.457E-09	1.076E-09	6.406E-10	3.978E-10	2.711E-10	1.982E-10	1.630E-10	1.429E-10
NE	4.343E-09	3.373E-09	2.311E-09	1.368E-09	6.088E-10	3.442E-10	2.403E-10	1.689E-10	1.244E-10	9.638E-11	7.759E-11
ENE	5.032E-09	3.220E-09	2.806E-09	1.619E-09	7.035E-10	4.353E-10	2.721E-10	1.861E-10	1.357E-10	1.073E-10	9.091E-11
E	5.093E-09	4.434E-09	2.979E-09	1.742E-09	7.672E-10	4.324E-10	2.772E-10	1.927E-10	1.415E-10	1.081E-10	8.509E-11
ESE	5.957E-09	4.586E-09	3.145E-09	1.849E-09	8.199E-10	4.585E-10	2.919E-10	2.020E-10	1.478E-10	1.126E-10	8.854E-11
SE	9.954E-09	5.493E-09	4.551E-09	2.614E-09	1.138E-09	6.242E-10	3.920E-10	2.688E-10	1.956E-10	1.485E-10	1.165E-10
SSE	1.471E-08	8.053E-09	6.778E-09	3.878E-09	1.682E-09	9.154E-10	5.713E-10	3.900E-10	2.830E-10	2.145E-10	1.681E-10

DISTANCE IN MILES

DIRECTION FROM SITE	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
S	1.750E-10	8.021E-11	4.787E-11	2.450E-11	1.547E-11	1.105E-11	8.565E-12	7.021E-12	5.993E-12	5.221E-12	4.673E-12
SSW	1.141E-10	5.314E-11	3.223E-11	1.690E-11	1.082E-11	7.903E-12	6.258E-12	5.232E-12	4.544E-12	4.017E-12	3.647E-12
SW	9.080E-11	4.259E-11	2.600E-11	1.376E-11	8.855E-12	6.542E-12	5.219E-12	4.386E-12	3.821E-12	3.383E-12	3.076E-12
WSW	5.942E-11	2.794E-11	1.709E-11	9.068E-12	5.855E-12	4.369E-12	3.539E-12	3.030E-12	2.689E-12	2.421E-12	2.240E-12
W	4.298E-11	2.041E-11	1.255E-11	6.675E-12	4.295E-12	3.203E-12	2.584E-12	2.203E-12	1.945E-12	1.745E-12	1.610E-12
WNW	7.413E-11	3.494E-11	2.140E-11	1.135E-11	7.291E-12	5.381E-12	4.278E-12	3.578E-12	3.101E-12	2.734E-12	2.474E-12
NW	2.294E-10	1.306E-10	9.003E-11	5.299E-11	3.418E-11	2.345E-11	1.719E-11	1.321E-11	1.058E-11	8.711E-12	7.354E-12
NNW	2.024E-10	1.119E-10	7.600E-11	4.405E-11	2.822E-11	1.922E-11	1.398E-11	1.065E-11	8.434E-12	6.877E-12	5.746E-12
N	2.253E-10	1.343E-10	9.493E-11	5.682E-11	3.653E-11	2.463E-11	1.763E-11	1.318E-11	1.022E-11	8.165E-12	6.667E-12

Table 2.7-85 (Sheet 2 of 3)
Annual Average D/Q Values (No Decay) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack

NNE	1.316E-10	8.094E-11	5.792E-11	3.496E-11	2.245E-11	1.506E-11	1.073E-11	7.982E-12	6.171E-12	4.912E-12	4.002E-12
NE	6.443E-11	3.368E-11	2.203E-11	1.237E-11	7.902E-12	5.465E-12	4.053E-12	3.161E-12	2.567E-12	2.141E-12	1.833E-12
ENE	8.563E-11	5.002E-11	3.485E-11	2.068E-11	1.332E-11	9.044E-12	6.535E-12	4.931E-12	3.870E-12	3.120E-12	2.572E-12
E	6.859E-11	3.197E-11	1.937E-11	1.012E-11	6.441E-12	4.647E-12	3.609E-12	2.946E-12	2.495E-12	2.155E-12	1.908E-12
ESE	7.131E-11	3.298E-11	1.982E-11	1.023E-11	6.484E-12	4.668E-12	3.650E-12	3.021E-12	2.601E-12	2.284E-12	2.063E-12
SE	9.375E-11	4.302E-11	2.569E-11	1.316E-11	8.323E-12	5.975E-12	4.675E-12	3.879E-12	3.352E-12	2.955E-12	2.679E-12
SSE	1.352E-10	6.174E-11	3.670E-11	1.868E-11	1.176E-11	8.363E-12	6.456E-12	5.269E-12	4.478E-12	3.886E-12	3.465E-12

USNRC COMPUTER CODE - XOQDOQ, VERSION 2.0 RUN DATE: 5-23-2008 14: 3
RBS COL
REACTOR BUILDING/FUEL BUILDING STACK

********************* RELATIVE DEPOSITION PER UNIT AREA (M**-2) BY DOWNWIND SECTORS ********************

SEGMENT BOUNDARIES IN MILES

DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	7.848E-09	2.317E-09	7.565E-10	3.708E-10	2.194E-10	8.689E-11	2.568E-11	1.123E-11	7.070E-12	5.247E-12
SSW	4.966E-09	1.438E-09	4.785E-10	2.391E-10	1.427E-10	5.739E-11	1.761E-11	8.023E-12	5.263E-12	4.036E-12
SW	4.091E-09	1.156E-09	3.795E-10	1.898E-10	1.135E-10	4.593E-11	1.430E-11	6.630E-12	4.409E-12	3.399E-12
WSW	2.623E-09	7.468E-10	2.468E-10	1.239E-10	7.422E-11	3.011E-11	9.422E-12	4.433E-12	3.045E-12	2.433E-12
W	1.574E-09	4.903E-10	1.721E-10	8.870E-11	5.360E-11	2.193E-11	6.922E-12	3.247E-12	2.214E-12	1.754E-12
WNW	3.074E-09	9.013E-10	3.043E-10	1.541E-10	9.257E-11	3.763E-11	1.178E-11	5.449E-12	3.596E-12	2.746E-12
NW	7.985E-09	2.272E-09	7.495E-10	3.735E-10	2.455E-10	1.345E-10	5.286E-11	2.381E-11	1.335E-11	8.764E-12
NNW	8.088E-09	2.304E-09	7.531E-10	3.717E-10	2.426E-10	1.161E-10	4.411E-11	1.952E-11	1.076E-11	6.919E-12
N	8.400E-09	2.325E-09	7.545E-10	3.989E-10	2.638E-10	1.370E-10	5.627E-11	2.500E-11	1.332E-11	8.220E-12
NNE	3.629E-09	1.189E-09	4.119E-10	2.056E-10	1.447E-10	8.197E-11	3.450E-11	1.530E-11	8.077E-12	4.948E-12
NE	2.128E-09	6.599E-10	2.394E-10	1.265E-10	7.828E-11	3.534E-11	1.253E-11	5.550E-12	3.189E-12	2.153E-12
ENE	2.371E-09	7.878E-10	2.812E-10	1.393E-10	9.381E-11	5.119E-11	2.056E-11	9.180E-12	4.985E-12	3.139E-12
E	2.752E-09	8.349E-10	2.848E-10	1.434E-10	8.580E-11	3.451E-11	1.054E-11	4.710E-12	2.964E-12	2.164E-12
ESE	2.889E-09	8.879E-10	3.003E-10	1.499E-10	8.930E-11	3.565E-11	1.070E-11	4.745E-12	3.041E-12	2.296E-12
SE	3.899E-09	1.238E-09	4.047E-10	1.986E-10	1.176E-10	4.659E-11	1.380E-11	6.081E-12	3.906E-12	2.970E-12
SSE	5.772E-09	1.829E-09	5.905E-10	2.875E-10	1.697E-10	6.694E-11	1.961E-11	8.506E-12	5.307E-12	3.905E-12

Table 2.7-85 (Sheet 3 of 3)
Annual Average D/Q Values (No Decay) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack

VENT AND BUILDING PARAMETERS:

RELEASE HEIGHT	(METERS)	52.62	REP. WIND HEIGHT	(METERS)	52.6
DIAMETER	(METERS)	2.40	BUILDING HEIGHT	(METERS)	48.0
EXIT VELOCITY	(METERS)	17.78	BLDG. MIN. CRS.SEC.AREA	(SQ. METERS)	.0
			HEAT EMISSION RATE	(CAL/SEC)	.0

AT THE RELEASE HEIGHT:			/	AT THE MEASURED WIND HEIGHT		(9.1 METERS)		
VENT RELEASE MODE	WIND SPEED	(METERS/SEC)	/	VENT RELEASE MODE	WIND SPEED	(METERS/SEC)	WIND SPEED	(METERS/SEC)
			/		STABLE CONDITIONS		UNSTABLE/NEUTRAL CONDITIONS	
ELEVATED	LESS THAN	3.556	/	ELEVATED	LESS THAN	1.482	LESS THAN	2.296
MIXED	BETWEEN	3.556 AND 17.780	/	MIXED	BETWEEN	1.482 AND 7.410	BETWEEN	2.296 AND 11.478
GROUND LEVEL	ABOVE	17.780	/	GROUND LEVEL	ABOVE	7.410	ABOVE	11.478

Table 2.7-86 (Sheet 1 of 3)
Annual Average χ/Q Values (No Decay) for Mixed-Mode Release from the Turbine Building Stack

USNRC COMPUTER CODE - XOQDOQ, VERSION 2.0 RUN DATE: 5-23-2008 14: 3
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TURBINE BUILDING STACK
NO DECAY, UNDEPLETED
CORRECTED USING STANDARD OPEN TERRAIN FACTORS

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) — DISTANCE IN MILES FROM THE SITE

SECTOR	.250	.500	.750	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500
S	1.418E-06	5.767E-07	4.153E-07	3.158E-07	2.029E-07	1.451E-07	1.100E-07	8.720E-08	7.145E-08	6.011E-08	5.164E-08
SSW	9.957E-07	4.084E-07	2.870E-07	2.234E-07	1.548E-07	1.158E-07	9.032E-08	7.286E-08	6.044E-08	5.130E-08	4.436E-08
SW	8.867E-07	3.651E-07	2.479E-07	1.845E-07	1.250E-07	9.334E-08	7.289E-08	5.893E-08	4.900E-08	4.168E-08	3.613E-08
WSW	4.674E-07	1.901E-07	1.283E-07	1.035E-07	7.942E-08	6.352E-08	5.179E-08	4.317E-08	3.674E-08	3.185E-08	2.804E-08
W	2.308E-07	1.106E-07	8.099E-08	7.387E-08	6.474E-08	5.483E-08	4.597E-08	3.889E-08	3.337E-08	2.904E-08	2.560E-08
WNW	5.309E-07	2.246E-07	1.541E-07	1.304E-07	1.052E-07	8.540E-08	6.969E-08	5.778E-08	4.877E-08	4.185E-08	3.644E-08
NW	1.870E-06	7.276E-07	4.886E-07	3.725E-07	2.570E-07	1.913E-07	1.479E-07	1.182E-07	9.706E-08	8.152E-08	7.792E-08
NNW	1.922E-06	7.347E-07	4.912E-07	3.457E-07	2.258E-07	1.665E-07	1.217E-07	9.359E-08	7.947E-08	6.894E-08	5.770E-08
N	2.165E-06	8.115E-07	5.344E-07	3.659E-07	2.132E-07	1.447E-07	1.200E-07	1.023E-07	8.481E-08	7.210E-08	5.969E-08
NNE	1.028E-06	3.830E-07	2.449E-07	1.641E-07	1.246E-07	1.055E-07	7.847E-08	6.103E-08	5.238E-08	4.578E-08	4.064E-08
NE	3.955E-07	1.690E-07	1.234E-07	1.008E-07	7.253E-08	5.506E-08	5.086E-08	4.684E-08	3.781E-08	3.136E-08	2.658E-08
ENE	3.855E-07	1.790E-07	1.228E-07	8.680E-08	7.264E-08	6.546E-08	5.008E-08	3.976E-08	3.505E-08	3.141E-08	2.858E-08
E	3.858E-07	1.888E-07	1.443E-07	1.158E-07	8.056E-08	6.043E-08	4.721E-08	3.813E-08	3.164E-08	2.685E-08	2.319E-08
ESE	4.355E-07	1.977E-07	1.507E-07	1.227E-07	8.704E-08	6.636E-08	5.257E-08	4.297E-08	3.604E-08	3.088E-08	2.691E-08
SE	6.623E-07	2.791E-07	1.923E-07	1.337E-07	9.446E-08	7.563E-08	5.836E-08	4.705E-08	3.921E-08	3.351E-08	2.923E-08
SSE	1.091E-06	4.420E-07	2.979E-07	2.027E-07	1.246E-07	8.855E-08	6.726E-08	5.345E-08	4.393E-08	3.707E-08	3.194E-08

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) — DISTANCE IN MILES FROM THE SITE

SECTOR	5.000	7.500	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000
S	4.514E-08	2.805E-08	2.049E-08	1.374E-08	1.032E-08	8.255E-09	6.872E-09	5.882E-09	5.138E-09	4.559E-09	4.096E-09
SSW	3.898E-08	2.455E-08	1.804E-08	1.216E-08	9.152E-09	7.330E-09	6.107E-09	5.231E-09	4.573E-09	4.059E-09	3.648E-09
SW	3.184E-08	2.031E-08	1.510E-08	1.036E-08	7.911E-09	6.406E-09	5.386E-09	4.648E-09	4.089E-09	3.650E-09	3.296E-09
WSW	2.502E-08	1.668E-08	1.273E-08	9.003E-09	6.987E-09	5.716E-09	4.839E-09	4.197E-09	3.705E-09	3.317E-09	3.002E-09
W	2.283E-08	1.501E-08	1.123E-08	7.652E-09	5.761E-09	4.599E-09	3.815E-09	3.253E-09	2.830E-09	2.502E-09	2.239E-09
WNW	3.216E-08	2.025E-08	1.467E-08	9.546E-09	6.952E-09	5.408E-09	4.393E-09	3.680E-09	3.154E-09	2.751E-09	2.434E-09
NW	7.460E-08	4.300E-08	2.963E-08	1.818E-08	1.278E-08	9.705E-09	7.740E-09	6.388E-09	5.409E-09	4.669E-09	4.094E-09
NNW	4.930E-08	2.801E-08	1.918E-08	1.170E-08	8.206E-09	6.221E-09	4.958E-09	4.090E-09	3.462E-09	2.988E-09	2.620E-09
N	5.052E-08	2.785E-08	1.874E-08	1.119E-08	7.752E-09	5.825E-09	4.611E-09	3.784E-09	3.189E-09	2.742E-09	2.396E-09
NNE	3.658E-08	2.060E-08	1.403E-08	8.509E-09	5.945E-09	4.494E-09	3.574E-09	2.944E-09	2.489E-09	2.146E-09	1.879E-09

SOF 2.7-502

Table 2.7-86 (Sheet 2 of 3)
Annual Average χ/Q Values (No Decay) for Mixed-Mode Release from the Turbine Building Stack

NE	2.295E-08	1.349E-08	9.415E-09	5.874E-09	4.176E-09	3.196E-09	2.566E-09	2.129E-09	1.811E-09	1.569E-09	1.380E-09
ENE	2.637E-08	1.542E-08	1.076E-08	6.739E-09	4.815E-09	3.702E-09	2.984E-09	2.485E-09	2.120E-09	1.843E-09	1.626E-09
E	2.036E-08	1.270E-08	9.211E-09	6.049E-09	4.455E-09	3.500E-09	2.869E-09	2.422E-09	2.090E-09	1.835E-09	1.633E-09
ESE	2.381E-08	1.533E-08	1.139E-08	7.745E-09	5.842E-09	4.675E-09	3.888E-09	3.323E-09	2.898E-09	2.566E-09	2.301E-09
SE	2.591E-08	1.706E-08	1.300E-08	9.218E-09	7.177E-09	5.886E-09	4.993E-09	4.336E-09	3.832E-09	3.434E-09	3.110E-09
SSE	2.800E-08	1.762E-08	1.301E-08	8.870E-09	6.755E-09	5.463E-09	4.590E-09	3.960E-09	3.483E-09	3.110E-09	2.809E-09

VENT AND BUILDING PARAMETERS:

RELEASE HEIGHT	(METERS)	71.30	REP. WIND HEIGHT	(METERS)	71.3
DIAMETER	(METERS)	1.95	BUILDING HEIGHT	(METERS)	52.0
EXIT VELOCITY	(METERS)	17.78	BLDG.MIN.CRS.SEC.AREA	(SQ.METERS)	.0
			HEAT EMISSION RATE	(CAL/SEC)	.0

AT THE RELEASE HEIGHT:			/	AT THE MEASURED WIND HEIGHT		(9.1 METERS)		
VENT RELEASE MODE	WIND SPEED	(METERS/SEC)	/	VENT RELEASE MODE	WIND SPEED	(METERS/SEC)	WIND SPEED	(METERS/SEC)
			/		STABLE CONDITIONS		UNSTABLE/NEUTRAL CONDITIONS	
ELEVATED	LESS THAN	3.556	/	ELEVATED	LESS THAN	1.273	LESS THAN	2.128
MIXED	BETWEEN	3.556 AND 17.780	/	MIXED	BETWEEN	1.273 AND 6.366	BETWEEN	2.128 AND 10.639
GROUND LEVEL	ABOVE	17.780	/	GROUND LEVEL	ABOVE	6.366	ABOVE	10.639

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RBS COL
TURBINE BUILDING STACK
NO DECAY, UNDEPLETED
CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

SEGMENT BOUNDARIES IN MILES FROM THE SITE

DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	4.070E-07	2.023E-07	1.102E-07	7.163E-08	5.174E-08	2.849E-08	1.372E-08	8.253E-09	5.881E-09	4.559E-09
SSW	2.857E-07	1.527E-07	9.013E-08	6.051E-08	4.442E-08	2.486E-08	1.213E-08	7.327E-09	5.231E-09	4.059E-09
SW	2.458E-07	1.241E-07	7.276E-08	4.905E-08	3.619E-08	2.055E-08	1.032E-08	6.400E-09	4.646E-09	3.649E-09
WSW	1.310E-07	7.770E-08	5.147E-08	3.671E-08	2.805E-08	1.678E-08	8.935E-09	5.704E-09	4.193E-09	3.315E-09
W	8.440E-08	6.236E-08	4.550E-08	3.330E-08	2.559E-08	1.507E-08	7.607E-09	4.595E-09	3.252E-09	2.502E-09
WNW	1.592E-07	1.020E-07	6.911E-08	4.871E-08	3.646E-08	2.042E-08	9.532E-09	5.414E-09	3.683E-09	2.753E-09
NW	4.901E-07	2.534E-07	1.476E-07	9.718E-08	7.776E-08	4.408E-08	1.833E-08	9.740E-09	6.401E-09	4.675E-09
NNW	4.807E-07	2.261E-07	1.224E-07	7.949E-08	5.792E-08	2.882E-08	1.181E-08	6.245E-09	4.099E-09	2.992E-09
N	5.211E-07	2.166E-07	1.195E-07	8.495E-08	5.997E-08	2.884E-08	1.134E-08	5.854E-09	3.794E-09	2.747E-09

Table 2.7-86 (Sheet 3 of 3)
Annual Average χ/Q Values (No Decay) for Mixed-Mode Release from the Turbine Building Stack

NNE	2.397E-07	1.249E-07	7.871E-08	5.234E-08	4.066E-08	2.123E-08	8.597E-09	4.513E-09	2.951E-09	2.149E-09
NE	1.235E-07	7.104E-08	5.038E-08	3.794E-08	2.665E-08	1.378E-08	5.906E-09	3.205E-09	2.133E-09	1.571E-09
ENE	1.193E-07	7.260E-08	5.005E-08	3.501E-08	2.860E-08	1.578E-08	6.778E-09	3.711E-09	2.489E-09	1.845E-09
E	1.415E-07	7.944E-08	4.710E-08	3.167E-08	2.323E-08	1.285E-08	6.043E-09	3.502E-09	2.423E-09	1.836E-09
ESE	1.487E-07	8.577E-08	5.241E-08	3.605E-08	2.694E-08	1.546E-08	7.709E-09	4.671E-09	3.323E-09	2.566E-09
SE	1.855E-07	9.482E-08	5.844E-08	3.928E-08	2.927E-08	1.722E-08	9.151E-09	5.873E-09	4.332E-09	3.432E-09
SSE	2.876E-07	1.259E-07	6.741E-08	4.404E-08	3.200E-08	1.788E-08	8.849E-09	5.458E-09	3.958E-09	3.109E-09

AVERAGE EFFECTIVE STACK HEIGHT IN METERS FOR EACH SEGMENT

DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	8.301E+01	7.993E+01	7.994E+01	7.994E+01	7.994E+01	7.994E+01	7.994E+01	7.994E+01	7.994E+01	7.994E+01
SSW	8.542E+01	8.234E+01	8.235E+01	8.235E+01	8.235E+01	8.235E+01	8.235E+01	8.235E+01	8.235E+01	8.235E+01
SW	8.696E+01	8.387E+01	8.388E+01	8.388E+01	8.388E+01	8.388E+01	8.388E+01	8.388E+01	8.388E+01	8.388E+01
WSW	8.752E+01	8.448E+01	8.452E+01	8.452E+01	8.452E+01	8.452E+01	8.452E+01	8.452E+01	8.452E+01	8.452E+01
W	9.045E+01	8.741E+01	8.744E+01	8.744E+01	8.744E+01	8.744E+01	8.744E+01	8.744E+01	8.744E+01	8.744E+01
WNW	8.921E+01	8.613E+01	8.614E+01	8.614E+01	8.614E+01	8.614E+01	8.614E+01	8.614E+01	8.614E+01	8.614E+01
NW	8.538E+01	8.229E+01	8.230E+01	8.230E+01	7.425E+01	6.731E+01	6.730E+01	6.730E+01	6.730E+01	6.730E+01
NNW	8.116E+01	7.378E+01	7.106E+01	6.668E+01	6.306E+01	6.306E+01	6.306E+01	6.306E+01	6.306E+01	6.306E+01
N	8.048E+01	7.738E+01	6.889E+01	5.801E+01	5.439E+01	5.439E+01	5.439E+01	5.439E+01	5.439E+01	5.439E+01
NNE	9.005E+01	7.936E+01	7.354E+01	6.915E+01	6.124E+01	5.754E+01	5.754E+01	5.754E+01	5.754E+01	5.754E+01
NE	8.805E+01	8.503E+01	7.657E+01	7.007E+01	7.007E+01	7.007E+01	7.007E+01	7.007E+01	7.007E+01	7.007E+01
ENE	9.483E+01	8.412E+01	7.829E+01	7.391E+01	6.600E+01	6.229E+01	6.229E+01	6.229E+01	6.229E+01	6.229E+01
E	8.847E+01	8.537E+01	8.538E+01	8.538E+01	8.538E+01	8.538E+01	8.538E+01	8.538E+01	8.538E+01	8.538E+01
ESE	8.622E+01	8.313E+01	8.314E+01	8.314E+01	8.314E+01	8.314E+01	8.314E+01	8.314E+01	8.314E+01	8.314E+01
SE	9.013E+01	8.373E+01	8.064E+01	8.064E+01	8.064E+01	8.064E+01	8.064E+01	8.064E+01	8.064E+01	8.064E+01
SSE	8.907E+01	8.753E+01	8.754E+01	8.754E+01	8.754E+01	8.754E+01	8.754E+01	8.754E+01	8.754E+01	8.754E+01

Table 2.7-87 (Sheet 1 of 3)
Annual Average D/Q Values (No Decay) for Mixed-Mode Release from the Turbine Building Stack

USNRC COMPUTER CODE - XOQDOQ, VERSION 2.0 RUN DATE: 5-23-2008 14: 3
RBS COL
TURBINE BUILDING STACK
CORRECTED USING STANDARD OPEN TERRAIN FACTORS

********************* RELATIVE DEPOSITION PER UNIT AREA (M**-2) AT FIXED POINTS BY DOWNWIND SECTORS ********************

	DISTANCE IN MILES										
DIRECTION FROM SITE	.25	.50	.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
S	1.716E-08	1.049E-08	7.029E-09	4.149E-09	1.833E-09	1.046E-09	6.760E-10	4.725E-10	3.479E-10	2.661E-10	2.095E-10
SSW	1.138E-08	6.838E-09	4.658E-09	2.740E-09	1.179E-09	6.760E-10	4.398E-10	3.089E-10	2.283E-10	1.752E-10	1.383E-10
SW	9.799E-09	5.878E-09	4.012E-09	2.319E-09	9.685E-10	5.487E-10	3.545E-10	2.481E-10	1.831E-10	1.404E-10	1.109E-10
WSW	6.009E-09	3.796E-09	2.630E-09	1.525E-09	6.374E-10	3.605E-10	2.326E-10	1.626E-10	1.200E-10	9.201E-11	7.266E-11
W	3.430E-09	2.288E-09	1.660E-09	1.005E-09	4.369E-10	2.537E-10	1.664E-10	1.175E-10	8.722E-11	6.709E-11	5.306E-11
WNW	6.942E-09	4.419E-09	3.090E-09	1.820E-09	7.738E-10	4.429E-10	2.879E-10	2.023E-10	1.496E-10	1.149E-10	9.077E-11
NW	1.929E-08	1.127E-08	7.621E-09	4.434E-09	1.884E-09	1.072E-09	6.937E-10	4.858E-10	3.585E-10	2.748E-10	2.272E-10
NNW	2.067E-08	1.184E-08	7.668E-09	4.358E-09	2.146E-09	1.155E-09	7.162E-10	4.871E-10	3.614E-10	2.729E-10	2.134E-10
N	2.241E-08	1.266E-08	7.963E-09	4.463E-09	1.890E-09	1.046E-09	7.276E-10	5.063E-10	3.646E-10	2.789E-10	2.193E-10
NNE	9.703E-09	4.706E-09	3.206E-09	2.174E-09	9.618E-10	6.121E-10	3.853E-10	2.645E-10	2.002E-10	1.515E-10	1.185E-10
NE	4.523E-09	2.789E-09	1.977E-09	1.211E-09	5.439E-10	3.174E-10	2.256E-10	1.674E-10	1.216E-10	9.230E-11	7.238E-11
ENE	5.339E-09	3.266E-09	2.329E-09	1.432E-09	6.241E-10	4.021E-10	2.565E-10	1.778E-10	1.376E-10	1.044E-10	8.189E-11
E	5.492E-09	3.460E-09	2.484E-09	1.518E-09	6.731E-10	3.930E-10	2.583E-10	1.826E-10	1.355E-10	1.042E-10	8.230E-11
ESE	5.900E-09	3.771E-09	2.656E-09	1.614E-09	7.242E-10	4.189E-10	2.733E-10	1.921E-10	1.420E-10	1.089E-10	8.585E-11
SE	9.204E-09	4.766E-09	3.304E-09	2.275E-09	1.003E-09	5.687E-10	3.662E-10	2.552E-10	1.876E-10	1.433E-10	1.128E-10
SSE	1.360E-08	6.841E-09	4.706E-09	3.329E-09	1.465E-09	8.264E-10	5.301E-10	3.685E-10	2.705E-10	2.064E-10	1.623E-10

	DISTANCE IN MILES										
DIRECTION FROM SITE	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
S	1.687E-10	7.892E-11	4.800E-11	2.504E-11	1.583E-11	1.137E-11	8.784E-12	7.144E-12	6.027E-12	5.194E-12	4.596E-12
SSW	1.116E-10	5.297E-11	3.259E-11	1.728E-11	1.103E-11	8.109E-12	6.384E-12	5.280E-12	4.515E-12	3.937E-12	3.524E-12
SW	8.963E-11	4.271E-11	2.636E-11	1.406E-11	8.997E-12	6.683E-12	5.290E-12	4.387E-12	3.754E-12	3.273E-12	2.927E-12
WSW	5.874E-11	2.799E-11	1.726E-11	9.199E-12	5.903E-12	4.421E-12	3.545E-12	2.988E-12	2.601E-12	2.304E-12	2.096E-12
W	4.289E-11	2.049E-11	1.264E-11	6.735E-12	4.313E-12	3.211E-12	2.561E-12	2.148E-12	1.862E-12	1.643E-12	1.490E-12
WNW	7.337E-11	3.499E-11	2.158E-11	1.150E-11	7.359E-12	5.458E-12	4.317E-12	3.578E-12	3.060E-12	2.668E-12	2.386E-12
NW	1.912E-10	8.756E-11	5.243E-11	2.711E-11	1.729E-11	1.244E-11	9.728E-12	8.020E-12	6.882E-12	6.014E-12	5.391E-12
NNW	1.715E-10	7.783E-11	4.616E-11	2.346E-11	1.476E-11	1.046E-11	8.035E-12	6.512E-12	5.495E-12	4.736E-12	4.187E-12
N	1.776E-10	8.331E-11	5.075E-11	2.655E-11	1.677E-11	1.177E-11	8.916E-12	7.114E-12	5.911E-12	5.026E-12	4.383E-12

Table 2.7-87 (Sheet 2 of 3)
Annual Average D/Q Values (No Decay) for Mixed-Mode Release from the Turbine Building Stack

NNE	9.813E-11	4.627E-11	2.819E-11	1.470E-11	9.254E-12	6.485E-12	4.919E-12	3.942E-12	3.294E-12	2.818E-12	2.479E-12
NE	5.825E-11	2.666E-11	1.588E-11	8.119E-12	5.129E-12	3.658E-12	2.829E-12	2.308E-12	1.960E-12	1.699E-12	1.512E-12
ENE	6.617E-11	3.050E-11	1.831E-11	9.490E-12	6.039E-12	4.319E-12	3.336E-12	2.708E-12	2.286E-12	1.968E-12	1.734E-12
E	6.646E-11	3.160E-11	1.943E-11	1.028E-11	6.530E-12	4.756E-12	3.688E-12	2.991E-12	2.504E-12	2.141E-12	1.875E-12
ESE	6.922E-11	3.257E-11	1.986E-11	1.039E-11	6.582E-12	4.762E-12	3.705E-12	3.037E-12	2.580E-12	2.238E-12	1.995E-12
SE	9.083E-11	4.237E-11	2.571E-11	1.338E-11	8.465E-12	6.096E-12	4.743E-12	3.895E-12	3.322E-12	2.894E-12	2.590E-12
SSE	1.306E-10	6.075E-11	3.676E-11	1.905E-11	1.197E-11	8.450E-12	6.354E-12	4.982E-12	4.036E-12	3.342E-12	2.821E-12

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RBS COL
TURBINE BUILDING STACK

********************* RELATIVE DEPOSITION PER UNIT AREA (M**-2) BY DOWNWIND SECTORS ********************

SEGMENT BOUNDARIES IN MILES

DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	6.518E-09	1.998E-09	6.932E-10	3.523E-10	2.112E-10	8.513E-11	2.605E-11	1.152E-11	7.187E-12	5.219E-12
SSW	4.290E-09	1.302E-09	4.504E-10	2.311E-10	1.393E-10	5.695E-11	1.790E-11	8.197E-12	5.304E-12	3.955E-12
SW	3.674E-09	1.082E-09	3.637E-10	1.854E-10	1.118E-10	4.587E-11	1.454E-11	6.743E-12	4.404E-12	3.287E-12
WSW	2.398E-09	7.116E-10	2.387E-10	1.215E-10	7.324E-11	3.005E-11	9.525E-12	4.466E-12	3.000E-12	2.315E-12
W	1.508E-09	4.816E-10	1.702E-10	8.821E-11	5.345E-11	2.198E-11	6.972E-12	3.245E-12	2.157E-12	1.651E-12
WNW	2.821E-09	8.592E-10	2.950E-10	1.514E-10	9.147E-11	3.756E-11	1.190E-11	5.509E-12	3.592E-12	2.680E-12
NW	7.015E-09	2.089E-09	7.113E-10	3.630E-10	2.280E-10	9.497E-11	2.837E-11	1.265E-11	8.074E-12	6.040E-12
NNW	7.124E-09	2.197E-09	7.416E-10	3.636E-10	2.155E-10	8.457E-11	2.464E-11	1.064E-11	6.560E-12	4.758E-12
N	7.450E-09	2.087E-09	7.241E-10	3.724E-10	2.215E-10	8.979E-11	2.758E-11	1.196E-11	7.170E-12	5.050E-12
NNE	3.081E-09	1.076E-09	3.975E-10	2.000E-10	1.207E-10	4.976E-11	1.528E-11	6.597E-12	3.974E-12	2.834E-12
NE	1.817E-09	5.914E-10	2.268E-10	1.235E-10	7.305E-11	2.889E-11	8.515E-12	3.718E-12	2.324E-12	1.707E-12
ENE	2.139E-09	7.050E-10	2.639E-10	1.364E-10	8.273E-11	3.301E-11	9.917E-12	4.384E-12	2.727E-12	1.976E-12
E	2.272E-09	7.363E-10	2.639E-10	1.370E-10	8.291E-11	3.394E-11	1.065E-11	4.802E-12	3.005E-12	2.150E-12
ESE	2.441E-09	7.862E-10	2.797E-10	1.437E-10	8.652E-11	3.506E-11	1.080E-11	4.825E-12	3.054E-12	2.249E-12
SE	3.172E-09	1.093E-09	3.758E-10	1.901E-10	1.137E-10	4.574E-11	1.393E-11	6.187E-12	3.919E-12	2.908E-12
SSE	4.568E-09	1.595E-09	5.445E-10	2.741E-10	1.636E-10	6.562E-11	1.984E-11	8.550E-12	5.014E-12	3.355E-12

Table 2.7-87 (Sheet 3 of 3))
Annual Average D/Q Values (No Decay) for Mixed-Mode Release from the Turbine Building Stack

VENT AND BUILDING PARAMETERS:

RELEASE HEIGHT	(METERS)	71.30	REP. WIND HEIGHT	(METERS)	71.3
DIAMETER	(METERS)	1.95	BUILDING HEIGHT	(METERS)	52.0
EXIT VELOCITY	(METERS)	17.78	BLDG. MIN. CRS.SEC.AREA	(SQ. METERS)	.0
			HEAT EMISSION RATE	(CAL/SEC)	.0

AT THE RELEASE HEIGHT:			/	AT THE MEASURED WIND HEIGHT		(9.1 METERS)			
VENT RELEASE MODE	WIND SPEED	(METERS/SEC)	/	VENT RELEASE MODE	WIND SPEED	(METERS/SEC)		WIND SPEED	(METERS/SEC)
			/		STABLE CONDITIONS			UNSTABLE/NEUTRAL CONDITIONS	
ELEVATED	LESS THAN	3.556	/	ELEVATED	LESS THAN	1.273		LESS THAN	2.128
MIXED	BETWEEN	3.556 AND 17.780	/	MIXED	BETWEEN	1.273 AND 6.366		BETWEEN	2.128 AND 10.639
GROUND LEVEL	ABOVE	17.780	/	GROUND LEVEL	ABOVE	6.366		ABOVE	10.639

ER 2.7 Figures

Due to the large file sizes of the figures for ER Section 2.7, they are collected in a single .pdf file, which you can navigate via the figure numbers in the Bookmark pane. When cited in the text, the links for these figures will launch the .pdf file.

2.8 RELATED FEDERAL PROJECT ACTIVITIES

The purpose of this section is to identify federal activities directly related to the proposed project in order to (1) determine the need for other federal agencies (i.e., cooperating agencies) to participate in the preparation of the environmental impact statement (EIS), and (2) assess the interrelationship and cumulative environmental effects of the proposed project and related federal activities.

The scope of this review is limited to directly related federal project activities that affect plant siting or transmission line routing, plant water supply, or the need for power. There are no federal agency plans or commitments that will result in significant new power purchases within the Applicant's service area that have been used to justify a need for power. Actions related only to the granting of licenses, permits, or approvals by other federal agencies are not discussed in this section. However, Chapter 1 contains information regarding licenses, permits, or approvals that may be required from federal agencies.

2.8.1 PLANT SITING AND COOLING WATER SOURCE AND SUPPLY

No directly related federal activities or relevant cooperating agencies that affect plant siting or water supply were identified. RBS Unit 3 will be sited on the same site as RBS Unit 1, which is owned by the Applicant, and will use the same Mississippi River cooling water supply as the existing unit. The new RBS Unit 3 facility is to be connected to the transmission system through a new 500 kV line connecting to the existing RBS 500/230 kV switchyard (with expansion and some modifications). Refer to Subsection 8.1.1.

Future federal actions related to this project include permits and licenses that may be required at the time of transmission system upgrades in anticipation of Unit 3 operation. Other federal actions may be required at a later time for RBS Unit 3, such as a FERC jurisdictional agreement. The new off-site transmission line and the on-site transmission corridor expansion and rights-of-way needed to support the new unit are discussed in more detail in Section 3.7. In summary, no other federal activities or projects are associated with the RBS Unit 3 COLA.

2.8.2 PLANNED FEDERAL PROJECTS CONTINGENT ON PLANT CONSTRUCTION OR OPERATION

Based on a review of federal agency public records, there are no planned federal projects that relate to the acquisition or use of the RBS Unit 3 site, expansion or acquisition of new transmission corridors, or the availability of an adequate supply of plant cooling water. No federal projects must be completed as a condition of plant operation, and no federal projects are contingent on the construction and operation of RBS Unit 3.

The proposed expansion of U.S. Highway 61 from two lanes to four lanes is the only major federal project planned for the region around the RBS. The highway widening, which was discussed in Sections 2.2 and 2.5, is not related to or dependent on the construction or operation of RBS Unit 3.

2.8.3 NON-FEDERAL PROJECT ACTIVITIES

Although there are several major projects in the planning and construction stages in the region around the RBS, none of these non-federal project activities are directly related to or dependent on the RBS Unit 3 project. Along with RBS Unit 3, these projects would minimally contribute to adverse cumulative effects to environmental resources in the region, including land use, water consumption, water quality, ecology, air quality, transportation infrastructure, and socioeconomic resources. Cumulative effects resulting from construction and operation of RBS Unit 3 are discussed in detail in Sections 4.7 and 5.11, respectively.

The table below lists the major federal and non-federal projects that are ongoing or planned in the region surrounding the RBS site approximately 5 years prior to the anticipated start of construction. These projects were previously discussed in Section 2.2:

Federal Projects	Non-Federal Projects
U.S. Highway 61 Widening	West Feliciana Parish Business Park and Port Construction
	Audubon Bridge Construction
	State Highway 10 Extension Construction
	Tembec Potential Reopening as Different Business
	Huey P. Long Bridge Construction
	Baton Rouge Loop Planning
	Big Cajun 1 Expansion
	Big Cajun 2 Unit 4 Planning and Construction (operation forecast 2010)
	Morgans Bend Hydrokinetic Power Project

2.8.4 REFERENCES

None.

CHAPTER 3 PLANT DESCRIPTION

Chapter 3 discusses the construction and operation of RBS Unit 3. The parameters associated with the station's appearance, water use, transmission facilities, and relationship to the surrounding area are described in the following sections:

- External Appearance and Plant Layout (Section 3.1).
- Reactor Power Conversion System (Section 3.2).
- Plant Water Use (Section 3.3).
- Cooling Systems (Section 3.4).
- Radioactive Waste Management System (Section 3.5).
- Nonradioactive Waste Systems (Section 3.6).
- Power Transmission System (Section 3.7).
- Transportation of Radioactive Materials (Section 3.8).

This Environmental Report (ER) identifies and describes the interfaces of the unit with the environment. The terms "site," "vicinity," and "region," as discussed in this chapter, are defined in Chapter 2.

3.1 EXTERNAL APPEARANCE AND PLANT LAYOUT

3.1.1 EXISTING RIVER BEND STATION DESCRIPTION

The 3330-acre (ac.) RBS Unit 1 facility is located approximately 2 miles (mi.) from the Mississippi River. The finished station grade is approximately 100 feet (ft.) above mean sea level (msl) (varies from 95 to 105 ft. msl). The Mississippi River supplies the cooling tower makeup water requirements.

The original site arrangement was designed for two nuclear units and two turbine generator sets. Construction of the second unit was halted prior to its completion.Figure 2.1-4 shows the building layout and site property boundary.

Four mechanical cooling towers for RBS Unit 1 are used for heat dissipation. The towers are approximately 56 ft. above grade elevation and are not visible above the trees.

A main access road connects the property with the parish road system. A peripheral road serving the power station provides access to the switchyard. This road joins the heavy haul road that extends across the floodplain from the barge slip and makeup water intake structures on the river to the plant.

Security fences surround the immediate station area. Visitor and employee parking is located outside this fenced area, with access to the plant through a security gate house that is controlled on a 24-hour-per-day basis.

There are no railroad spurs or active rail lines in the vicinity of the RBS site. Rail lines and spurs that were used during construction of the existing plant have since been abandoned and/or removed.

The grounds in the immediate vicinity of the plant buildings are attractively landscaped.

3.1.2 NEW FACILITY ARRANGEMENT

Unit 3 is to be constructed west of the Unit 1 complex. The new unit is to be located in approximately the same area proposed for the original Unit 2. RBS Unit 3 is an ESBWR, a light-water-cooled reactor designed by GEH.

The ESBWR standard plant layout is shown in the ESBWR Design Control Document (DCD Figure 1.1-1). The locations of the major structures of the new facility on the RBS site are indicated in Figure 2.1-4. Unit 3 is to share a common river intake structure and certain support structures, such as office buildings, with Unit 1. Paved site roadways are to connect the new units to the rest of the RBS site, providing routine and non-routine access to the existing and new unit with minimal disturbance of the area.

The circulating water system for the new unit includes a concrete natural draft hyperbolic cooling tower with a mechanical draft helper cooling tower and common river intake and discharge structures. The Mississippi River is to be used for makeup water for the circulating water and the turbine plant cooling systems.

Existing infrastructure is to be modified to integrate the new unit with the existing unit; however, none of the existing unit's structures or facilities that directly support power generation are to be shared. The existing switchyard is to be modified to provide interconnections with the new unit, and the transmission lines modified and rerouted as required to incorporate the new generation capacity into the electric grid. The existing security perimeter is to be expanded to include the new unit. Existing administrative buildings, warehouses, and other minor support facilities may be used, expanded, or replaced, based on prudent economic and operational considerations.

The RBS site environs are described in Chapter 2 of this report. Specifically, the site environs are rural, with a low level of industry and primarily an agricultural economy. Therefore, from a visual impact or land use perspective, the operation of RBS Unit 3 would have a minimal effect on the areas surrounding the RBS site.

The most visually obtrusive structure under consideration for the new facility is the natural draft cooling tower. The bounding cooling tower height would be approximately 550 ft. The areas around the RBS site are rural and generally heavily wooded, which would conceal construction of the new facility. Some construction activities for the new facility may be visible from the Mississippi River (e.g., the transmission tower erection, barge slip dredging, etc.). The cooling tower plume would be visible from a distance in all directions when the unit is operating. Refer to Figures 3.1-1, 3.1-2, and 3.1-3, which illustrate the effects of the ESBWR on the existing plant and the current site environs.

Because the RBS site is already aesthetically altered by the presence of an existing nuclear power plant and construction operations would be temporary, significant adverse effects on the visual aesthetics of the site and vicinity are not expected from the construction of a new facility.

Figure 2.1-4 provides an aerial photograph of the existing site with the ESBWR layout, including projected construction areas.

After the completion of new unit construction, areas used for construction support would be graded, landscaped, and planted to enhance the overall site appearance. Previously forested areas cleared for temporary construction facilities would be revegetated, and harsh topographical features created during construction would be contoured to match the surrounding areas. These areas could include equipment laydown yards, module fabrication areas, concrete batch plant, areas around completed structures, and construction parking.

3.1.3 REFERENCES

None.

ER 3.1 Figures

Due to the large file sizes of the figures for ER Chapter 3, they are collected in a single .pdf file, which you can navigate via the figure numbers in the Bookmark pane. When cited in the text, the links for these figures will launch the .pdf file.

3.2 REACTOR POWER CONVERSION SYSTEM

The proposed plant will consist of one boiling water reactor (BWR) and auxiliaries. The specific design is the ESBWR supplied by GEH.

The reactor power conversion system is described in Chapter 10 of the Final Safety Analysis Report (FSAR). Figure 3.2-1 provides a simplified depiction of the reactor power conversion system.

The design condenser/heat exchanger duty is 3057 MWt (10.43E+09 Btu/hr), and the rated power is 4500 MWt. The gross electrical rating of the ESBWR is 1600 ± 50 MWe. The net electrical output is approximately 1520 MWe.

The ESBWR core and fuel assembly designs are described in Table 1.3-1 of the DCD. For reload cores, the uranium enrichment will be approximately 4.6 percent U-235. The expected assembly average burnup of discharged fuel is approximately 46,000 megawatt-days/metric tons uranium (MWd/MTU). The total quantity of uranium in the core is approximately 167 MTU.

Engineered safety features of the ESBWR are described in Chapter 6 of the FSAR; instrumentation and controls for the engineered safety features are described in Chapter 7 of the FSAR.

3.2.1 REFERENCES

None.

ER 3.2 Figures

Due to the large file sizes of the figures for ER Chapter 3, they are collected in a single .pdf file, which you can navigate via the figure numbers in the Bookmark pane. When cited in the text, the links for these figures will launch the .pdf file.

3.3 PLANT WATER USE

RBS Unit 3 requires water for cooling and operational uses. The Mississippi River provides water for plant cooling, including the normal power heat sink (NPHS) and auxiliary heat sink (AHS), as well as makeup water for plant operations.

Subsection 3.3.1 discusses water consumption and discharges by the various plant systems, including the NPHS, AHS, ultimate heat sink (UHS), potable water and sanitary waste system, makeup water system (MWS), and fire protection system (FPS). Additionally, Figure 3.3-1 presents a water use diagram for RBS Unit 3 that outlines normal plant operating conditions as well as shutdown conditions. The normal flows represent the maximum water consumption rates anticipated. Monthly mean flow variations and monthly mean flow occurrences for the Mississippi River for the period 1956-2006 are illustrated in Figures 2.3-5 through 2.3-8. The flows identified, as compared to the consumption values identified in Figure 3.3-1 indicate that the maximum water withdrawal from the Mississippi River is negligible under conditions of minimum river flow.

Subsection 3.3.2 discusses the methods of water treatment used in the plant and the process for discharging back to the receiving water body (i.e., the Mississippi River).

3.3.1 WATER CONSUMPTION

Plant water systems discussed in this section include the circulating water system (CIRC), plant service water system (PSWS), potable water system (PWS), sanitary waste system, MWS, and FPS. The NPHS, AHS, and all station water uses, including the MWS and FPS, share a common intake from the Mississippi River with RBS Unit 1. RBS Unit 1 water usage is described in the RBS Unit 1 ER (Reference 3.3-1). The design of the intake structure is based on record low water levels for the Mississippi River; thus even under conditions of low water availability, plant operation would be able to carry on normally. The design of the intake structure is discussed further in Subsection 3.4.2.1. Makeup water to the NPHS and AHS shares one branch from the intake, while station water uses another branch. Blowdown from several sources, including both NPHS and AHS cooling towers, treated liquid radwaste, and MWS demineralized water waste, is combined and shares a common discharge to the Mississippi River.

3.3.1.1 Circulating Water System

The CIRC is used to remove the waste heat from the main condenser and main plant heat exchangers by rejecting that heat to the NPHS. During normal operation, the NPHS also provides cooling to the AHS loads. Makeup water to the NPHS cooling towers replenishes water losses due to evaporation, drift, and blowdown. A more detailed description of the CIRC is presented in Section 3.4. Figure 3.3-1 shows the water use (makeup, blowdown, evaporation, etc.) by the NPHS for RBS Unit 3. For the bounding plant evaluation, the expected average and maximum makeup water flow is 25,112 gpm for the NPHS.

Monthly water consumption is expected to vary, but is bounded by the values presented herein.

The maximum blowdown from the NPHS cooling tower is 6264 gpm. This blowdown is directed to a pipeline that discharges in the Mississippi River. The blowdown is combined with the RBS Unit 1 blowdown prior to discharge.

3.3.1.2 Plant Service Water System

During the operation of RBS Unit 3, PSWS cooling is provided by either the NPHS cooling tower or the AHS. While in shutdown operation, the PSWS is cooled by the AHS cooling tower. The AHS requires makeup water to replenish water losses due to evaporation, drift, and blowdown. If it is required to operate AHS and NPHS simultaneously, the blowdown from the AHS is mixed with the NPHS cooling tower blowdown. The flow requirements for makeup flow for the closed loop type PSWS are a maximum of 1018 gpm. The makeup water requirements when the RBS Unit 3 AHS is in operation are already included in the limits stated in Subsection 3.3.1.1.

Maximum blowdown from the AHS cooling tower is 254 gpm. This blowdown is directed to an outfall that discharges in the Mississippi River. The blowdown water requirements when the RBS Unit 3 AHS is in operation are already included in the limits stated in Subsection 3.3.1.1.

3.3.1.3 Ultimate Heat Sink

The RBS Unit 3 ESBWR design has no separate emergency cooling water system. The UHS function is provided by safety systems integral and interior to the reactor plant. This system ultimately uses the atmosphere as the eventual UHS. These systems have no cooling towers, basins, or cooling water intake/discharge structures external to the reactor plant.

3.3.1.4 Potable Water and Sanitary Waste Systems

The potable water and sanitary waste systems are designed to provide the potable water and sewage treatment necessary for normal plant operation and shutdown periods. The source of the potable water supply is the West Feliciana Parish municipal supply. The potable water system is designed to supply up to 200 gpm of potable water during peak demand periods, with a monthly average usage of 35 gpm.

Sanitary waste is treated in an on-site waste water treatment plant consisting of two trains, each capable of treating up to 40,000 gallons per day (gpd). This plant is separate from Unit 1.

The sanitary waste system is designed to treat and dispose of the waste from all plumbing fixtures, except lavatories, sinks, and drains containing waste that is contaminated or potentially contaminated with chemicals or radioactivity. Such contaminated or potentially contaminated waste is physically separate from the sanitary drains and disposal system and is piped directly to the radioactive liquid waste system (Section 3.5). The sanitary waste system consists of aerated lagoons, sedimentation ponds, rock filter basins, a sand filter, and ultraviolet disinfection.

3.3.1.5 Makeup Water System

The required flow for makeup water to the MWS for demineralized water production is expected to average 160 gpm monthly, with short-term maximum flow expected to be approximately 640 gpm during outages. This makeup water is supplied from the station water system (SWS), as depicted in Figure 3.3-1.

3.3.1.6 Fire Protection System

Fire protection water is provided to the system from on-site storage tanks that have makeup supplied from the SWS. After the system is initially filled, the flow for system usage would average approximately 30 gpm monthly.

3.3.2 WATER TREATMENT

All plant makeup water is supplied by the SWS and is taken from a common intake from the Mississippi River, which is then processed through a bank of four clarifiers. This raw water is treated with polyelectrolyte to enhance the flocculation and settling of suspended solids. After the clarifier, the water is distributed to the MWS, NPHS basin, and AHS basin. The water treatment processes and quantities of chemicals used are proportional to the amounts of water used.

A more detailed description of each water treatment system as to frequency of treatment for normal and shutdown modes of operation, as well as the quantities and points of addition of the chemical additives is described in Section 3.6.

3.3.2.1 Circulating Water System

The CIRC provides cooling water for the removal of the power cycle heat from the main condensers and transfers this heat to the NPHS. Chemical additions are made to both influent and effluent flows. System chemistry control is provided by the incorporation of an injection system at the cooling tower basin that introduces a biocide, algaecide, pH adjuster, corrosion inhibitor, and scale inhibitor. These various chemicals are identified in Table 3.3-1. The blowdown may require treatment before exiting to the Mississippi River to reduce chlorine levels. Section 5.2 provides a discussion on effluent limitations and permit conditions.

3.3.2.2 Makeup Water System

The MWS demineralization production is accomplished through a reverse osmosis process. This process is described in FSAR Subsection 9.2.3.

3.3.2.3 Plant Service Water System

System chemistry control is maintained in a similar fashion to that of the CIRC, with the addition of a biocide, algaecide, pH adjuster, corrosion inhibitor, and scale inhibitor. The PSWS is described in FSAR Subsection 9.2.1. Water treatment chemistry is provided in Table 3.3-1.

3.3.2.4 Potable Water and Sanitary Waste Systems

The potable water and sanitary waste systems are described in Subsection 3.3.1.4. The sanitary waste system effluent is discharged to the Mississippi River following treatment.

3.3.3 REFERENCES

3.3-1 Gulf States Utilities Company, "River Bend Station Environmental Report, Operating License Stage," Volumes 1-4, Supplements 1-9, November 1984.

Table 3.3-1
Chemical Additives for Water Treatment

System/Injection Point	Chemical	Usage
Circulating Water System Cooling Tower Basin	Biocide/Algaecide – 10% - 15% Sodium Hypochlorite with the aid of a surfactant, if required	500 gpd
Circulating Water System Cooling Tower Basin	Sulfuric Acid - pH Adjuster	Metered to maintain a pH between 6.5 to 9.0
Circulating Water System Cooling Tower Basin	Phosphinosuccinic Oligomer (PSO) – Corrosion Inhibitor	140 gpd
Circulating Water System Cooling Tower Basin	55% Phosphate – Scale Inhibitor with the aid of a dispersant	30 gpd
Station Water System	Polyelectrolyte Coagulant (suspended solids removal)	1 - 2 ppm metered based on flow
Station Water System	Polyelectrolyte Flocculant (suspended solids removal)	1 - 4 ppm metered based on flow

ER 3.3 Figures

Due to the large file sizes of the figures for ER Chapter 3, they are collected in a single .pdf file, which you can navigate via the figure numbers in the Bookmark pane. When cited in the text, the links for these figures will launch the .pdf file.

3.4 COOLING SYSTEMS

Subsection 3.4.1 provides a description of the various cooling water systems and the operational modes for a new facility, and Subsection 3.4.2 provides a description of the major components of the systems.

ER Figures 2.1-3 and 2.1-4 show the locations of the components of the plant cooling systems.

RBS holds a current LPDES permit for the Mississippi River at RBS, in compliance with the FWPCA. The permit number is LA0042731, and it is valid until June 1, 2011. The permit requires modification to support the new RBS Unit 3 prior to construction.

3.4.1 DESCRIPTION AND OPERATIONAL MODES

3.4.1.1 Circulating Water System (Normal Power Heat Sink)

The circulating water system provides cooling water during startup, normal plant operations, and shutdown for the removal of power cycle heat from the main condensers and rejects this heat to the normal power heat sink (NPHS). The main plant condensers contribute the majority of the heat to the NPHS, with additional heat load during normal operation introduced by the plant service water system (PSWS). The NPHS consists of both a hyperbolic natural draft cooling tower (NDCT) and a MDCT. The NDCT utilizes low clog high performance fill and drift eliminators to maximize efficiency and minimize drift. Operation of the two towers would vary seasonally, with the MDCT operating during periods of high ambient temperature to ensure that the design water temperature and unit electrical output can be maintained. The MDCT is designed to accommodate approximately 30 percent of the heat load during design ambient conditions and normal full power operation. At these conditions, the maximum quantity of water is withdrawn, consumed, and discharged. During cooler periods, MDCT flows would vary by reducing and/or stopping flow to the MDCT. The quantity of water withdrawn, consumed, and discharged would be less during these cooler periods. Full circulating water system flow can be accommodated by the NDCT if the MDCT is not operating. Refer to FSAR Section 10.4 for additional information.

The main condenser for each unit of a new facility rejects heat to the atmosphere at a rate of approximately 10.43×10^9 Btu/hr during normal full power operation. Water from the circulating water system (CIRC) is pumped through the condenser and then to the cooling tower(s), where heat that has been transferred to the cooling water in the condenser is dissipated to the environment (the atmosphere) by evaporation.

During the heat dissipation process, where some water is evaporated, an increase in the solids level in the NPHS cooling tower(s) would result. To control solids levels or concentrations, a portion of the recirculated water must be removed, or blown down. In addition to the blowdown and evaporative losses, a small percentage of water in the form of droplets (drift) is lost from the cooling tower(s). Water pumped from the Mississippi River (refer to Section 3.3) intake structure would be used to replace water lost by evaporation, drift, and blowdown from the cooling tower(s). Blowdown water is returned to the Mississippi River via an outfall on the river shoreline (refer to Subsection 5.3.2). A portion of the waste heat is thus dissipated to the Mississippi River through the blowdown process.

The Unit 3 blowdown is combined with the Unit 1 blowdown with discharge volumes as reflected on Figure 3.3-1. The maximum temperature of the combined blowdown is 101°F at the discharge to the river. The heat rejected to the Mississippi River via blowdown was determined on the basis of these maximum blowdown flow and temperature conditions (Subsection 5.3.2).

During other operating modes, heat dissipation to the environment would be less than the bounding values for the full power operational mode of the NPHS.

3.4.1.2 Station Water System

The station water system (SWS) draws water from the Mississippi River through screens and intake pipes located in the embayment into the intake pump house located on the north bank of the embayment. The intake pumps discharge the water through clarifiers and granular filters to provide makeup water to various plant systems, such as the makeup water to the NPHS cooling tower basins for the circulating water system and to the auxiliary heat sink (AHS) cooling tower basin for makeup to the PSWS. Refer to FSAR Subsection 9.2.1 for PSWS operational modes and a simplified figure.

The SWS provides the total makeup flow required for Units 3 and 1. The Unit 3 normal operation makeup is 25,112 gpm, and the Unit 3 shutdown operation makeup (AHS only) is 1018 gpm.

3.4.1.3 Plant Service Water System

The PSWS provides cooling water to the Turbine Building component cooling heat exchangers and the Reactor Building component cooling heat exchangers and rejects the heat back to the NPHS during normal power operations. The PSWS is described in FSAR Subsection 9.2.1, and a simplified flow diagram is provided in DCD Figure 9.2-1. During shutdown operations, when the NPHS is not operating, the PSWS utilizes mechanical draft wet cooling towers to remove the heat from served loads, with makeup to the enclosed PSWS cooling tower basin directly from the SWS. Figure 3.3-1 provides the flow requirements for makeup to the PSWS for normal operation and shutdown conditions and provides the blowdown flow expected during operation in shutdown conditions.

3.4.1.4 Ultimate Heat Sink

The Unit 3 ESBWR design has no separate emergency water cooling system. The ultimate heat sink (UHS) function is provided by safety systems integral and interior to the reactor plant. This system ultimately uses the atmosphere as the eventual heat sink. These systems have no cooling towers, basins, or cooling water intake/discharge structures external to the reactor plant.

3.4.1.5 Discharges to Mississippi River

The Mississippi River would be subject to liquid discharges during plant operation. Discharge from the heat dissipation system would consist of blowdown from the main cooling water system. Additions to this blowdown include treated liquid radwastes and neutralized demineralizer wastes. Section 3.5 and 3.6 describe the discharge characteristics.

The rate of blowdown from the main cooling water system into the Mississippi River would be constant, depending on the number of units operating.

The two-unit discharge, which includes plant effluents from all sources, is a maximum 9034 gpm, with a maximum temperature of 101°F. A discussion of thermal plume predictions is contained in Subsection 5.3.2.1. The status of the Louisiana Pollutant Discharge Elimination System (LPDES) permit for this discharge is discussed in Section 1.2.

3.4.1.6 Discharges to Air

Approximately 10.43 x 10^9 Btu/hr of waste heat would be dissipated to the atmosphere through the cooling towers.

At the design condition during winter operation, the natural draft tower requires an airflow rate ranging from 48,500 lbm/s (22,000 kg/s) to 124,780 lbm/s (56,600 kg/s). During summer operation, the tower rejects a lower amount of heat and requires an airflow ranging from 33,687 lbm/s (15,280 kg/s) to 86,628 lbm/s (39,294 kg/s).

The MDCTs require an airflow range from 14,990 lbm/s (6800 kg/s) to 38,548 lbm/s (17,485 kg/s) of ambient air. The air passing through the cooling tower is mechanically induced so that the discharged airflow remains fairly constant.

Exit air temperatures are proportional to the wet-bulb temperature of the ambient air. Cooling tower drift is designed to be 0.002 percent or less of the total tower water flow.

The cooling towers planned for use at RBS Unit 3 are expected to provide the only plant effluents with a potential for influencing local meteorology. The effluent types of concern are commonly described as visible plumes (fog) and cooling tower drift. Each of these effluent types and their effects on local weather are described in Subsection 5.3.3.

3.4.2 COMPONENT DESCRIPTIONS

3.4.2.1 Intake System

The river water intake and makeup water system comprises three main parts: river intake screens and makeup water suction pipelines from the embayment, a dry pit pump house structure, and piping routed from the pump house structure to clarifiers.

The SWS draws river water from the existing Unit 1 embayment (Figures 5.3-1 and 5.3-2) in the Mississippi River through two pairs of intake screens located below the extreme low water level to ensure proper system operation under all expected river conditions.

The water is drawn through suction pipes to three dry pit type vertical pumps located in the existing Unit 1 intake structure at the Mississippi River (Figures 5.3-4 and 5.3-5). Each pump has the capacity to supply 50 percent of the total flow requirements for Units 1 and 3. Two pumps are normally operated, and the third pump is reserved for standby operation. The two operating pumps are capable of delivering the maximum cooling tower makeup water requirement of 40,927 gpm to the two units.

The intake flow enters through two pairs of intake screens. One 36-in. diameter intake line for each intake screen conveys water to the makeup pump house. Within the pump house, two 36-in. diameter intake lines manifold through a common header into three 24-in. diameter lines, each directly connected to a makeup water pump.

The two suction lines are provided with automatic valves and interconnected by a pipe to allow the operating pumps to draw water from either set of screens. The intake screens are sized to allow a total maximum flow of 27,000 gpm[a] (102,000 l/min), each with a corresponding maximum screen slot velocity of 0.50 ft/s (0.15 m/sec) or less, which meets the U.S. Environmental Protection Agency (EPA) requirements (≤0.50 ft/sec) found in the Clean Water Act, Section 316(b) (Reference 3.4-1). Variations in the final design for screen flow and approach velocity may occur; however, Reference 3.4-1 requirements for an approach velocity of 0.5 ft/sec or less will be adhered to.

The base of each intake screen is at Elevation -7.5 ft. mean sea level (msl), providing a normal separation of 4.5 ft. to the embayment dredged bottom. With this separation and the estimated sedimentation rate, it is anticipated that monitoring and subsequent sediment removal would be required at least every other year to minimize any effect on intake operation. However, the interval between embayment soundings would be modified to correspond to the rate of embayment sedimentation incurred during station operation.

Figure 5.3-2 shows a profile view of the intake screens and suction piping leading to the pump house. The pipe support members between the piles do not extend above +0.25 ft. msl. The pile members support the suction pipelines to the recession slope, after which the pipelines are buried until entering the pump house structure. Riprap is placed to minimize possible erosion of the natural bank that covers the suction pipes.

This maximum intake design flow exceeds the expected total makeup flow required from the Mississippi River to the SWS, as shown in the water usage charts in Figure 3.3-1. This ensures that the slot velocity of the intake screens is 0.50 ft/sec (0.15 m/s) or less.

The entrance to the pump house structure is at Elevation +60 ft. 6 in. msl to protect pumps and motors from the project design flood level with wave runup. The three SWS pumps are mounted at floor Elevation +10 ft. msl, and their columns extend to floor Elevation -15 ft. msl at their suction elbows.

Flow from the pump discharge is sent to four 33 percent clarifiers that remove suspended solids from the water prior to use in the cooling systems. Section 3.3 provides more details about chemical treatment of the cooling system water.

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a. Each RBS unit has its own pair of intake screens. Each pair is sized for at least the maximum single Unit 3 flow of 25,524 gpm, with a bounding maximum flow of 27,000 gpm to accommodate changes in the makeup water flow rate in the circulating water system without exceeding the maximum screen slot velocity of 0.50 ft/s (0.15 m/sec) or less.

3.4.2.2 Discharge System

Effluent (e.g., cooling tower(s) blowdown, excess water return, etc.) discharge is located downstream from the embayment and inlet screens to avoid recirculation of the effluents into the river water intake. Dilution and dissipation of the discharge heat, as well as other effluent constituents, are affected by both the design of the discharge structure and the flow characteristics of the receiving water (river). Normal plant effluent flow from all sources (e.g., cooling tower and radwaste) is a maximum of 9034 gpm. The NPHS cooling tower(s) blowdown is the major contributor to the total flow, and its maximum return temperature is estimated at 101°F.

The 36-in. diameter blowdown outfall is located 610 ft. downstream of the intake structure. The pipe is buried in the downstream bank protection material (Figure 5.3-7). Model studies conducted by Colorado State University for RBS Unit 1 have shown that the discharge location is out of the influence zone of the vortex formed in the recession. Therefore, the blowdown would not recirculate to the intake pumps.

The discharge facility has been designed to minimize the thermal effects of a winter extreme condition during times of maximum temperature differential. Considering the relatively small flow rate of the discharge, an exit pipe with a diameter of 36 in. is considered adequate. Figure 5.3-7 shows the location and design of the outfall structure. For a total discharge flow rate of 9034 gpm, the exit jet velocity is approximately 3 fps. The submerged jet mixes rapidly with the ambient river water, accompanied by a reduction of momentum and kinetic energy through turbulent action. The environmental effects of discharged heat are discussed in Subsection 5.3.2.

3.4.2.3 Heat Dissipation System

Heat dissipation is provided by a combination of natural draft and mechanical draft cooling towers. Subsection 3.4.1.1 provides further description of this system.

3.4.3 REFERENCES

3.4-1 U.S. Environmental Protection Agency, National Pollutant Discharge Elimination System, "Regulations Addressing Cooling Water Intake Structures for New Facilities."

3.5 RADIOACTIVE WASTE MANAGEMENT SYSTEM

This section describes the liquid, gaseous, and solid radioactive waste (radwaste) treatment systems and the instrumentation used to monitor all effluent release points. This information includes the origin, treatment, and disposal of all liquid, gaseous, and solid radwastes generated by the RBS during normal operation, including anticipated operational occurrences (e.g., refueling, purging, equipment downtime, and maintenance).

Radioisotopes are produced during the normal operation of nuclear reactors, primarily through the processes of activation and fission; trace metals such as iron, cobalt, and manganese may become activated. Small amounts of fission-activated products within the fuel may enter the coolant by diffusing through the fuel cladding or by escaping through fuel cladding leaks, if they occur. Thus, the reactor coolant normally carries materials with varying degrees of radioactivity. The sources of radioactivity and the source terms used for the design of the radwaste management systems are described in FSAR Section 11.1.

The radwaste management systems are designed to maintain releases of radioactive materials in effluents as low as reasonably achievable (ALARA) levels in conformance with 10 CFR Parts 20 and 50, including the design objectives of 10 CFR 50, Appendix I. Brief descriptions of the radwaste management systems are provided in this section. More complete descriptions of the radwaste management systems design, including process and instrumentation diagrams, are included in FSAR Sections 11.2, 11.3, and 11.4.

3.5.1 SOURCE TERMS

This subsection defines the radioactive source terms in the reactor water and steam that serve as design bases for the liquid, gaseous, and solid radwaste systems described in FSAR Sections 11.2, 11.3, and 11.4. These sources include fission products (e.g., noble radiogas, radioiodine, and other types) and activation products (e.g., coolant, noncoolant, tritium, and Argon-41). FSAR Section 12.2 provides additional information on plant sources of radioactivity.

The calculation model used to determine the activity of each radionuclide in the reactor coolant system is based on American National Standards Institute/American Nuclear Society (ANSI/ANS) 18.1, Radioactive Source Term for Normal Operation of Light Water Reactors, with appropriate adjustment factors applied. The details of the model, including the fission product noble gas release rate used, are provided in FSAR Section 11.1. The operational source term calculated supports compliance with General Design Criteria (GDC) 60 for liquid and gaseous effluent releases, which are discussed in DCD Subsection 12.2.2.

Regulatory Guide 1.112, Appendix A, provides a listing of data needed for radioactive source term calculations for boiling water reactors. General data needed for the calculation of the radioactive source term is provided in FSAR Sections 11.1, 11.2, and 11.3. Additional information on condensate demineralization and condensate and gland seal air removal systems are provided in FSAR Section 10.4. The ESBWR DCD concluded that the ESBWR conforms to Regulatory Guide 1.112. There are no site-specific parameters that change that conclusion.

3.5.2 RADWASTE SYSTEMS

3.5.2.1 Liquid Radwaste Systems

Liquid radwastes originate from minor leaks or drainage of equipment containing water that is contaminated with radioactivity. The liquid radwaste system collects, processes, and disposes of liquid radwastes and collects and transfers to the solid radwaste system certain solid wastes that are produced during shutdown, startup, and normal plant operation.

Inputs to the liquid waste management system (LWMS) from operational occurrences are listed in DCD Table 11.2-4 and are depicted in a block diagram in DCD Figure 11.2-2. This diagram also provides cross-references to DCD sections that discuss the systems generating the influent streams. Decontamination factors for the various subsystems of the LWMS are provided in DCD Table 11.2-3. Tank and pump capacities of the LWMS are provided in DCD Tables 11.2-2a, 11.2-2b, and 11.2-2c. A process diagram of the LWMS is provided in DCD Figure 11.2-1.

All radioactive releases from the LWMS would be discharged to the circulating water system (CIRC). Prior to discharge to the environment, the contents of the tank being released are sampled and analyzed to ensure that the activity concentration is consistent with the discharge criteria of 10 CFR 20 and that dose commitments in 10 CFR 50, Appendix I, are met. A radiation monitor provides an automatic closure signal to the discharge line isolation valve (refer to DCD Subsection 11.2.3). The effluent is eventually released to the environment through blowdown of the CIRC. The CIRC blowdown is combined with the RBS Unit 1 blowdown and discharged to the Mississippi River through a single outfall.

The bounding annualized liquid effluent release for RBS Unit 3 is shown in DCD Table 12.2-19b. The parameters used for determining the release characteristics are shown in DCD Table 12.2-19a. The resulting bounding annualized release was used to determine the radiological impacts of operation. This analysis, resulting impact determinations, and evaluation showing conformance with 10 CFR 50, Appendix I, design objectives are described in more detail in Section 5.4.

DCD Section 11.5 describes the radiation monitoring and control system interfaces in further detail.

3.5.2.2 Gaseous Radwaste System

Radwaste products in the form of gases or airborne particles can be released to the environment by the ventilation systems or by other waste gas processing and handling systems. The gaseous radwaste system processes and controls the release of gaseous radioactive effluents to the environment. The gaseous radwaste system is described in FSAR Section 11.3.2.

The two main sources of plant gaseous radioactive effluents are the building ventilation systems (discussed in FSAR Section 9.4) and the power cycle offgas system (OGS) (described in FSAR Subsection 11.3.2 and DCD Figure 11.3-1). The building ventilation systems that contribute to the gaseous radioactive effluents include the Fuel Building, Radwaste Building, Turbine Building, and Reactor Building. The wastes discharged to the OGS during normal operation include radiolytic hydrogen and oxygen, power cycle injected gases and air inleakage, and radioactive isotopes of krypton, xenon, iodine, nitrogen, and oxygen.

FSAR Section 9.4 describes the building ventilation systems listed above and DCD Section 9.4 includes process diagrams for each system. Detailed discussion of the potential sources of airborne activity to each of these systems is provided in DCD Subsection 12.2.3. This includes information on airborne sources from the fuel pool resulting from refueling activities (refer to DCD Subsection 12.2.3.2.2).

During periods of high radioactivity, the Reactor Building and Fuel Building ventilation systems may direct exhaust to the Reactor Building heating, ventilating, and air conditioning (HVAC) purge exhaust filter unit. The Reactor Building purge exhaust filter units are equipped with prefilters, high-efficiency particulate air (HEPA) filters, and carbon filters for mitigating and controlling gaseous effluents from the Reactor or Fuel Buildings. DCD Table 9.4-11 provides design information for the Reactor Building purge exhaust filter units. The exhaust air is monitored for radiation prior to discharge to the atmosphere through the Reactor Building/Fuel Building vent stack.

The Radwaste Building ventilation system directs exhaust air to exhaust filtration units. The system uses HEPA filtration of the exhaust air from the building prior to discharge to the atmosphere. The exhaust air is monitored for radiation prior to discharge to the atmosphere through the Radwaste Building vent stack. DCD Table 9.4-7 provides design information for the Radwaste Building exhaust ventilation system.

The Turbine Building ventilation system directs building exhaust air to filtration units. Exhaust air from low potential contamination areas is exhausted to the Turbine Building vent stack, where it is monitored for radioactive contamination. Exhaust air from high potential contamination areas is filtered using HEPA filters before being exhausted to the Turbine Building vent stack. Areas with high potential contamination have exhaust subsystems equipped with HEPA filtration units for localized air cleanup prior to mixing with the main ventilation exhaust. The Turbine Building combined ventilation exhaust is monitored for halogens, particulates, and noble gas releases.

Process radiation monitoring is provided for all of the systems described above. DCD Section 11.5 describes the radiation monitoring and control system interfaces in further detail.

The bounding annualized airborne radioactivity source terms for the RBS Unit 3 are shown in FSAR Table 12.2-16R. The parameters used for determining the release characteristics are shown in FSAR Table 12.2-15R. The resulting bounding annualized release was used in determining the radiological impacts of operation. This analysis, resulting impact determinations, and evaluation showing conformance with 10 CFR 50, Appendix I, design objectives are described in more detail in Section 5.4.

3.5.2.3 Solid Radwaste System

Certain amounts of radioactive materials are generated in solid form. The solid radwaste system collects, processes, packages, and stores these solid radwastes for off-site shipment and permanent disposal.

The solid waste management system (SWMS) controls, collects, handles, processes, packages, and temporarily stores solid waste generated by the plant prior to shipping the waste off-site. These wastes include filter backwash sludge, reverse osmosis concentrates, and bead resins generated by the LWMS, reactor water cleanup (RWCU)/shutdown cooling (SDC) system, fuel and auxiliary pools cooling system (FAPCS), and condensate purification system. Contaminated solids such as HEPA and cartridge filters, rags, plastic, paper, clothing, tools, and equipment are also disposed of in the SWMS. Liquids generated by the SWMS are processed through the LWMS, as described in Subsection 3.5.2.1.

The SWMS processes and components are described in DCD Section 11.4. DCD Table 11.4-1 provides SWMS component capacities. DCD Table 11.4-2 provides estimates of annual waste generation and shipped volumes of dry active, wet solid, and mixed wastes. DCD Figures 11.4-1, 11.4-2, and 11.4-3 provide process and instrumentation diagrams for the SWMS.

3.5.2.4 Population Doses

Population doses off-site were determined for airborne and liquid release pathways. A detailed discussion of the calculation methods and inputs is provided in Section 5.4.

Results of the analysis and conformance with 10 CFR Parts 20 and 50, including the design objectives of 10 CFR 50, Appendix I, are provided in Section 5.4.

3.5.2.5 Cost Benefit Analysis Regarding Population Doses

A cost benefit analysis for the radwaste management systems is discussed in FSAR Subsections 11.2.1, 11.3.1, and 11.4.1.

3.5.3 REFERENCES

None.

3.6 NONRADIOACTIVE WASTE SYSTEMS

This section describes the nonradioactive waste streams that are expected at RBS Unit 3, including effluents containing chemicals or biocides (Subsection 3.6.1), effluents containing sanitary waste (Subsection 3.6.2), and other effluents (Subsection 3.6.3). Sources of chemicals discharged by RBS Unit 3 are identified, as applicable, by the waste categories specified in 40 CFR 423. These categories include circulating and service water systems; blowdown from recirculating cooling water systems; low-volume waste discharge systems; water treatment supernatant; filter backwash; area rainfall runoff; waste streams or discharges from roofs, yards, and other drains; and laundry waste.

Potentially radioactive or chemically contaminated floor and equipment drains would be collected separately and treated in the radioactive liquid waste system, which is described in Section 3.5.

The baseline water quality of the Mississippi River near St. Francisville, Louisiana, including seasonal variations of principal constituents of RBS Unit 3 intake and receiving waters and any minor or trace materials of environmental relevance, is provided in the U.S. Geological Survey (USGS) Water Data Report for water year October 2006 to September 2007 (Reference 3.6-1).

3.6.1 EFFLUENTS CONTAINING CHEMICALS OR BIOCIDES

This subsection discusses the identification and quantification of each chemical and biocide added to the receiving water by the discharge stream. These chemicals are typically used to control water quality, scale, corrosion, and biological fouling in the various systems.

The chemical concentrations within effluent streams from this facility are controlled through engineering and operational/administrative controls in order to meet the LPDES permit requirements at the time of construction and operation. The LPDES permit for the RBS is discussed in Section 1.2.

Examples of seasonal variations of principal constituents, including minor or trace materials, of the Mississippi River in the vicinity of the RBS site are provided in Subsection 2.3.3. The LDEQ permitting process also addresses this data.

Effluents from the station water system (SWS), circulating water system (CIRC), plant service water system (PSWS) and makeup water system (MWS) are discussed in Subsections 3.6.1.1, 3.6.1.2, 3.6.1.3, and 3.6.1.4, respectively. Effluent from the sanitary waste system is discussed in Subsection 3.6.2, and other station effluents are discussed in Subsection 3.6.3.

3.6.1.1 Station Water System

The SWS draws water from the Mississippi River, as described in Subsection 3.4.1.2. This water is passed through clarifiers and granular filters to provide makeup water to the various plant systems such as makeup water to the normal power heat sink (NPHS) cooling tower basins for the circulating water system and to the auxiliary heat sink (AHS) cooling tower basin for makeup to the PSWS, as shown in Figure 3.3-1. Polyelectrolyte coagulant and flocculent chemicals are added, via metered flow in accordance with Table 3.3-1, for suspended solids removal. Effluent from the plant clarifiers is distributed to a sludge dilution tank, diluted with river water, and combined with RBS Unit 1 clarifier underflow for discharge. This is further diluted when combined with other discharges so that the total dissolved solids (TDS) concentration from the combined RBS Units 1 and 3 discharges is projected to be between 1500 and 2700 milligrams per liter (mg/l), as described in ER Subsection 5.2.2.2.2. System normal and shutdown flow rates are shown in Figure 3.3-1.

3.6.1.2 Circulating Water System

The CIRC effluent and influent flows are treated with a biocide, an algaecide, sulfuric acid for pH adjustment, a corrosion inhibitor, and a scale inhibitor, as described in Subsection 3.3.2 and listed in Table 3.3-1. Chemical constituents of the RBS Unit 3 CIRC are expected to be similar to the constituents provided for RBS Unit 1, Outfall 001 (refer to Table 5.2-2). Discharge at this outfall consists of cooling tower blowdown and combined internal Outfall Effluents 101, 201, 301, 401, 501, and 601, as mapped in Figure 5.2-1 and described in Table 5.2-1.

The CIRC would be operated so that the concentration of TDS and other chemical constituents in the circulating water would typically be approximately four times the concentration in the makeup water (i.e., four cycles of concentration) on a year-round basis.

CIRC water would be chlorinated up to a maximum of 5 parts per million (ppm) at the point of application by the addition of sodium hypochlorite liquid. Residual chlorine is monitored at the discharge from the condensers, the SWS, and at the cooling tower blowdown. In accordance with 40 CFR 423, monthly average and daily maximum free available chlorine is not to exceed 0.2 mg/l and 0.5 mg/l, respectively. The discharge duration for either free available or total residual chlorine is not to exceed 2 hours in any 1 day from any one unit at one time (Reference 3.6-2). CIRC water effluent would not require treatment before discharge to the Mississippi River. The concentration of chemicals and solids in the cooling tower drift is expected to be the same as is in the circulating water. The maximum expected amount of drift is estimated to be 0.002 percent of the circulating water flow, or approximately 14 gpm. The resulting maximum solids emission rate associated with the maximum TDS in the CIRC water is approximately 229 pounds per day (lb/day) (Reference 3.6-2). System normal and shutdown flow rates are shown in Figure 3.3-1.

3.6.1.3 Plant Service Water System

The PSWS is described in FSAR Subsection 9.2.1. Its water use is discussed in Subsection 3.3.1.2 of the ER. Water treatment is discussed in Subsection 3.3.2.3 and consists of chemicals and additives similar to those of the CIRC, including biocide, algaecide, sulfuric acid for pH control, corrosion inhibitor, and scale inhibitor. If the AHS and NPHS are both required to be in service simultaneously, the blowdown from the AHS is mixed with the NPHS cooling tower blowdown. If the AHS is in service for shutdown loads, its blowdown is directed to an outfall and then to the Mississippi River. In either case, chemical constituents in this effluent would be similar to the chemical constituents for RBS Unit 1, Outfall 001 (refer to Table 5.2-2). The PSWS would be operated so that the concentration of total suspended solids (TSS) and other chemical constituents in the circulating water would typically be approximately four times the concentration in the makeup water (i.e., four cycles of concentration) on a year-round basis. System normal and shutdown flow rates are shown in Figure 3.3-1.

3.6.1.4 Makeup Water System

The MWS consists of two subsystems: the demineralization subsystem and the storage and transfer subsystem. The demineralization subsystem produces plant demineralized water. The storage and transfer subsystem distributes demineralized water throughout the entire plant.

Demineralized water will be produced by a vendor-supplied mobile water treatment system. The chemical constituents of this system's discharge would be similar to those listed for Outfall 001 in Table 5.2-2. System normal and shutdown flow rates are shown in Figure 3.3-1.

3.6.2 EFFLUENTS CONTAINING SANITARY WASTE

This subsection discusses anticipated quantities and characteristics of sanitary effluent during the construction and operation of RBS Unit 3.

Sanitary systems installed during preconstruction and construction activities would likely include portable toilets that are supplied and serviced by a contracted vendor.

A permanent sanitary waste system is provided for the operational phase of RBS Unit 3. Industrial materials, such as chemistry laboratory wastes, would be excluded from the sanitary waste system, as would any potentially radioactive materials. The chosen sanitary waste system design would consist of two trains, each capable of treating 40,000 gpd. System normal and shutdown flow rates are shown in Figure 3.3-1. Effluent discharges are regulated under the provisions of the Clean Water Act; the conditions of discharge for the plant would be specified in an amendment to the LPDES water discharge permit, Permit Number LA0042731 for RBS Unit 1 (Reference 3.6-3). Effluent discharge characteristics are expected to be similar to the Outfall 201 values shown in Table 5.2-2. Excess sludge produced by the system would be periodically removed and disposed of by a licensed waste disposal contractor.

3.6.3 OTHER EFFLUENTS

This subsection addresses miscellaneous gaseous, liquid, and solid effluents that are non-radioactive, including gaseous releases from operation of the auxiliary boiler, standby diesel generators (SDGs), and two diesel driven fire protection system pumps. This subsection also discusses stormwater drainage and other intermittent liquid low-volume sources (including the auxiliary boiler and mechanical drain systems), hazardous waste, and trash (including paper, metals, and garbage).

3.6.3.1 Gaseous Effluents

Nonradioactive gaseous effluents result from operation of the auxiliary boilers and from testing and operating the SDG power system and two diesel driven fire protection system pumps. These effluents commonly include particulates, sulfur oxides, carbon monoxide, hydrocarbons, and nitrogen oxides. Constituents of the auxiliary boiler effluent and their quantities are provided in Table 3.6-1. Constituents of the SDG and diesel driven fire pumps effluents and their quantities are provided in Tables 3.6-2 and 3.6-3, respectively. Gaseous effluent releases are limited by Louisiana Department of Environmental Quality (LDEQ) air emissions permit requirements.

3.6.3.2 Stormwater Drainage

In accordance with the RBS Stormwater Pollution Prevention Plan, stormwater from RBS Unit 3 structures would flow into major drainage courses and finally to West Creek, which discharges to Grants Bayou, and ultimately to the Mississippi River. A portion of the RBS Unit 3 areas would also drain to Alligator Bayou, which discharges to the Mississippi River. Major changes to current drainage courses at RBS are not anticipated as a result of Unit 3 construction; however, any changes in drainage are subject to review by the LDEQ.

Constituents of RBS Unit 3 stormwater effluents would be very similar to those listed in Tables 5.2-1 and 5.2-2 for Outfall 002 (materials storage and other areas); Outfall 003 (several plant building areas including low-volume wastewaters and condensates); Outfall 004 (several additional building areas, including maintenance wastewater and condensates and an external vehicle wash area), and Outfall 005 (stormwater from the cooling tower areas).

3.6.3.3 Other Intermittent Drainage and Oily Wastewater

Other intermittent plant drainage consists of other low-volume sources with constituents similar to those of Outfall 101, as listed in Table 5.2-2.

Auxiliary boiler blowdown is discharged to the non-radioactive Equipment and Floor Drain System.

Drainage that may contain oil is routed to an oily water separator prior to discharge to the stormwater system. Oil collected by the separators is trucked off-site for disposal by a licensed contractor. Oily water separators are provided to treat the floor drainage from the fire pump house, SDG areas, auxiliary boiler area, and drains in the transformer yard. Effluent from the separators would meet limits specified in the LPDES permit (Reference 3.6-2).

3.6.3.4 Hazardous Wastes

Hazardous wastes are wastes with properties that make them dangerous or potentially harmful to human health or the environment, or that exhibit at least one of the following characteristics:

- Ignitability
- Corrosivity
- Reactivity
- Toxicity

Federal Resource Conservation and Recovery Act (RCRA) regulations govern the generation, treatment, storage, and disposal of hazardous wastes.

RBS Unit 1 currently generates small quantities of hazardous wastes and has been classified as a small quantity generator (producing less than 2200 lb of waste in any calendar month, pursuant to the RCRA). Although wastes can be stored for a maximum of 180 days, wastes are typically stored approximately 90 days prior to disposal at a permitted disposal facility. All hazardous wastes activities are performed in compliance with federal regulations and RBS waste handling procedures.

RBS has procedures in place to minimize the impact of an unlikely hazardous waste spill. The treatment, storage, and disposal of wastes generated by the construction and operation of RBS Unit 3 would be managed as wastes are currently managed at RBS Unit 1. The classification of RBS as a small quantity generator would most likely not change with the additional hazardous wastes generated by RBS Unit 3 based on recent and historic generation quantities.

3.6.3.5 Miscellaneous Liquid and Solid Effluents

Nonradioactive solid wastes include typical industrial wastes such as metal, wood, and paper, as well as process wastes such as spent filter cartridges, nonradioactive resins, and sludge. The RBS ships waste oil, grease, hydraulic fluid, adhesives, liquid paint, and solvent for fuel blending and thermal energy recovery. Used oils, diesel fuel, and antifreeze solutions are sent to a recycling vendor for reprocessing. Lead-acid batteries are returned, when possible, to the original manufacturer for recycling or are shipped to a registered battery recycler. In addition, the RBS has an active paper and scrap metal recycling program. Nonradioactive solid waste that cannot be shipped for recycling is shipped for disposal.

Municipal type waste and construction-related noncombustibles, inert debris are transported to a permitted off-site landfill. Solid debris taken from the intake screens would be sluiced back into the Mississippi River, as is currently done by RBS Unit 1 operations. The RBS would apply similar waste management practices for RBS Unit 3.

3.6.4 REFERENCES

3.6-1 U.S. Geological Survey, *Water Data Report 2007, 07373420 Mississippi River near St. Francisville, LA, for Water Year October 2006 through September 2007*, Website, http://wdr.water.usgs.gov/wy2007/pdfs/07373420.2007.pdf, accessed April 7, 2008.

3.6-2 Gulf States Utilities Company, "River Bend Station Environmental Report, Operating License Stage," Volumes 1-4, Supplements 1-9, November 1984.

3.6-3 Louisiana Department of Environmental Quality, "Louisiana Water Discharge Permit - River Bend Station, Permit Number LA0042731," June 2006.

Table 3.6-1
RBS Unit 3 Auxiliary Boiler Annual Air Emissions

	Annual Emissions (lb)
Particulates	1438
Sulfur Oxides	515
Carbon Monoxide	3267
Hydrocarbons	180
Nitrogen Oxides	14,374

Table 3.6-2
RBS Unit 3 Standby Diesel Generator Annual Air Emissions

	Emissions per SDG (g/kWh)	Annual Emissions per SDG (g)	Annual Emissions per SDG (lb)
Particulates	0.59	484,272	1068
Sulfur Oxides	12	9,849,600	21,715
Carbon Monoxide	0.6	492,480	1086
Hydrocarbons	0.8	656,640	1448
Nitrogen Oxides	12.8	10,506,240	23,162

Table 3.6-3
RBS Unit 3 Diesel Driven Fire Pump Annual Air Emissions

	Emissions per DDFP[(a)] (g/kWh)	Annual Emissions per DDFP (g)	Annual Emissions per DDFP (lb)
Particulates	0.59	5664	12
Sulfur Oxides	12	115,200	254
Carbon Monoxide	0.6	5760	13
Hyrdocarbons	0.8	7680	17
Nitrogen Oxides	12.8	122,880	271

a) Diesel driven fire pump.

3.7 POWER TRANSMISSION SYSTEM

Currently, RBS Unit 1 is linked to load demand areas by a system of transmission lines in the Entergy Electric System (EES). The EES grid system consists of interconnected hydroelectric plants, fossil fuel plants, and nuclear plants that supply electric energy over a 500/345/230/161/138/115 and 69 kV transmission system. Entergy Gulf States Louisiana, L.L.C. (EGSL) owns the 13-ac. (approximately) RBS Unit 1 plant switchyard area. EGSL is a member of the EES. Other members include Entergy Arkansas, Inc., Entergy Louisiana, LLC, Entergy Mississippi, Inc., Entergy New Orleans, Inc., and Entergy Texas, Inc.

Entergy will provide the service to move the energy generated by Unit 3 to the regional transmission grid and the ultimate consumers. Entergy will construct a 500 kV line from a new 500 kV tap to the Unit 3 switchyard for the interconnection. As discussed in Section 2.2, the proposed new transmission corridor has not been finalized and is still subject to change. The final selection of a route will be the responsibility of Entergy, and the construction will be permitted by the Louisiana Public Service Commission (LPSC) in the form of a Certificate of Convenience and Necessity.

Six transmission lines associated with the RBS are routed to the nearby Fancy Point Substation along the three rights-of-way (ROWs), which are designated as Routes I, II, and III. The transmission lines are described in Table 3.7-1.

During RBS Unit 3 startup and operation, the EES power transmission and distribution (T&D) system will be relied upon to distribute the electricity generated by the new facility. In support of site selection evaluation work (Section 9.3), a reliability impact study of the Entergy transmission system was conducted to assess the transmission steady-state and transient stability performance with the new potential electrical power generation at the RBS. The assessment required a new 500 kV transmission line from Fancy Point Substation to a new tap between two existing substations. An SIS (Reference 3.7-1) was performed based on the installation of a nuclear unit facility with a maximum capacity of 1933 MVA. The scheduled gross power output of the plant is 1684 MW. An auxiliary/host load of approximately 90 MW is also expected at the site; therefore, the study anticipated the power injection of 1594 MW into the EES.

As part of its application for an interconnect approval to the off-site system, the SIS was performed by the Southwest Power Pool - Independent Coordinator of Transmission (SPP-ICT) to determine what upgrades, if any, are required to allow the interconnection and transmission of the energy output from the plant to the grid. This report has identified the system improvements that will be required to maintain grid integrity and system stability while accepting the anticipated injection from Unit 3. It is important to note that the SIS is based not only on the anticipated contributions from Unit 3, but also on all other new generation capacity and other system alternations planned (by any party known to SPP-ICT) between the commissioning of the SIS and expected on-line date of the facility being studied. The SIS evaluates 1594 MWe net output to the grid in the determination of impacts. The output of Unit 3 is bounded by this parameter. The SIS evaluates a new 500 kV line from the existing Fancy Point 500 kV Substation to the new tap.

The new 500 kV transmission line is planned to connect the Fancy Point Substation to an existing 500 kV transmission line routed from Hartburg to Mount Olive. A route selection study has been performed which recommends a 148-mi. route for this new transmission line that would connect to the 500 kV Hartburg-Mount Olive line in the Natchitoches Parish near the community of Marthaville, Louisiana. Refer to Figure 3.7-1 for the corridors considered in the route selection study. A Geographic Information System (GIS) study was performed of the five preliminary transmission routes. Figure 2.4-6 is a GIS-generated composite constraint map where the constraints were classified with values representing desirability of the area for transmission corridor development. A score was calculated for each of the routes, based on the features identified in Table 3.7-2.

The total score was calculated for each of the preliminary routes. The route with the lowest score is considered the most environmentally favorable route. The transmission line routing will be finalized during detailed design. Refer to FSAR Figure 8.2-201 for information on existing corridors. Permitting authority for transmission line construction lies with the U.S. Army Corps of Engineers (USACE) and with the EPA. Entergy Transmission and Distribution has an established process for evaluating the environmental impacts of new transmission lines. The process ensures that the transmission line planner considers the potential for environmental impacts resulting from stormwater drainage, wetland crossings, dredging or filling, and wildlife hazards. It also identifes the agencies that would need to be contacted, permits needed, and special design considerations based on the types of impacts identified.

3.7.1 TRANSMISSION LINE RIGHT-OF-WAY AND CONSTRUCTION

The power transmission and off-site power system for RBS Unit 3 will be connected to the Fancy Point 500 kV switchyard located adjacent to the RBS. The Fancy Point 500 kV switchyard will be expanded to the west and reconfigured to support the generation output and off-site power connections for RBS Unit 3. The existing McKnight 500 kV line and Big Cajun No. 2 500 kV lines will be reconfigured, as shown in FSAR Figure 8.2-202.

The new transmission line from Fancy Point Substation to the Hartburg-Mount Olive line will consist of a single-circuit 500 kV transmission line. The preliminary route for this transmission line is expected to exit the Fancy Point 500 kV Substation and proceed west-southwest paralleling several existing Entergy transmission lines. This line crosses the Mississippi River at the Big Cajun Generating Station near New Roads, Louisiana. Approximately 9 mi. west of New Roads, the route turns to the northwest, passing through the parishes of Point Coupee, Avoyelles, and Rapides. It crosses the Red River and continues in a northwesterly direction between two units of the Kisatchie National Forest. At this point, the route is located approximately 5 mi. north of the cities of Alexandria and Pineville. It continues to the northwest, crossing the Red River a second time as it passes through portions of Grant and Rapides parishes. The line is located approximately 5 mi. south of the city of Natchitoches and interconnects with the existing Hartburg-Mount Olive 500 kV transmission line at a site near the small community of Marthaville, Louisiana.

The size and type of the 500 kV conductors proposed for the transmission line have not yet been determined. However, bundled conductors will be employed for each phase. Two to four conductors per phase would likely be used in the final design. The conductor to be used would likely be a standard size and type that is used on Entergy's 500 kV transmission system. The typical span length for the proposed transmission line is anticipated to be 1000 ft., resulting in an average of approximately five structures per mile. The ROW along the new corridor is planned to be 200 ft. in width.

Surveying, design, and construction of the new route are performed by the EES. The transmission towers would have an average height of 150 feet, though the structures required for crossing the Mississippi River would be substantially higher. The minimum line-to-ground clearance heights vary from 26 to 28 ft. throughout its length, with a greater minimum height of 40 ft. near road crossings (for areas accessible to pedestrians only) to 45 ft. over cultivated farmland. The minimum clearance is calculated on the basis of maximum sag for a conductor temperature of 212°F. A typical tower construction is shown in Figure 3.7-2.

3.7.2 CONFORMANCE TO STANDARDS

Design standards for the T&D system meet or exceed the *National Electrical Safety Code* (NESC) (Reference 3.7-2) design criteria, and modifications to the existing system will comply with the relevant local, state, and industry standards, including the NESC and various American Standards Institute/Institute of Electrical and Electronics Engineers standards. The standards include the rules in Section 23, 25, and 26 of the NESC.

3.7.3 ENVIRONMENTAL EFFECTS OF TRANSMISSION LINE OPERATION

There are two categories of electrical environmental effects from power transmission lines: corona effects caused by electrical stresses resulting in air ionization, and field effects caused by induction to objects in proximity to the line. Corona-produced audible noise and ground-level electric field effects are the primary concerns.

Audible noise is typically at its maximum during or following rain events. This is due to the corona effect on a wet conductor. A predicted audible noise profile for a representative 500 kV transmission line with a wet conductor is provided in Figure 3.7-3. The maximum noise level, which is less than 50 dB at the center of the ROW (measured from an X-coordinate of zero in the figure), is below the level that would probably result in a number of complaints (52.5 dB, in accordance with Reference 3.7-3).

Ground-level electric field effects of overhead power transmission lines relate to the possibility of exposure to electric discharges from objects in the field of the line. A typical electric field profile at ground level for a power transmission line is shown in Figure 3.7-3 (the X-coordinate in the figure corresponds to the center of the ROW). The value would vary depending on line sag, three-phase current balance, and line current. The likely range of maximum vertical electric field for 500 kV is 5 to 9 kV/m (Reference 3.7-3).

The impacts of maintenance activities in the ROW are discussed in Subsections 5.6.1 and 5.6.2. The effect of electromagnetic fields is discussed in Subsection 5.6.3.

The transmission line route selection study avoided wildlife preserves and refuges to the extent possible with the scoring system used. A more detailed survey will be performed when the ROW is finalized.

3.7.4 REFERENCES

3.7-1 Southwest Power Pool, "System Impact Study Report (PID 208)," 1594 MW (1684 MW Gross) Plant, Fancy Point, Mississippi, January 10, 2008.

3.7-2 Institute of Electrical and Electronics Engineers, *National Electrical Safety Code*, New York, New York, 2007.

3.7-3 Fink, D. G. and H. W. Beaty, eds., *Standard Handbook for Electrical Engineers*, 13th ed., McGraw-Hill, New York, 1993.

3.7-4 U.S. Nuclear Regulatory Commission, *Final Environmental Statement related to the Operation of River Bend Station*, NUREG-1073, Docket 50-458, January 1985.

3.7-5 Entergy Operations, Inc., "River Bend Station Updated Safety Analysis Report" through Revision 19, July 2006.

Table 3.7-1
Transmission ROW Information

Route	Line Name	Line	Voltage	Termination Point	Distance from RBS to Termination Point, mi.
I	Big Cajun No. 2	L-746/745/ 715	500/230 kV	Webre Substation	29.2
II	Enjay	L-351/352	230 kV	Jaguar Bulk Substation	23.8
II	Port Hudson	L-353	230 kV	Port Hudson Bulk Substation	11.5
II	Port Hudson	L-354	230 kV	Port Hudson Bulk Substation	11.5
II	Waterloo Big Cajun No. 1	L-715	230 kV	Big Cajun No. 1	8.3
III	McKnight	L-752	500 kV	McKnight Switching Substation	27.2

Source: References 3.7-4 and 3.7-5.

Table 3.7-2
GIS Scoring

Feature	Score
Louisiana Land Stewardship Program	8
Wildlife Preserves and Refuges	7
Wetlands	5
Woody Wetlands	6
Lakes and Reservoirs	Avoided
Rivers and Streams	1
Navigable Waters	6
Pastures and Vacant Fields	1
Croplands and Orchards	2
Woodlands	3
Subdivisions, Cities, and Towns	8
Rice Fields and Aquaculture	6
Hospitals, Schools, and Cemeteries	Avoided
Airports and Military Bases	Avoided
Towers	Avoided
Historical Places	8
National Forests	7
State Parks	8
Local Parks	5

ER 3.7 Figures

Due to the large file sizes of the figures for ER Chapter 3, they are collected in a single .pdf file, which you can navigate via the figure numbers in the Bookmark pane. When cited in the text, the links for these figures will launch the .pdf file.

3.8 TRANSPORTATION OF RADIOACTIVE MATERIALS

This section addresses the transportation of radioactive materials associated with the RBS. Postulated accidents as a result of transporting radioactive materials are discussed in Section 7.4.

As required by 10 CFR 51.52, an environmental report prepared for the combined license stage of a light-water-cooled reactor (LWR) and submitted after February 4, 1975, shall contain a statement concerning the transportation of fuel and radioactive wastes to and from the reactor.

Table S-4 (as provided in 10 CFR 51.52(c) and reproduced herein as Table 3.8-1) is a summary impact statement concerning the transportation of fuel and radioactive wastes to and from a reactor. The table is divided into two categories of environmental considerations: (1) normal conditions of transport and (2) accidents in transport. The "normal conditions of transport" considerations are further divided into environmental impact, exposed population, and range of doses to exposed individuals per reactor reference year. These conditions describe the environmental impacts of the heat of the fuel cask in transit, weight, and traffic density. The number and range of radioactive doses to transportation workers and the general public are also described.

The "accidents in transport" consideration addresses environmental risk from radiological effects and common nonradiological causes such as fatal and nonfatal injuries and property damage. "Accidents in transport" are addressed in Section 7.4.

To indicate that Table S-4 adequately describes the environmental effects of the transportation of fuel and waste to and from the reactor, an environmental report must state that the reactor and this transportation either meet all of the conditions in Paragraph (a) of 10 CFR 51.52 or all of the conditions in Paragraph (b) of 10 CFR 51.52. Subparagraphs 10 CFR 51.52(a)(1) through (5) delineate specific conditions that the reactor must meet to use Table S-4 as part of its environmental report. These conditions include reactor core thermal power, fuel form, fuel enrichment, fuel encapsulation, average fuel irradiation, time after discharge of irradiated fuel before shipment, mode of transport of unirradiated fuel, mode of transport for irradiated fuel, and mode of transport for radioactive waste other than irradiated fuel. There are two other conditions in Table S-4 which require that radioactive waste, with the exception of irradiated fuel, be packaged and in solid form. Table 3.8-2 was prepared to succinctly show the reference conditions, along with the bounding values for the ESBWR reactor technology. Subparagraph 10 CFR 51.52(a)(6) states, "The environmental impacts of transportation of fuel and waste to and from the reactor, with respect to normal conditions of transport and possible accidents in transport, are as set forth in Summary Table S-4 in paragraph (c) of this section; and the values in the table represent the contribution of the transportation to the environmental costs of licensing the reactor."

Paragraph 10 CFR 51.52(b) states that reactors not meeting the conditions of 10 CFR 51.52(a) shall have a full description and detailed analysis of the environmental impacts for the reactor.

The ESBWR reactor design exceeds the conditions prescribed in 10 CFR 51.52 in three areas: (1) reactor power level, (2) fuel enrichment, and (3) average burnup. For these exceptions, results from the analyses presented in Appendix H.2 of NUREG-1817 have been referenced and applied in the appropriate subsections below. Use of these analyses is appropriate because Section H.2.2.1 contains the following statement: "Impacts were not calculated for the River Bend site because the analysis is bounded by the impacts calculated for Grand Gulf."

3.8.1 TRANSPORTATION OF UNIRRADIATED FUEL

In this subsection, the number and characteristics of shipments of unirradiated fuel to the RBS site are compared to the conditions described in 10 CFR 51.52.

The conditions specified in 10 CFR 51.52(a) that apply to unirradiated fuel include the following:

1. The reactor has a core thermal power level not exceeding 3800 megawatts thermal (MWt).

2. The reactor fuel is in the form of sintered uranium dioxide (UO_2) pellets having a uranium -235 (U-235) enrichment not exceeding 4 percent by weight, and the pellets are encapsulated in Zircaloy rods.

3. Unirradiated fuel is shipped to the reactor by truck.

Conditions (1) and (2) are not met by the ESBWR reactor design, while condition (3) is met because the RBS plans to ship unirradiated fuel by truck. Since the ESBWR reactor design has a core thermal power of 4500 MWt and a fuel enrichment of 4.6 percent U-235, both exceeding the conditions specified in 10 CFR 51.52(a), a full description and detailed analysis is required. Such an analysis was performed for the Grand Gulf site and is documented in NUREG-1817, Appendix H.2.

The initial core load and annual reload quantities for the ESBWR reactor design are 166.76 metric tons uranium (MTU) and 68.20 MTU, respectively. This equates to approximately 30 shipments for the initial core load, and subsequent reloads would require an average of 6.1 shipments per year, or 12.2 shipments per reload based on a 24-month operating cycle. The condition specified in Table S-4 of 10 CFR 51.52(c) 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. WASH-1238 (Reference 3.8-1) provided input data for Table S-4, including the number of truck shipments of unirradiated fuel for a reference 1100-megawatts electric (MW(e)) reactor (refer to Table 3.8-3). The ESBWR shipments were normalized to the net electrical generation output for this reference reactor. The results yielded a normalized value of 165 truck shipments for the ESBWR reactor, which is well within the 252 shipments for the reference plant.

In addition, 10 CFR 51.52(c) includes a condition that the truck shipments not exceed 73,000 lb. (33,100 kg), as governed by federal or state gross vehicle weight restrictions. In accordance with the *Early Site Permit Environmental Report Sections and Supporting Documentation* (Reference 3.8-2), all of the advanced reactor designs (including the ESBWR) would meet this weight restriction for unirradiated fuel.

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 in NUREG-1817 using the RADTRAN 5 computer code.

The input parameters for the RADTRAN 5 calculations included the shipping distance; dose rate at 1 m from the vehicle; packaging length; number of truck crew; stop time; population density at stops; and population densities, vehicle speeds, and traffic counts for rural, suburban, and urban areas. Using these inputs, "generic" doses per shipment of unirradiated fuel were calculated to workers, to the general public onlookers at stops/sharing the highway, and to the general public along the route/living near a highway. These generic doses were then multiplied by the average annual shipments of unirradiated fuel for the ESBWR reactor, normalized to the WASH-1238 reference reactor. From NUREG-1817, the cumulative annual doses for the ESBWR in comparison to the reference reactor are shown in Table 3.8-4.

Based on this assessment, the calculated radiation doses for shipping unirradiated fuel to the RBS for the ESBWR reactor is bounded by the conditions shown in Table S-4.

3.8.2 TRANSPORTATION OF IRRADIATED FUEL

In this subsection, the impact of transporting irradiated fuel from the RBS site to a potential high-level waste repository at Yucca Mountain, Nevada, is considered. As in Subsection 3.8.1, reference is made to the analyses contained in NUREG-1817, which considered the Grand Gulf Nuclear Power Station as a primary site. These analyses and results bound the RBS site. In the following subsections, the number and characteristics of shipments of irradiated fuel to the RBS site are compared to the conditions described in 10 CFR 51.52. Nonconformances are discussed, where appropriate, and overall conclusions are reported in Subsection 3.8.4.

3.8.2.1 Core Thermal Power

10 CFR 51.52(a)(1) requires that the reactor has a core thermal power level not exceeding 3800 MW. The ESBWR reactor power level is 4500 MWt. The higher rated core power level would typically indicate the need for more fuel and, therefore, more fuel shipments. This is not the case in this instance, because of the higher unit capacity and higher burnup for the reactors with the increased power level. The annual fuel loading for the reference reactor was 35 MTU, while the annual fuel loading for the ESBWR is only 34.1 MTU (68.197 MTU per reload, based on a 2-year cycle). Also, WASH-1238 states: "The analysis is based on shipments of fresh fuel to and irradiated fuel and solid waste from a boiling water reactor or a pressurized water reactor with design ratings of 3,000 to 5,000 megawatts thermal (MWt) or 1,000 to 1,500 megawatts electric (MWe)." The ESBWR falls within these bounds.

3.8.2.2 Fuel Form

10 CFR 51.52(a)(2) requires that the reactor fuel be in the form of sintered UO_2 pellets. The ESBWR technology utilizes the sintered UO_2 pellet fuel form.

3.8.2.3 Fuel Enrichment

10 CFR 51.52(a)(2) requires that the reactor fuel have a U-235 enrichment not exceeding 4 percent by weight. The ESBWR reactor design has a fuel enrichment of 4.6 percent U-235, which exceeds this requirement. The U.S. Nuclear Regulatory Commission (NRC) has subsequently concluded that enrichment up to 5 percent is also bounded by the environmental impacts considered in Table S-4. These evaluations are documented in the "NRC Assessment of the Environmental Effects of Transportation Resulting from Extended Fuel Enrichment and Irradiation" as provided in NUREG-1437 (Reference 3.8-3). The ESBWR technology meets this subsequent evaluation condition.

3.8.2.4 Fuel Encapsulation

10 CFR 51.52(a)(2) also requires that the reactor fuel pellets be encapsulated in Zircaloy rods. The fuel design utilized in the ESBWR technology uses Zircaloy rods.

3.8.2.5 Fuel Irradiation

10 CFR 51.52(a)(3) requires that the average burnup is not to exceed 33,000 megawatt-days per metric tons uranium (MWd/MTU). The ESBWR reactor design has an expected average burnup of 46,000 MWd/MTU, which exceeds this requirement. The NRC has subsequently concluded that average burnup up to 62,000 MWd/MTU for the peak rod is also bounded by the environmental impacts considered in Table S-4. These evaluations are also documented in the "NRC Assessment of the Environmental Effects of Transportation Resulting from Extended Fuel Enrichment and Irradiation," as provided in 53 *FR* 30555 and 53 *FR* 32322, and in NUREG-1437. The ESBWR technology meets this subsequent evaluation condition.

3.8.2.6 Time after Discharge of Irradiated Fuel before Shipment

Spent fuel assemblies would be discharged from the unit at intervals of approximately 2 years. Spent fuel assemblies would remain in the spent fuel pool while short half-life isotopes decay. The fuel storage racks provided in the spent fuel pool in the Fuel Building provide for storage of irradiated fuel assemblies resulting from 10 calendar years of plant operation plus one full core off-load. As described in the DCD, the fuel storage racks in the Reactor Building buffer pool deep pit can hold a total of 154 spent fuel assemblies. After approximately 10 years, the fuel would be removed from the pool and packaged in casks for on-site storage and potential off-site transport. RBS Unit 1 has a dry fuel storage capacity to hold 2720 fuel assemblies. Packaging of the fuel for off-site shipment will comply with applicable U.S. Department of Transportation (DOT) and NRC regulations for transportation of radioactive material. By law, the U.S. Department of Energy (DOE) is responsible for spent fuel transportation from reactor sites to a repository (Reference 3.8-4) and will make the decision on transport mode.

10 CFR 51.52(a)(3) requires that no irradiated fuel assembly be shipped until at least 90 days after it is discharged from the reactor. Table S-4 assumes 150 days of decay time prior to shipment of any irradiated fuel assemblies. Five years is the minimum decay time expected before shipment of irradiated fuel assemblies; this amount of time is supported by two current practices. One practice is in accordance with the contract with the DOE, who has ultimate responsibility for the spent fuel. Five years is the minimum cooling time specified in 10 CFR 961,

Appendix E. The other practice is that the NRC specifies 5 years as the minimum cooling period when it issues certificates of compliance for casks used for shipment of power reactor fuel (Reference 3.8-5).

3.8.2.7 Shipment of Irradiated Fuel

10 CFR 51.52(a)(5) allows for truck, rail, or barge transport of irradiated fuel. The ESBWR vendor states that either rail or truck shipment will be used. Table 3.8-5 identifies the bounding value for the number of truck shipments of irradiated fuel annually is 33 for the ESBWR, based on 1 MTU (seven assemblies) per truck cask. The analysis in NUREG-1817 assumed 41 shipments, but noted that "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." Table 3.8-6 identifies the estimated annual population doses from routine (incident-free) transportation of the spent fuel to the proposed Yucca Mountain repository.

3.8.3 TRANSPORTATION OF RADIOACTIVE WASTE

As described in Subsections 3.5.2.3 and 5.5.3, low-level radioactive waste will be packaged to meet transportation and disposal site acceptance requirements. Packaging of waste for off-site shipment will comply with applicable DOT and NRC regulations for transportation of radioactive material. The packaged waste will be stored on-site on an interim basis before being shipped off-site to a licensed volume reduction facility or disposal site. Table 3.8-7 presents estimates of annual waste volumes and annual waste shipment numbers for the ESBWR, normalized to the reference 1100 MWe LWR defined in WASH-1238 (Reference 3.8-1). The annual water volumes and waste shipments for the ESBWR were less than those of the reference LWR that was the basis for the Table S-4 criteria.

10 CFR 51.52(a)(5) requires that the mode of transport of low-level radioactive waste be either truck or rail. RBS plans to ship low-level radioactive waste by truck.

3.8.4 ANALYSIS AND CONCLUSION

The NRC evaluated the environmental impact and risk effects of the transportation of fuel and waste for LWRs in WASH-1238 and Supplement 1 of NUREG-75/038, and found the impacts to be SMALL. These NRC analyses provided the basis for Table S-4 in 10 CFR 51.52.

In NUREG-1817, an analysis was performed to investigate the doses to crew, onlookers, and persons along the route for 11 representative reactor sites, including the Grand Gulf site. For the purposes of this report, it has been assumed that the Grand Gulf results bound those for the RBS site, and this assumption is explicitly supported in NUREG-1817. Since the Grand Gulf and RBS sites are in close proximity, it is reasonable to assume that the input parameters to the RADTRAN 5 calculation, such as the shipping distance, number of shipments, population density, traffic count, packaging dimensions, stop times, and dose rate from vehicles would be nearly identical.

The bounding cumulative doses to the exposed population, as provided in Table S-4 of 10 CFR 51.52(c), are 4 person-rem per reference reactor year to transport workers, and 3 person-rem per reference reactor year to the general public (i.e., onlookers and persons along the route).

The NUREG-1817 analysis for Grand Gulf resulted in the population doses identified in Table 3.8-6.

As identified in Table 3.8-6, the population dose to onlookers for the ESBWR reactor type exceeded the Table S-4 value by a factor of 4. In accordance with NUREG-1817, there are several reasons for this exceedance, including the assumed number of spent fuel shipments, as well as conservative shipping distances, dose rates from casks, and average truck stop times. The analysis in Appendix H.2 of NUREG-1817 normalized the number of spent fuel shipments to the reference reactor, which assumed that 60 shipments per year would be made, each shipment carrying 0.5 MTU of spent fuel. The normalized value of 41 shipments was utilized for the ESBWR reactor design, as well as a shipping distance of 2310 mi. (3718.3 km), 5 years of cooling time for the spent fuel, resulting in a dose rate of 10 mrem/hr at approximately 7 ft. (2 m) from the vehicle, and 30 minutes per truck stop.

As cited in Subsection 3.8.2.7, the expected number of annual shipments from the RBS to Yucca Mountain is 33. Newer spent fuel shipping cask designs are based on longer-cooled spent fuel and have larger capacities than shorter-cooled casks, which results in fewer shipments per year. Furthermore, the assumed 5-year cooling time is conservative in comparison with the expected 10-year cooling time at the RBS. This longer cooling time would result in lower dose rates during transport, as substantiated by NUREG/CR-6672, which is cited in NUREG-1817.

WASH-1238 used a typical shipping distance of 1000 mi. (1600 km), whereas the shipping distance used for the Grand Gulf site was 2310.5 mi. (3718.3 km). This discrepancy resulted in an apparently higher cumulative dose to the public in the NUREG-1817 analysis, but if the shipping distances were normalized, this discrepancy would not be nearly as significant.

Finally, in accordance with NUREG-1817, the use of 30 minutes as an average stop time for trucks is an overestimation by a factor of 2, because many stops along the way are of short duration for brief visual inspections of the cargo, and these stops normally take place in minimally populated areas.

As a result of these conservative differences between the assumptions made in the calculation of the values in Table S-4 and the analyses performed in NUREG-1817, a correction factor of 0.12 is suggested to provide more accurate dose rates for comparison to the acceptance criteria set forth in Table S-4. This correction factor is based on reduction by a factor of 2 for close proximity exposure time at stops, a factor of 1.5 for the average stop time at food and refueling stops, a factor of 1.5 for the number of people in proximity to the shipping cask, and a factor of 2 for fuel aging [1/(2 x 1.5 x 1.5 x 2) = 0.12]. Applying this correction factor brings the dose rate to onlookers down to 1.4 person-rem per reference reactor year, which is within the cumulative dose of 3 person-rem per reference reactor year from Table S-4.

Based on the above assessment, it is concluded that the ESBWR technology meets the conditions delineated in 10 CFR 51.52, as modified by the subsequent evaluations stated in this section, and that the environmental impacts summarized in Table S-4 are bounding for the RBS site. The RBS Unit 3 ESBWR design plant parameters that are applicable to the transportation of irradiated and unirradiated fuel are expected to be identical to or bounded by those identified in the Grand Gulf Unit 3 COLA (Reference 3.8-6). Therefore, no additional analyses of fuel transportation effects for normal conditions or accidents are required.

3.8.5 REFERENCES

3.8-1 U.S. Nuclear Regulatory Commission, *Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants*, WASH-1238, December 1972.

3.8-2 Idaho National Engineering and Environmental Laboratory, *Early Site Permit Environmental Report Sections and Supporting Documentation*, Engineering Design File Number 3747, Idaho Falls, Idaho, 2003.

3.8-3 U.S. Nuclear Regulatory Commission, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437, May 1996.

3.8-4 U.S. Department of Energy, Nuclear Waste Policy Act as Amended, March 2004, Section 302.

3.8-5 U.S. Nuclear Regulatory Commission, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437, Addendum 1, August 1999.

3.8-6 Gulf States Utilities Company, "Grand Gulf Nuclear Station Unit 3, Combined License Application, Part 3: Environmental Report," Revision 0, February 2008.

3.8-7 Idaho National Engineering and Environmental Laboratory, Early Site Permit Environmental Report Sections and Supporting Documentation, Engineering Design File Number 3747, Idaho Falls, Idaho, 2003.

Table 3.8-1 (Sheet 1 of 2)
Summary Table S-4
Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor[1]

Normal Conditions of Transport

Condition	Value
Heat (per irradiated fuel cask in transit)	250,000 Btu/hr.
Weight (governed by Federal or State restrictions)	73,000 lbs. Per truck; 100 tons per cask per railcar.
Traffic density:	
Truck	Less than 1 per day.
Rail	Less than 3 per month.

Exposed Population	Estimated Number of Persons Exposed	Range of Doses to Exposed Individuals[2] (per reactor year)	Cumulative Dose to Exposed Population (per reactor year)[3]
Transportation workers	200	0.01 to 300 millirem	4 man-rem.
General public:			
Onlookers	1,100	0.003 to 1.3 millirem	3 man-rem.
Along Route	600,000	0.0001 to 0.06 millirem	

Accidents in Transport

Types of Effects	Environmental Risk
Radiological effects	Small[4]
Common (nonradiological) causes	1 fatal injury in 100 reactor years; 1 nonfatal injury in 10 reactor years; $475 property damage per reactor year.

49 FR 9381, Mar. 12, 1984; 49 FR 10922, Mar. 23, 1984, as amended at 53 FR 43420, Oct. 27, 1988; 72 FR 49512, Aug. 28, 2007.

Table 3.8-1 (Sheet 2 of 2)
Summary Table S-4
Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor[1]

1) Data supporting this table are given in the Commission's "Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants," WASH-1238, December 1972, and Supp. 1 NUREG-75/038 April 1975. Both documents are available for inspection and copying at the Commission's Public Document Room, 2120 L Street NW., Washington, DC and may be obtained from the National Technical Information Service, Springfield, VA 22161. WASH-1238 is available form NTIS at a cost of $5.45 (microfiche, $2.25) and NUREG-75/038 is available at a cost of $3.25 (microfiche $2.25).

2) The Federal Radiation Council has recommended that the radiation doses from all sources of radiation other than natural background and medical exposures should be limited to 5,000 millirem per year for individuals as a result of occupational exposure and should be limited to 500 millirem per year for individuals in the general population. The dose to individuals due to average natural background radiation is about 130 millirem per year.

3) Man-rem is an expression for the summation of whole body doses to individuals in a group. Thus, if each member of a population group of 1,000 people were to receive a dose of 0.001 rem (1 millirem), or if 2 people were to receive a dose of 0.5 rem (500 millirem) each, the total man-rem dose in each case would be 1 man-rem.

4) Although the environmental risk of radiological effects stemming from transportation accidents is currently incapable of being numerically quantified, the risk remains small regardless of whether it is being applied to a single reactor or a multireactor site.

Table 3.8-2
ESBWR Transportation Worksheet

Reactor Technology	Reference LWR[a] (Single Unit) (1100 MWe)	ESBWR (Single Unit) (4500 MWt) (1600 MWe)	Table S-4 Condition
Characteristic			
Reactor Power Level MWt	~3400 MWe	4500 MWt[b]	Not exceeding 3800 MWt per reactor
Fuel Form	Sintered UO_2 pellets	Sintered UO_2 pellets	Sintered UO_2 pellets
U-235 Enrichment	1 to 4 percent	Initial Core < 3.5%; Reload average < 4.5%[b]	Not exceeding 4%; NUREG-1437 concludes that 5% is bounded
Fuel Rod Cladding	Zircaloy	Zircaloy	Zircaloy rods; 10 CFR 50.44 allows use of ZIRLO
Average Burnup MWd/MTU	33,000	46,000[b]	Not exceeding 33,000; NUREG-1437 concludes 62,000 MWd/MTU for peak rod is bounded
Unirradiated Fuel			
Transport Mode	Truck	Truck	Truck
Irradiated Fuel			
Transport Mode	Truck, rail, or barge	Truck, rail	Truck, rail, or barge
Decay Time Prior to Shipment	150 days	5 years	Not less than 90 days is a condition for use of Table S-4; 5 years is in accordance with contract with the DOE
Radioactive Waste			
Transport Mode	Truck or rail	Truck	Truck or rail
Waste Form	Solid	Solid	Solid
Packaged	Yes	Yes	Yes

a) The "Reference LWR" refers to a typical 1100 MWe LWR, as described in WASH-1238.

b) The value identified is larger than or different from the reference LWR.

Table 3.8-3
Number of Truck Shipments of Unirradiated Fuel for the ESBWR

Reactor Type	Number of Shipments per Reactor Unit			Unit Electric Generation, MWe[c]	Capacity Factor[c]	Normalized Shipments per 1100 MWe[d,e]
	Initial Core[a]	Annual Reload	Total[b]			
Reference LWR (WASH-1238)	18	6	252	1100	0.8	252
ESBWR	30	6.1	267	1500	0.95	165

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 (Reference 3.8-7).

d) Normalized to new electric output for WASH-1238 reference LWR; i.e., 1100 MWe plant at 80 percent or net electrical output of 880 MWe.

e) Ranges of capacities are provided in INEEL (Reference 3.8-7) for these unirradiated fuel shipments. The unirradiated fuel shipment data for these reactors were derived using the upper limit of the ranges.

Source: NUREG-1817, Table H-3.

Table 3.8-4
Radiological Impacts of Transporting Unirradiated Fuel to Reactor Site

Plant Type	Normalized Average Annual Shipments	Cumulative Annual Dose, person-rem/yr per 1100 MW(e)		
		Workers	Public Onlookers	Public Along Route
Reference LWR (WASH-1238)	6.3	1.1×10^{-2}	4.2×10^{-2}	1.0×10^{-3}
ESBWR	4.1	7.1×10^{-3}	2.7×10^{-2}	6.6×10^{-4}

Source: NUREG-1817, Table H-6.

Table 3.8-5
Irradiated Fuel Shipments for the ESBWR

Reactor Type	Reference LWR (WASH-1238)	ESBWR	Bounding Shipments
No. of Spent Fuel Shipments per Year	60	41	33[a]

a) The bounding value for the number of truck shipments of irradiated fuel annually is 33 for the ESBWR, based on 1 MTU (seven assemblies) per truck cask.

Source: NUREG-1817, Table H-9.

Table 3.8-6
Routine (Incident-Free) Population Doses from Spent Fuel Transportation

	Environmental Effects,[a] person-rem per reference reactor year		
Reactor Site/ Reactor Type	Crew	Onlookers	Along Route
Reference LWR (WASH-1238)	5.2	17	0.42
Grand Gulf/ESBWR	3.5	12[b]	0.28

a) The bounding cumulative doses to the exposed population are given in Table S-4 (Table 3.8-1).

b) The 12 person-rem dose to onlookers exceeds the Table S-4 dose of 3 person-rem by a factor of 4.

Source: NUREG-1817, Table H-9.

Table 3.8-7
Radioactive Waste Shipments for the ESBWR

Reactor Type	Waste Generation Information, m^3/yr per unit	Annual Waste Volume, m^3/yr per unit	Electrical Output, MWe per unit	Normalized Rate, m^3/ 1100 MWe Reactor (880 MWe net)[a]	Shipments/ 1100 MWe (880 MWe net) Electrical Output[b]
Reference LWR (WASH-1238)	100	108	1100	108	46
ESBWR	100	100	1500	62	27

a) Capacity factors used to normalize the waste generation rates to an equivalent electrical generation output are provided in Table 3.8-3.

b) The number of shipments per 1100 MWe 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).

Source: NUREG-1817, Table H-15.

CHAPTER 4 ENVIRONMENTAL IMPACTS OF CONSTRUCTION

Chapter 4 presents the potential environmental impacts resulting from construction activities, which are inclusive of preconstruction activities not within the NRC's jurisdictional authority, for RBS Unit 3. Impacts are analyzed in each section within this chapter, and a single significance level of SMALL, MODERATE, or LARGE has been estimated for potential impacts in each environmental resource area, as defined in Subsection 1.1.7. Potential mitigation measures that may be taken to reduce adverse impacts are also described in each section, as applicable. Construction activities would take place within a secure, delineated construction impact area within the RBS site, as shown in Figure 2.4-2. The sections in this chapter address the following environmental resource areas:

- Land Use Impacts (Section 4.1).
- Water-Related Impacts (Section 4.2).
- Ecological Impacts (Section 4.3).
- Socioeconomic Impacts (Section 4.4).
- Radiation Exposure to Construction Workers (Section 4.5).
- Measures and Controls to Limit Adverse Construction Impacts (Section 4.6).
- Cumulative Impacts of Construction (Section 4.7).

The following definitions are generally used throughout the sections in this chapter, with some variation in the areas of the vicinity and region as necessary for particular issues:

- RBS site - The 3330-ac. existing Unit 1 and proposed Unit 3 site.
- Vicinity - The area within approximately the 8- to 10-mi. radius around the RBS site, specified by resource area.
- Region - The area within approximately the 50-mi. radius around the RBS site.

4.1 LAND USE IMPACTS

This section describes the potential impacts of RBS Unit 3 preconstruction activities, site preparation activities, and construction activities on land use at the RBS site and in the surrounding 8-mi. vicinity. Preconstruction and construction activities would require temporary and permanent modifications or changes to some current land uses on the site. Changes to temporary or permanent off-site land uses would not occur, with the exception of the land use changes along the new off-site transmission corridor. The on-site portion of the transmission corridor would not be expanded and the transmission line work off-site would not be conducted until the middle-to-latter stages of construction of RBS Unit 3.

Background information on existing land use conditions at the site can be found in Section 2.2. Land use considerations also include existing and potential historic properties. Impacts to the site and vicinity, impacts along new or expanded transmission corridors, and impacts to historical and cultural resources are described in Subsections 4.1.1, 4.1.2, and 4.1.3, respectively. Socioeconomic and land use-related impacts attributable to increased tax revenues for West Feliciana Parish from RBS Unit 3 are not described in this section, but are included in Subsection 4.4.2. The construction of RBS Unit 3 is expected to have an impact similar to the construction of Unit 1, which was found to have a SMALL impact in the NRC's Final Environmental Impact Statements for construction (Docket Numbers 50-458 and 50-459) and operation (NUREG-1073) (References 4.1-1 and 4.1-2). Therefore, the overall construction impact on land use is anticipated to be SMALL.

The difference between construction activities and preconstruction activities is that construction activities involve safety-related systems, structures, and components (SSCs) and risk-significant, nonsafety-related SSCs (as defined in DCD Chapters 17 and 19) and, therefore, must receive NRC approval through the NRC COL issuance process before construction can begin. Preconstruction activities do not require NRC approval before construction can begin. The Applicant has no plans to apply for a limited work authorization (LWA) (References 4.1-3 and 4.1-4) and will not commence safety-related construction activities until the RBS COLA is approved by the NRC.

Examples of general types of preconstruction activities include the following:

- Preparation of the site for facility construction, including site exploration, logging, clearing of land, grading and construction of temporary access roads and spoils areas.
- Installation of temporary construction support facilities, including such items as warehouse and shop facilities, utilities, concrete mixing plants, docking and unloading facilities, and construction support buildings.
- Excavation for any non-NRC jurisdictional structure, including dewatering for concrete placement, provided draining is temporary.
- Construction of service facilities, including such facililties as roadways, paving, fencings, exterior utility and lighting systems, transmission lines, and sanitary sewage treatment facilities.

Construction activities involving safety-related SSCs within the NRC's Atomic Energy Act jurisdictional authority to regulate in the interest of radiological health and safety and the common defense and security during construction include the following:

- Pile driving.
- Subsurface preparation.
- Placement of backfill, concrete, or permanent retaining walls within an excavation.
- Foundation installation.
- In-place assembly, erection, fabrication, or testing.
- Construction of main power block building/structures.
- Water intake and pump house modifications and additions.
- Construction of cooling towers and associated structures.

Impacts resulting from work not subject to NRC oversight and permitting that is done during the preparation and preconstruction time periods would be SMALL because a limited amount of the preparation and preconstruction work would be in the Unit 3 power block area.

To accommodate the proposed new unit construction, it is likely that certain preparation activities would occur on-site. A man-made drainage ditch would be straightened and the main portion of the ditch relocated west of its current location to allow space for construction of the Unit 3 buildings. The three no-longer used Unit 1 standby service water chemical cleaning waste storage tanks currently in the former Unit 2 excavation would be drained and removed, and several buildings in the immediate area of the Unit 3 reactor would be rearranged to allow space for the new unit construction.

There is not expected to be a construction landfill on-site and no borrow pit will be used for RBS Unit 3 construction. A 5-ac. aggregate storage area will be located alongside the heavy haul road (River Access Road) south of the spoils area, as shown in Figure 2.1-4.

Upon completion of construction activities, surface and subsurface features would be restored in accordance with permit requirements and conditions. For some of the impacts related to construction activities, mitigation measures that would be applied are referred to as best management practices (BMPs). BMPs are designed to address the specific types of activities that are to be performed.

4.1.1 THE SITE AND VICINITY

Construction impacts on land use at the RBS site and vicinity are discussed in this subsection. The RBS site is located in West Feliciana Parish, Louisiana, with a property boundary that encompasses approximately 3330 ac. For purposes of the land use analysis, the RBS Unit 3 site is considered the same as the entire RBS property. The vicinity is the 8-mi. area surrounding the

RBS site, which includes portions of Pointe Coupee, East Feliciana, East Baton Rouge, and West Baton Rouge Parishes. Since these parishes comprise the majority of the vicinity, they are the focus of the vicinity land use impact discussions included in this subsection.

The entire RBS site is zoned for industrial use (industrial M-1 base zoning) by West Feliciana Parish. All safety-related and nonsafety-related construction activities for Unit 3, including all ground disturbance, would occur within the RBS site boundary except for work on the new off-site transmission corridor. The total construction area anticipated to be disturbed for all on-site construction activities is approximately 364 ac., which would be confined to a designated impact area (shown in Figure 2.4-2) and would be lost to other uses until after decommissioning of Unit 3. The area that would be converted to long-term plant use for Unit 3 is estimated to be approximately 43 ac., while the remaining 204 ac. would be disturbed on a short-term basis. An area of 117 ac. is occupied by RBS Unit 1 structures and maintained areas. Most of the land to be occupied by RBS Unit 3 and its associated facilities was disturbed during construction of Unit 1; however, some construction would occur in areas that have been undisturbed for longer periods of time. Refer to Figure 2.5-16 for an illustration of the areas previously disturbed for Unit 1 compared with the areas proposed to be disturbed for Unit 3.

Housing provisions for construction workers could lead to some development of temporary housing facilities in the vicinity. No other significant land use changes to the vicinity are anticipated to result from the presence of the construction workforce. Refer to Subsection 4.4.2.4.2 for a detailed discussion of socioeconomic impacts related to transportation and the RBS construction workforce.

Because of the presence of an operating nuclear power plant, current land use on the developed portion of the RBS site is limited to electricity generation and transmission. Figure 2.1-4 provides a detailed description of the areas proposed for use during Unit 3 construction. When construction of RBS Unit 3 is complete, cleared areas will be paved, graveled, or allowed to revegetate to minimize potential erosion, while allowing adequate access to plant facilities.

4.1.1.1 Site and General Vicinity Land Use Impacts

Construction of the new plant would result in alterations to on-site land use. Some of these alterations are unavoidable and irreversible; others are unavoidable, but can be mitigated. As noted above, some of the areas designated for the new plant were prepared or altered during the construction of and in preparation for the operation of RBS Unit 1.

The various areas potentially affected by construction of a new plant and the acreage within each area are provided in Table 2.2-1; these areas are also depicted in Figure 2.1-4. The site preparation and construction actions that involve major impacts are clearing, grading, excavation, and dewatering. No explosives will be used during construction of RBS Unit 3. The major types of construction impact that could result from construction activities include alteration of existing vegetation, alteration of topography, and alteration of site drainage patterns and water quality.

As mentioned above, some areas of the site proposed for new construction were previously developed or altered for use by the existing RBS Unit 1 or in anticipation of RBS Unit 2 construction. Unit 2 construction was planned, but cancelled in early 1984. Many of the areas cleared for Unit 1 construction (753-ac. total area) have been allowed to naturally reforest during the intervening years, giving Unit 1 a permanent footprint of about 267 ac. (Reference 4.1-2). New construction for RBS Unit 3 may have a MODERATE impact in these areas, because forest would be cleared for construction of several facilities and construction areas associated with RBS Unit 3.

Of the approximately 364 ac. estimated to be disturbed for the construction of a new unit, approximately 285 ac. overlap currently developed or previously altered areas. It is estimated that approximately 43 ac. would contain permanent structures associated with RBS Unit 3 (primarily the power block area, cooling tower area, and bottomland pipeline and intake areas, as shown in Figure 2.1-4). Acreage not containing permanent structures would be reclaimed after construction to the maximum extent possible and would be paved, graveled, or allowed to reforest naturally. Since the Unit 3 projected acreage for permanent structures is smaller than the permanent footprint of Unit 1 (the impacts of which the NRC found to be SMALL), it is expected that the Unit 3 overall land use impact would also be SMALL.

4.1.1.2 Land Use Plan and Zoning Compliance

4.1.1.2.1 West Feliciana Parish Land Use

The construction of RBS Unit 3 will comply with West Feliciana Parish land use plans and policies and with parish zoning regulations and their specified uses. West Feliciana Parish land use planning documents, including the Feliciana Vision 2005 document, emphasize parish goals of retaining green space and the rural atmosphere of the St. Francisville area while encouraging economic development. Development of the RBS site has been consistent with parish goals: a large portion of the natural, forested area on the site has been left intact, while a power plant that provides economic benefits to the parish and surrounding communities has been developed.

According to the parish's Feliciana Vision 2005 land use maps, the RBS site is included in an area zoned industrial (M-1 industrial base zoning) that has been planned for future industrial development and use. The West Feliciana Community Development Foundation is progressing in its plan to attract clean industrial businesses in a business park south of the RBS and the future State Highway 10. Since a new unit at the existing RBS site would be compatible with the planned business park development and consistent with current and planned land use (as well as the property zoning designation), RBS Unit 3 would comply with local land use plans and zoning. No rezoning would be required at the RBS site for the new unit because West Feliciana Parish has zoned the site and surrounding area for industrial use.

West Feliciana Parish is developing a new comprehensive plan in cooperation with the Center for Planning Excellence and Fregonese Associates (Reference 4.1-5). Preliminary public feedback on the desired direction of the comprehensive plan reflects priorities and goals consistent with those included in the Feliciana Vision 2005 plan (Reference 4.1-6). The forthcoming West Feliciana Parish comprehensive plan is not likely to include changes to the planned use of the RBS site or its immediate surroundings. Parish Planning and Zoning staff are also drafting a new Unified Land Development Ordinance for West Feliciana Parish, which would be used by the parish as one of its planning tools, but would not affect the RBS site.

RBS Unit 3 may have a positive economic impact on land use in the parish by encouraging industry and economic development. The new unit at RBS could be an incentive for other industries to locate in the planned parish business park south of the RBS, which could eventually spur a land use change from low-intensity developed land and forest to medium- or high-intensity developed areas in the corridor from the Audubon Bridge to U.S. Highway 61 along the future State Highway 10. This same effect could also be perceived as a negative impact by those who want to maintain current land uses in the vicinity of the RBS. The business park is already in the planning stages; development of RBS Unit 3 would not be directly related to a change in land use in the area south of the future State Highway 10.

No impacts to land use planning in West Feliciana Parish are expected as a result of RBS Unit 3 construction; therefore, this impact would be SMALL.

4.1.1.3 Pointe Coupee Parish Land Use

Pointe Coupee Parish is located just west of West Feliciana Parish across the Mississippi River. During the 20 years since RBS Unit 1 construction, Pointe Coupee Parish has experienced significant growth in population, but little growth in industry. The predominant land use in Pointe Coupee Parish is agricultural, which comprises approximately 48 percent of the parish. Other major land uses in the parish include developed land uses (3 percent), water (6 percent), and forest (41 percent). Residential land use has shown an increasing trend since 1986. Pointe Coupee Parish gained approximately 5000 new residents as a result of the migration of southern Louisiana residents from areas damaged by Hurricane Katrina in 2005. The parish is currently developing land use plans and zoning ordinances to assist in managing its residential and economic growth (Reference 4.1-7). No impacts to land use planning in Pointe Coupee Parish are expected as a result of RBS Unit 3 construction; therefore, this impact would be SMALL.

4.1.1.4 Transportation and Rights-of-Way

The roads and highways within the immediate vicinity of the site would experience an increase in use during construction activities, especially at the beginning and end of the workday and during shift changes. Louisiana State Highway 965 intersects U.S. Highway 61 approximately 1.6 mi. from the plant. North Access Road intersects U.S. Highway 61 approximately 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. During high traffic periods, a number of controls could be implemented, such as staggered shifts and the use of all three plant entrances, to mitigate potential traffic congestion problems on U.S. Highway 61 caused by construction activities. The use of traffic control measures should prevent significant congestion problems from construction activities. During construction activities, traffic control on and off the site will adhere to the applicable local, state, and federal requirements.

RBS employee travel within and around the RBS site could be affected by the presence of large construction areas at various locations on the site. Some areas may be restricted for safety reasons. Residents living along Highway 965, or those who use it to access the river, may need to use alternate routes, which could add additional time to their commutes. These delays are expected to constitute minor inconveniences to area commuters, but would not cause significant impacts to traffic flow or site egress if an emergency occurs.

Land use impacts associated with RBS Unit 3 construction that may have social and economic impacts to the region are discussed in Section 4.4.

No significant adverse traffic impacts to the land uses in surrounding communities are anticipated as a result of RBS Unit 3 construction. Transportation routes are described in Section 2.2 (Figure 2.2-4). The influx of construction workers may result in temporary traffic congestion on local roadways. No change to the local transportation infrastructure is anticipated as a result of RBS Unit 3 construction.

No significant adverse impacts to barge traffic on the Mississippi River are anticipated. The barge slip constructed for RBS Unit 1 would be used to offload large equipment and materials transported by river for the construction of a new plant. Because the river near the RBS site already supports heavy barge traffic, deliveries of construction supplies for RBS Unit 3 would comprise a minimal addition to the existing barge traffic. Schedules for barge deliveries would be developed to avoid conflict with the majority of the existing barge traffic in the immediate area and to maximize safety and minimize the potential for navigational hazards on the river.

There would be no adverse impact to existing railway service in the area from new facility construction activities at the RBS site; there are no active rail lines in the immediate area, and there are no plans to use rail service for construction material delivery to the RBS. The nearest railroad is operated by Kansas City Southern, which has a freight train main line that passes within 4 mi. southwest of the site near New Roads. A spur line serves the Big Cajun 2 power plant; however, the rail line and spur are both across the river from the RBS site and would not be affected (Figure 2.1-2). No rail service is required for the construction of RBS Unit 3, and no restoration of rail service to the site is planned, as described in Section 2.2. Consequently, no land use impacts to the site and vicinity are anticipated from the construction or modification of rail lines or restoration of rail service.

Heavy equipment for RBS Unit 3 would be barged on the Mississippi River to the site. The existing heavy haul road would be used to transport barged equipment to the construction site (refer to Section 2.2). Existing roads would be used for construction access, with traffic balanced between U.S. Highway 61, State Route 965, and West Feliciana Parish 7 (Powell Station Road) site entrances to prevent and alleviate traffic congestion on U.S. Highway 61. Existing gravel roads would be used to access the intake structure for dredging and laying of the new intake line for Unit 3. Additional gravel cover on the on-site roads would likely be needed to prevent excessive fugitive dust emissions resulting from construction and other vehicle use. Fugitive dust impacts are discussed further in Section 4.4.

Overall, transportation impacts to land use from the construction of RBS Unit 3 are expected to be SMALL.

4.1.1.5 Agricultural and Soil Issues

Construction activities associated with a new unit would require a construction stormwater permit and Stormwater Pollution Prevention Plan (SWPPP) under federal and state Louisiana Pollutant Discharge Elimination System (LPDES) regulations. During construction activities, in compliance with the permit and the SWPPP, erosion control measures would be used to contain eroded soil on the site and remove sediment from stormwater prior to the water leaving the site. Design measures would be incorporated to avoid concentrated flow that has a high potential to transport sediment. Visual inspections of erosion control measures would be incorporated into the project to monitor the effectiveness of the control measures and to aid in determining if other mitigation measures are necessary. Control measures would be incorporated into the requirements of the SWPPP.

BMPs used in conjunction with the SWPPP may include appropriate use of run-on flow diversion, stormwater collection ponds, silt fences, seeding, revegetation plans, and use of other surface stabilization techniques. Protection of existing runoff drains from sediment loss is part of the planning process. Some stabilization and restoration methods that may be used include recontouring using heavy construction equipment; mulching, seeding, and planting; natural revegetation; pavement, rock, or gravel permanent stabilization; and installation of temporary or permanent stormwater management and erosion and sedimentation control measures.

During construction activities, disturbances to the existing ground surface, if uncontrolled, would potentially increase the current sediment load through runoff to the Mississippi River via Grants Bayou, Thompson Creek, and Alligator Bayou. Site grading and drainage during construction would be designed to avoid erosion during the construction period and would be in compliance with the SWPPP, as required by the Louisiana Department of Environmental Quality (LDEQ) and the FWPCA. Construction activities would be properly controlled and monitored so that erosion from improperly graded areas does not lead to sediment runoff off-site or to nearby surface waters. Final stabilization would consist of revegetation at final grade conditions as practical.

In addition, as described in Section 4.2, several different structural controls may be used to avoid degradation of the quality of the stormwater runoff to Grants Bayou, Thompson Creek, Alligator Bayou, and the Mississippi River during construction activities. The final location of these controls would be based on the site conditions prior to and during construction activities.

Soil compaction would occur as construction machinery traverses the construction areas; however, many of the areas where compaction occurs would eventually be covered with permanent structures or would become areas maintained with grass cover. Those areas used temporarily and allowed to revegetate after construction completion would recover more slowly, but would be able to regenerate vegetation and forest cover despite the soil compaction.

On-site grading activities would create construction spoils. However, it is expected that the grade elevations in the parking, laydown, and batch plant areas could be adjusted to balance the cut and fill volumes as much as possible, resulting in a minor net excess cut volume. It is anticipated that spoils would be used as nonengineered backfill as necessary. All excess material would be disposed of in the non-wetland former Unit 1 spoil fill area (shown on the site arrangement, Figure 2.1-4) and in accordance with BMPs for disposal of spoils. There will be no borrow area on the RBS site, as stated in Section 2.2. Therefore, it is anticipated that the land use impact would be SMALL because of the small net excess of spoils materials disposed and the use of a site previously used for the same purpose during Unit 1 construction. Dredged material excavated during water intake modifications would be returned to the Mississippi River, as is the current practice.

According to the RBS Construction Stage Environmental Impact Assessment issued by the NRC in 1976, soil types that are considered prime farmland are present at the RBS site, as discussed in Section 2.2. The Natural Resources Conservation Service (NRCS) online soil survey data and maps also show several small areas of prime farmland that would be affected by RBS Unit 3 construction (Reference 4.1-8). These small areas of prime farmland are currently forested and located adjacent to previously disturbed areas as well as along the west side of Highway 965 and along the Mississippi River. The larger areas west of Highway 965 and along the river would not be affected by RBS Unit 3 construction.

Exceptions to the prime farmland designation apply for land that is frequently flooded during the growing season or is already in or committed to urban development or water storage (Reference 4.1-9). According to this exception, the area proposed for RBS Unit 3 development would not be considered prime farmland because the site has already been committed to the development of a nuclear power plant. Further, the prime farmland soils that did exist on-site before Unit 1 construction would no longer fit the definition of prime farmland because they are on a site dedicated to a developed use. Based on the above factors, prime farmland would not be significantly affected by construction of RBS Unit 3.

Overall impacts to soils and agricultural land use are expected to be SMALL.

4.1.1.6 Ecological Impacts

4.1.1.6.1 Natural and Forested Areas

Construction activities would occur within the boundaries of the existing site. Areas outside the site would be unaffected with respect to habitat disturbance except along the new off-site transmission corridor, as described in Subsection 4.1.2 and Section 4.3. The site contains no critical habitat areas that would require replacement as a result of construction activities. Some habitats would begin to recover naturally as construction is completed in each of the areas.

Three general vegetation types are present on-site: upland forests, bottomland hardwoods, and meadows and pastures (including mowed grass cover around developed areas). Construction of RBS Unit 3 would likely remove these three vegetation types in similar proportions as did construction of the existing Unit 1 at the RBS site, which were upland hardwood forests (63.3 percent); bottomland hardwoods (3.0 percent); and meadows and pastures (33.7 percent) (Reference 4.1-10). Because some of the areas cleared during Unit 1 development and needed for Unit 3 development remain cleared of forest, the proportion of upland hardwood forests cleared for Unit 3 construction may be less than it was during Unit 1 construction.

Construction of a new facility at the RBS site would disturb roughly 364 ac. Of the 364 ac., approximately 43 ac. would be converted to industrial (power plant) use. As shown in Table 4.3-1, the permanent loss of upland and bottomland hardwood forest would be about 35 ac., which is less than 10 percent of the total area that would be disturbed for Unit 3 construction. Ecological impacts to the site from RBS Unit 3 construction are further discussed in Section 4.3. Ecological impacts as they relate to land use on the RBS site and the vicinity are anticipated to be SMALL.

4.1.1.6.2 Water Courses, Wetlands, and Floodplains

4.1.1.6.2.1 Groundwater

The hydrologic alterations anticipated to result from construction activities might also include temporary changes in groundwater levels from dewatering of foundation areas or general lowering of the groundwater table in localized areas due to topographic alterations. When dewatering activities are terminated, the groundwater levels are expected to return to their previous levels.

The Fabriform ditch that was installed during RBS Unit 1 construction (110 ft. wide by 50 ft. base width, and approximately 2800 ft. long) to contain West Creek flow and to minimize the potential for plant flooding during extreme rainfall events will be realigned just west of its current location, as shown in Figure 2.3-16. Several buildings in the area west of the ditch will be moved to allow realignment of the ditch; however, the ditch realignment would have SMALL impacts to land use on-site because the work would be confined to the area occupied by the ditch and the adjacent area to the west.

The RBS Unit 3 area is located over a deep, sole-source aquifer used for drinking water in the site area; therefore, strict spill prevention measures and compliance with the site Spill Prevention, Control, and Countermeasure (SPCC) Plan will be enforced to prevent potential impacts to the aquifer. This aquifer and potential impacts from RBS Unit 3 construction are discussed further in Section 4.2. With the implementation of the mitigation measures listed in Section 4.6 and considering the depth to the aquifer, RBS Unit 3 construction impacts to groundwater are expected to be SMALL and are not anticipated to affect land use around the RBS site.

4.1.1.6.2.2 Floodplain Impacts

Construction work on the intake and barge facilities would occur in the 100-year floodplain along the edge of the Mississippi River. Other than in these areas, all construction areas are outside the 500-year floodplain. Construction-related erosion and water flows would be reduced and controlled through measures contained in the RBS SWPPP; however, these measures would not completely prevent impacts to the floodplain and river. The erosion, increased sedimentation and turbidity, and increased water flows that are likely to occur during construction activities would have effects on the floodplain similar to those of natural flood events. Vegetation and aquatic organisms living in these kinds of environments have acclimated to the cyclic nature of water and sediment flow; therefore, it is reasonable to conclude that they would also be able to adapt to similar events resulting from RBS Unit 3 construction with no significant effects. Floodplain impacts during construction would not affect land use on the site or in the vicinity; therefore, the impact is SMALL. Potential impacts to the Mississippi River are discussed in Subsection 4.3.2.

4.1.1.6.2.3 Streams and Water Bodies

Proper safeguards would be used to minimize adverse effects to the Mississippi River, Grants Bayou, Thompson Creek, and Alligator Bayou during construction activities, preventing long-term effects to downstream habitats. Potential effects to land use and the surrounding environment resulting from construction activities involving hydrologic alterations would be buffered by the Mississippi River.

During construction activities, the water quality of the on-site and nearby water bodies mentioned above may be affected by increased erosion and sediment transport, as well as potential spills of petroleum liquids from construction vehicles. However, these potential erosion impacts would be minimized through compliance with the controls specified in Subsection 4.1.1.11. Construction activities would be in compliance with a SWPPP, as required by the LDEQ and the FWPCA. Petroleum spills would be prevented and avoided by strict observance of the site SPCC Plan, as mentioned previously.

Construction activities to be conducted within the floodplain on the site would include the water intake structure modifications, installation of a new 36-in. water intake pipe, and the intake and barge slip dredging. The existing water intake will be modified at its current location near the barge slip area, and the new water intake pipe would run adjacent to the existing water intake pipe along the heavy haul road (Figure 2.1-3 and Section 5.3 figures show more detail). Existing gravel roads would be used for access to the barge slip area. Dredging will be performed at the barge slip area to accommodate construction deliveries for RBS Unit 3 equipment. The dredged material would be returned to the river downstream of the intake piping. There would be some impact from construction machinery during the excavation and modification of the intake structure along the riverbank in the floodplain and during burial of the new water intake line, but with the implementation of erosion prevention measures and compliance with the SWPPP, SPCC Plan, and dredging and intake permits, the impacts are expected to be SMALL, localized to the barge slip and water line areas, and temporary.

No coastal zones or wild and scenic rivers were identified in or around the proposed RBS Unit 3 construction area (Reference 4.1-10).

4.1.1.6.2.4 Wetlands

RBS Unit 3 on-site construction activities will avoid floodplain and wetland areas to the maximum extent practicable. The new water intake line for Unit 3 would cross bottomland forested areas, but would be located in an existing raised berm that would not require work in or impacts to wetlands. Off-site transmission corridor work may minimally impact some wetland areas where they cannot be spanned. For further discussion of construction impacts to wetlands, refer to Section 4.3. Transmission line construction impacts are discussed in Subsection 4.1.2.

4.1.1.7 On-Site and Off-Site Recreation Impacts

There are a number of recreational land use areas within the vicinity of the RBS site, as detailed in Section 2.2. Although none of the recreation areas in the vicinity is expected to be affected by RBS Unit 3 construction, the recreational areas that have the greatest potential to be affected are the Audubon State Commemorative Area and Cat Island National Wildlife Refuge because of their proximity to the site. There would be an increase in traffic, noise, and dust from construction activities that may affect these parks. Peak park use is on the weekend, however, when construction activity would likely be reduced.

As described in Section 2.2, private hunting activities are allowed on portions of the RBS site. This use would not be affected by construction of Unit 3 because the hunting occurs only in designated areas away from the main plant facilities.

Construction activities for RBS Unit 3 would not affect recreational land uses off-site, with the potential exception of aesthetic impacts of the proposed 550-ft. natural draft cooling tower (NDCT), which may be visible from certain higher elevation vantage points in the vicinity. The nearest recreation areas to RBS are generally buffered from views of the cooling tower by forest vegetation. Refer to Section 3.1 for a projected on-site view of the proposed NDCT and Section 4.4 for a description of aesthetic impacts that may occur during RBS Unit 3 construction. RBS Unit 3 construction impacts to recreation areas are expected to be SMALL.

4.1.1.8 Aesthetics

Refer to Section 4.4 for a description of potential aesthetic impacts from RBS Unit 3 construction. The 550-ft. NDCT that will serve Unit 3 would be the major aesthetic impact because it would be visible from nearby areas, where no tall structure could previously be seen. The view of the new cooling tower may cause a shift in perception of the area by making the presence of a nuclear power plant more clearly visible, but it is not likely to cause alteration of land use patterns in the area. Potential aesthetic impacts related to land use are not expected on the site or in the vicinity of the RBS and would be SMALL.

4.1.1.9 Air Quality Impacts

Dust, smoke, and vehicle engine exhaust are sources of air pollution during construction activities. A number of controls would be implemented as needed to mitigate air emissions during construction, including preventing excessive idling of equipment and vehicles, practicing dry weather wetting, covering open-bodied trucks that transport materials likely to become airborne, and using barriers and windbreaks. Overall air pollution effects from construction activities are expected to be minimal. Construction air emissions will be controlled in accordance with local, state, and federal laws and the requirements and conditions of the construction air permit for RBS Unit 3.

On-site, unpaved roads at RBS release visible quantities of dust when driven over during dry conditions, especially when they are subjected to increased traffic by heavy vehicles. Measures such as spraying the roads with water or adding more gravel to road surfaces may be taken to reduce fugitive dust emissions.

Air quality issues are not expected to affect land use on the RBS site or in the vicinity; therefore, these impacts would be SMALL.

4.1.1.10 Pipelines

The natural gas pipelines that run 2.1 and 2.2 mi. southeast of the site (Figure 2.2-2) and the DEMCO electric transmission line that runs parallel with U.S. Highway 61 in a northwest-southeast direction would not be affected by RBS Unit 3 construction because of their distances from the proposed construction areas. The Enbridge petroleum pipeline approximately 4 mi. southeast of the site would be similarly unaffected because of its distance from the site construction areas. If new water lines are laid for increased supply of parish water to the site, they would likely be installed during site preparation or construction and would be designed to avoid interference with construction of Unit 3.

RBS Unit 3 construction should have no impact on site or area pipelines and, therefore, would have a SMALL impact on land use.

4.1.1.11 Spill Prevention, Control, and Response

With the use of construction equipment at the site, there is the potential for spills of gasoline, oil, and other fluids from various possible pollutant sources such as vehicle fueling stations, loading and unloading areas, vehicle equipment maintenance activities, and material storage and handling. These spills will be prevented, and addressed if they occur, by the implementation and careful observance of the RBS SPCC Plan. The RBS LPDES permit would also provide a description of procedures to be used for spill prevention and response.

The following is a list of some potential measures to control discharges of pollutant sources during construction activities:

- Precautions would be taken to prevent the release of pollutants to the environment from vehicle and equipment maintenance and refueling. Oil contaminated materials would be stored in suitable containers and disposed of in accordance with federal, state, and local regulations. Spill kits would be maintained nearby for prompt cleanup of oil spills.

- Vehicle and equipment maintenance activities, such as lubrication or equipment repair that could result in oil spills or grease spills, would be performed in an enclosed building, if practical, or in a bermed and lined area designated for these purposes.

- Vehicle and equipment refueling would be performed in designated areas similar to the vehicle maintenance areas.

- Materials in use on the site would be stored in areas designated for that purpose. Suitable measures would be taken in these site storage areas to reduce the likelihood of and mitigate any discharges, such as use of storage containers, berms, straw or hay bale barriers, and similar precautions. Materials not in use would be stored in an enclosed building, if practical, or in a designated area with similar protective measures. Material safety data sheets (MSDSs) for hazardous chemicals used or stored on the site would be available for review and use. Hazardous substances such as used oil, antifreeze, spent solvents, discarded paint cans, and similar items would be controlled, stored, and disposed of in accordance with the applicable requirements and site procedures.

With the implementation of the above spill prevention measures, impacts from construction spills to land use on the RBS site and in the vicinity are anticipated to be SMALL.

4.1.1.12 Solid Waste

The presence of construction workers (expected to be more than 3000 during the peak construction period) in addition to normal Unit 1 plant staff on the site for approximately a 5- to

6-year period would significantly increase the quantity of solid waste generated at the RBS site during construction. Littering at the RBS site will be prohibited, and all wastes will be separated as appropriate for recycling, reuse, or disposal and placed and stored in the appropriate containers. Solid waste pickup will be scheduled at a frequency appropriate to the amount of waste generated during the construction period. Implementation of these measures would result in a SMALL impact to the RBS site and vicinity and land use in those areas. Refer to Section 5.5 for a discussion of the environmental impacts of waste resulting from operation of RBS Unit 3.

4.1.1.13 Noise

During construction activities, ambient noise levels on- and off-site would likely increase. Neither the state of Louisiana nor St. Francisville, Louisiana, has a noise ordinance that impacts RBS. However, noise levels would be controlled by engineering design and compliance with the noise standards of St. Francisville, Louisiana.

During construction, noise would increase with the operation of vehicles, earthmoving equipment, materials handling equipment, impact equipment, and other stationary equipment (pumps, compressors, etc.), and the increase in human activity on the site.

Large industrial equipment needed for demolition, clearing, excavating, grading, garbage disposal, and earthmoving operations would add to the temporary noise pollution in the area. Standard noise dampening devices on trucks and other equipment are expected to be sufficient to keep off-site noise levels below allowable thresholds.

As is typical of large construction projects, there would be some disruption of the site and immediate area, primarily from noise and traffic, during peak periods of construction activity. The RBS site, however, as an industrial site near the Mississippi River, is largely separated from most of the St. Francisville community. Construction trucks and workers would travel to the site and noise would occur, sometimes intrusive, from building construction and trucks and other vehicles backing, loading, and unloading. Because of the RBS site's buffering forested areas and its proximity to the river, construction would have a negligible effect on neighboring forest and agricultural land uses in off-site areas. The disruptions would be temporary, with the noisiest construction period occurring when grading, pile driving, and superstructure work is performed. Overall, while construction would be evident to the local community, the limited duration and limited intrusive periods of construction should not result in significant or long-term adverse impacts on the local land use patterns or character of the nearby area.

The variable nature of construction activity makes it difficult to predict construction noise impacts. Average noise levels are discussed in Subsection 4.4.1 and are representative of construction activities. Construction noise emissions discussed in Subsection 4.4.1 and summarized in Table 4.4-1 could contribute to the temporary displacement of wildlife on the site and in the vicinity, similar to the temporary displacement that likely occurred during the construction of Unit 1. Noise impacts are expected to be SMALL with regard to land use on the RBS site and in the vicinity. Refer to Section 4.4 for further information on construction impacts from noise.

4.1.1.14 Site Restoration and Management Actions

Mitigation measures implemented to reduce construction activity impacts would be targeted toward erosion control, controlled access roads for personnel and vehicular traffic, and restricted construction zones. The site preparation work would be completed in two stages, the first of which would consist of stripping, excavating, and backfilling the areas needed for structures and roadways. The second stage would entail developing the site with the necessary facilities to support construction, such as construction offices, warehouses, trackwork, large unloading facilities, water wells, construction power, construction drainage, and similar facilities. In addition, temporary structures would be razed and holes would be filled. Grading and drainage work would be designed and executed with the goal of avoiding and minimizing erosion during the construction period.

Disturbed areas would be restored consistent with existing and native vegetation. A total of approximately 364 ac. would be disturbed for construction activities, including permanent facility structures, parking, and laydown. Existing on-site roads would be used for construction traffic; no new on-site roads are anticipated to be needed. The site roads and facilities would be usable in all weather conditions for travel and storage of materials and equipment during construction.

The RBS Unit 3 site would be stabilized and restored after completion of construction activities. A redress plan for site restoration is not required for the RBS because the Applicant is not seeking a limited work authorization (LWA). Permanently disturbed locations would be stabilized and contoured to blend with the surrounding area in accordance with design specifications. Revegetation of disturbed areas would be compliant with site maintenance and safety requirements, and stabilization and restoration methods would comply with applicable laws, regulations, permit requirements and conditions, good engineering and construction practices, and recognized environmental BMPs. Restoration and management impacts to land use are anticipated to be SMALL.

4.1.1.15 Factors Contributing to Potential Cumulative Impacts

Apart from the preconstruction activities that may occur at the RBS site, there are several projects planned and already under construction in the RBS vicinity that could contribute to future cumulative land use impacts to the vicinity, because they would substantially change the nature of the vicinity surrounding the RBS site. Some of the past major projects in the area that could contribute to cumulative impacts include RBS Unit 1, the former Tembec facility, Georgia-Pacific Port Hudson Operations, Big Cajun Units 1 and 2 power plants, and the U.S. Army Corps of Engineers (USACE) revetment (river stabilization) projects along the Mississippi River. Present and future projects include construction of the John James Audubon Bridge to replace the St. Francisville-New Roads ferry, the State Highway 10 extension from the Mississippi River to Starhill on U.S. Highway 61 (operational in 2010), expansion of U.S. Highway 61 to four lanes, the Morgans Bend hydrokinetic power project in the Mississippi River near Cat Island National Wildlife Refuge, and the planned business park and eventual planned commercial and retail development just south of the new State Highway 10 corridor (refer to Section 2.2). Although the RBS Unit 3 construction activities may not begin until after some of the aforementioned projects are completed, these projects, when analyzed collectively, would result in some cumulative land use impact to the vicinity that is difficult to quantify. The impacts would be visible mainly in the form of forested and some agricultural areas being converted to developed uses. Cumulative impacts would largely result from continued urbanization and industrial and commercial development in an area that formerly featured only light development or that was undeveloped.

There are no related federal projects in progress or proposed in the vicinity of the RBS site that could contribute to cumulative impacts to the area, but there are several large, nonfederal projects proposed and in progress in the area, as described above. The RBS Unit 3 contribution to cumulative impacts from construction are expected to be SMALL, and cumulative impacts are discussed further in Section 4.7.

4.1.1.16 General Land Use Impacts Summary

Land in the RBS vicinity is rural and largely privately owned. The majority of the land within the 8-mi. vicinity is dedicated to forest (including forested wetlands) and agriculture. The Cat Island National Wildlife Refuge, about 3 mi. north-northwest of the RBS site, is to include about 36,500 ac. of forested wetland floodplain wildlife habitat when all of the land within the Congressionally approved boundary is acquired (refer to Section 2.2).

General land use in the vicinity includes forested and agricultural areas with scattered industrial facilities. Construction of RBS Unit 3 would be consistent with these uses and would not cause significant changes in the established land use patterns of the area. The new Unit 3 footprint would be wholly contained within the existing dedicated nuclear site originally planned for two units and would not be available for other uses until after decommissioning. NUREG-1555 acknowledges that impacts of less than 1235 ac. usually have minor effects. Since the expected direct impact at the RBS encompasses only 364 ac. of land, the impact is expected to be minor. Site and vicinity land use impacts would be SMALL and would not require mitigation.

4.1.2 TRANSMISSION CORRIDORS AND OFF-SITE AREAS

Land use impacts resulting from the new off-site transmission corridor are expected to be SMALL to MODERATE because the preferred route of the new 500 kV transmission line would convert significant tracts of previously undeveloped land (3334 ac.) along a 148-mi. corridor to utility use. A total of approximately 3334 ac. would be disturbed for construction activities, which includes the corridor only. Laydown and other areas (which may or may not be located within the corridor) would not be defined until the route is finalized. Existing roads would be used for access and construction traffic as much as possible, and some new access roads may be needed depending on the finalized route. The site roads and facilities would be usable in all weather conditions for travel and storage of materials and equipment during construction. There are no off-site areas associated with RBS Unit 3 other than the new off-site transmission corridor.

The impacts of construction of transmission corridors are anticipated to be SMALL to MODERATE because of the placement of the new off-site transmission lines and structures through land previously used as agricultural fields, forest, and open space. Mitigation is not possible for the 3334 ac. beneath the new transmission line that would be permanently converted to a utility corridor. To the degree possible, land use impacts would be partially mitigated through the use of best environmental, management, and industry practices, and conformance with applicable laws and regulations pertaining to ground-disturbing activities, such as forest and wetlands protection and stormwater controls. Based on the description in Subsection 2.2.2, the proposed off-site transmission line corridor is expected to have SMALL impacts on urban areas, state parks, or federally regulated wetland areas. No federal lands are anticipated to fall within the new transmission corridor, because it was selected based partially on the criteria that it not cross any federal lands.

The Applicant's System Impact Study Report (Reference 4.1-12) determined that an additional 500 kV transmission line from the RBS Fancy Point Substation to a new switchyard on the Mount Olive to Hartburg 500 kV line would be needed for increased grid stability associated with the interconnection of RBS Unit 3. The new line would be installed on new transmission towers in a new corridor from Fancy Point Substation to a new switching station west of Natchitoches. This approximate corridor is shown in red in Figure 2.2-7; it is 200 ft. wide and approximately 148 mi. long.

Land use impacts from construction of the new transmission line would be largely limited to a defined corridor proposed to be 200 ft. wide. The corridor areas under construction may be fenced to prevent other land uses during the construction period. New access roads would be minimized, and existing road infrastructure would be used as much as possible to access the new corridor. Construction of the new off-site transmission corridor and access roads (as needed) may result in the following potential impacts: vegetation removal and tree and brush piles; soil disturbance and erosion; stream and water body siltation; damage to culverts, driveways, and roadways; disturbance of special habitats of threatened, endangered, or species of concern; and disturbance of cultural, historical, or archaeological artifacts.

Corridor clearing methods for vegetation would be conducted in accordance with the Applicant's standard procedures and would prevent soil erosion and stream siltation. The Applicant does not use herbicides in its transmission corridor maintenance program. Vegetation within a 50-ft. buffer of a creek, river, swamp, or other surface water body would be hand-cleared and either chipped and spread over the corridor area or left in place, with no debris piling allowed in streams or wetland areas. If the need arises for machinery to cross a stream, the machinery operator would avoid damaging the stream bank or would repair any damage. Roots of felled trees and other vegetation would be left in place and be cut to ground level to assist soil retention in place and to prevent erosion. In the event of discovery of potential historic, cultural, or archaeological resources, appropriate action would be taken to prevent damage to the resources in consultation with the Louisiana State Historic Preservation Office (SHPO) (refer to Subsection 4.1.3.6).

After construction completion, the transmission corridor and access roads would be restored using the following techniques:

- Land restoration including discing, fertilizing, seeding, and installing erosion control devices (filter fences, hay or straw bales, mulch).
- Cleanup and proper disposal of construction debris.
- Property damage repaired to its original condition and to landowner satisfaction.

There are two types of transmission lines connected to the RBS switchyard: 500 kV and 230 kV. The Fancy Point Substation will be expanded to the west of the existing substation to accommodate RBS Unit 3 power output. This expanded switchyard area would encompass about 10 ac., with a small amount of overlap in the southwest corner of the expanded area that would affect the parish road called West Feliciana Parish 7 (Figure 2.1-4). This road will be rerouted around the expanded switchyard during the detailed design phase at a time closer to construction.

One 1000 by 1000 ft. new switching station at the point of connection of the new RBS 500 kV off-site transmission line and the Mount Olive to Hartburg 500 kV line would be needed. This switching station would be likely to affect a small area of pine plantation forest at a location near Natchitoches, Louisiana. No new substations are expected to be necessary to support the new 500 kV transmission line from RBS Unit 3. No modifications would be needed to the Big Cajun Unit 2 Substation or other substations in the RBS site vicinity as a result of the construction of the new transmission line.

A large number of new towers would be needed to support the new off-site 500 kV transmission line because of its 148-mi. length. Methods of new tower erection and line stringing, as well as the number and length of access roads, will be determined after the new off-site transmission corridor route is finalized at a time closer to the proposed construction time frame for RBS Unit 3. Specifications for these new towers are described in detail in Section 3.7. To avoid further impacts to forested and wetland/floodplain areas, existing access roads and local roads would be used to service the new corridor whenever possible. Part of this new corridor as it leaves the site and spans the Mississippi River is included in the industrial zoned area within West Feliciana Parish. Moving across the Mississippi River into Pointe Coupee Parish, the zoning is less distinct. Pointe Coupee Parish is formulating a parish land use plan, but has not had comprehensive zoning ordinances or land use planning in the past (References 4.1-7 and 4.1-11).

Approximate acreages of land use categories located within the transmission corridor are reported in Section 2.2. The on-site area that would need to be cleared to accommodate the expanded transmission line corridor consists largely of forested lands, including some forested wetland areas. Placement of the new lines and towers beside the existing transmission corridor in this area minimizes the amount of forest that would need to be cleared for the expanded corridor. The impacts of construction of the expanded on-site transmission corridor would be considered SMALL. It is noted that the type of vegetation cover affected over some of the corridor is older bottomland forest. Refer to Section 5.6 for further discussion of transmission line impacts on terrestrial ecology. Land use impacts are expected to be mitigated for the new off-site corridor through confinement of the transmission line work within a designated corridor, the use of existing access roads, implementation of the SWPPP and SPCC Plan, use of BMPs, consultation with landowners along the route, and by adherence to all applicable federal, state, and local laws and regulations governing the transmission line work.

Overall, transmission construction impacts to land use in the vicinity of RBS Unit 3 and the new off-site transmission corridor would be MODERATE because of the number of acres affected and would require mitigation as described in Section 4.6. Some of the mitigation measures that would be implemented include limiting construction work to a defined corridor area, placing gravel on access roads and using existing access roads to the degree possible, establishing vegetation cover in disturbed areas, limiting machinery access points to reduce erosion, compensating owners for land damaged by the corridor, and using measures from the SWPPP and SPCC Plan to avoid erosion, siltation, and potential spills. Additional issues related to land use that could be affected by transmission corridor construction work are discussed in the following subsections.

4.1.2.1 Planning and Zoning

The new off-site corridor is compatible with the land use planning and zoning designations for the corridor areas in West Feliciana, Pointe Coupee, Avoyelles, Grant, Rapides, and Natchitoches Parishes. The more rural parishes of Louisiana with police jury forms of government tend to have fewer adopted planning and zoning regulations and tools than the metropolitan areas. Grant and Rapides Parishes have neither zoning ordinances nor Comprehensive or Master Plans; Natchitoches Parish has zoning ordinances, but no Comprehensive or Master Plan; Avoyelles and Pointe Coupee Parishes have no zoning ordinances, but do have Comprehensive Plans that were adopted in 2005 and 2007, respectively. West Feliciana Parish is the only one of the parishes crossed by the new off-site transmission corridor that has both a zoning ordinance and a Comprehensive Plan, scheduled to be complete in 2008 (Reference 4.1-11).

Along its 148-mi. length, the new off-site transmission corridor would primarily cross areas that are not formally zoned, but are used as residential, agricultural, and industrial land, as well as several pockets of forested land. The new corridor, new switching station, and new transmission lines will be constructed in areas where electrical infrastructure is likely to be viewed as an acceptable use and where transmission use complies with local planning policies. During the process of final route determination for the off-site transmission line, parish and city offices will be contacted to determine necessary measures to ensure that the new corridor complies with zoning and planning regulations or guidance in place at that time for each parish or city that the corridor crosses.

Construction work for the expansion of the on-site transmission system would be within the RBS site boundaries; work for the new off-site transmission corridor to the Mount Olive to Hartburg 500 kV line would occur outside the boundaries of the RBS site. The new off-site corridor would affect primarily agricultural land along the proposed route. Adjacent farmland can continue to be used as pasture and cropland, with only short-term, temporary disruptions of use to the portions of croplands closest to the transmission corridors during the construction work. These areas would be able to revert to agricultural use after transmission line construction is completed. Therefore, RBS Unit 3 transmission corridor construction would have a SMALL impact on planning and zoning in the vicinity.

4.1.2.2 Transportation and Rights-of-Way

Because of its length, the new off-site corridor will cross multiple road and railroad intersections as well as other utility corridors and could have minor impacts on road traffic flow during the construction period. Rail traffic is less likely to be affected because of its periodic nature. These impacts would be minimal, localized, and temporary because affected intersections and utility corridors would be used as normal after transmission line construction is completed.

The new transmission corridor would also cross multiple pipelines carrying various materials such as petroleum and natural gas. Care would be taken to locate and avoid pipelines before excavation work is undertaken for placement of towers to support the new transmission line. Because natural gas and petroleum pipelines are underground and the new transmission line would be above ground, SMALL impacts to access or maintenance of pipelines are expected.

4.1.2.3 Agricultural and Soil Issues

Agricultural land use is prevalent along the new off-site transmission corridor route and comprises about 46 percent of the 3334 total ac. anticipated to be affected by the new corridor. Construction of the transmission corridor would disturb the use of portions of adjacent properties for a short time until work on the corridor is complete.

The majority of the construction work on-site would affect forested land, while the new off-site portion would affect, to a large extent, agricultural land along with various other uses. Compared to the available acreages of agricultural land available for cultivation within the parishes along the new off-site corridor, the corridor itself would affect a very small portion. Although exact dimensions of prime farmland along the route cannot be determined until the route is finalized, it is likely that prime farmland soils would be present within limited areas of the new off-site transmission corridor. New off-site transmission corridor impacts would be minimized by keeping the clearing and construction within the approximately 200-ft. wide corridor. The observance and implementation of BMPs as delineated in the SWPPP, use of existing access roads to the extent possible for the new corridor, and limiting the area disturbed to the minimum dimensions necessary would keep impacts to agriculture and soils SMALL to MODERATE.

4.1.2.4 Ecological Impacts

Natural vegetation would be affected primarily by activities involved in preparing the transmission line corridor both on-site and off-site, which would involve clearing some areas of bottomland hardwood forest on-site and additional portions of forest along the new off-site corridor.

The Applicant's policy for work on transmission lines states that vegetation clearing within 50 ft. of creeks, rivers, swamps, or other surface water bodies must be accomplished using "above-grade" vegetation removal methods. No mechanized earthmoving equipment can be used for vegetation clearing in these areas. Plant materials are often piled into windrows and disposed of on-site or in the transmission corridor; however, the timber cleared for transmission line expansion on the RBS site may be sold as part of the Applicant's selective logging program (described in Section 2.2). Natural revegetation of the corridor area on-site and off-site may be hampered by loss of topsoil and soil compaction caused by excavation and construction machinery traffic. Reclamation of the corridor areas would likely consist of allowing natural vegetation to return, as well as seeding where needed to reestablish vegetative cover. In some cases, natural succession may again resume to a degree, but maintenance activities usually promote a stable vegetative composition and uniform appearance within the corridor.

As noted previously, bottomland hardwood forest would be cleared for expansion of some areas of the transmission corridor on the RBS site. Compared to the total acreage of bottomland hardwood forest in West Feliciana Parish and the surrounding vicinity, this acreage represents a small portion. On-site bottomland hardwood forests could provide rare or unique habitat for protected species, but the areas cleared would be adjacent to transmission corridor areas that have already been cleared, and no rare or unique species have been observed in these areas. Forested areas cleared would be kept to the minimum dimensions that will satisfy the Applicant's transmission line clearance and maintenance requirements.

The expanded on-site corridor would cross the floodplain and wetland areas in the lower elevation portion of the RBS site abutting the Mississippi River. Impacts to floodplain areas and wetlands would be minimized by placing the fewest possible number of new towers and by keeping the work as much as possible adjacent to the areas already disturbed by existing towers and corridors. The floodplain on-site would be minimally affected and would be avoided where possible when transmission towers are placed.

Wildlife using the edge of the forested area for habitat or cover would have slightly reduced habitat area in that the forested area would recede to accommodate the expanded transmission corridor, and the greater amount of disturbed land for the expanded corridor would allow invasive species to establish themselves more easily. No ecologically important species are known to inhabit the expanded transmission corridor on-site.

In the proposed new off-site transmission corridor, more edge habitat would be created where the route passes through forested areas. This would likely change the species composition in those areas from species favoring contiguous forest to those that live in edge habitats. Generalist species (deer, opossum), invasive/exotic species (kudzu), and parasitic species (cowbird) would be able to more easily move into the off-site transmission corridor area and the surrounding forest after tree clearing. The presence of cowbirds could contribute to the decline of forest nesting songbirds in forest areas adjacent to the new off-site transmission corridor.

Important species that may be present in the new off-site corridor cannot be determined until the route has been finalized; these species are to be evaluated at a later time. However, based on the areas traversed by the new off-site transmission route and the steps taken to avoid ecological impacts during the route selection study, land use impacts related to ecological resources during transmission line construction are expected to be SMALL.

For further discussion of transmission line construction impacts to ecological resources, refer to Subsections 5.6.1 and 5.6.2.

4.1.2.5 Recreation and Aesthetics

The new off-site transmission corridor may cross some recreation areas. Wherever possible, towers and lines will be placed to avoid recreation areas or the most sensitive features therein if the areas cannot be entirely avoided. The transmission line routing process considered and avoided recreation areas to the greatest extent possible. Based on the evaluation detailed in Subsection 2.2.2, the new off-site transmission corridor is expected to have minimal impacts on residential areas, federal lands, and state parks.

Visual impacts from the presence of construction machinery, excavated soil, and stripped vegetation would be largely temporary and would be confined to the immediate transmission corridor area for both on-site and off-site corridors. Because much of the land area traversed by the off-site transmission corridor is agricultural, nearby residents and the public would likely be able to view much of the construction and would notice the presence of a large new transmission line and support structures. Depending on the observer's point of view, the transmission line construction could be perceived as a degradation of the viewshed or could represent a reliable source of power through the region and be perceived in a positive light.

Since the existing on-site transmission line is already present, the expanded corridor would minimally increase aesthetic impact. Most portions of the corridor would not be directly visible from roads or populated areas in the vicinity. The portion nearest the Mississippi River would be visible to boaters and other river users and is likely to be visible when viewed from Big Cajun Unit 2 or other nearby areas across the river in Pointe Coupee Parish.

The impacts discussed above are not expected to cause changes in land use at recreation or other areas as a consequence of aesthetic perceptions of the transmission line construction. Overall impacts of transmission line construction related to land use are expected to be SMALL.

4.1.2.6 Spills

Spill prevention and response would be addressed the same way along the new off-site transmission corridor as it is on the RBS site (Subsection 4.1.1.11), through observance of the preventive measures. Extra care would be taken during construction to avoid spills of transformer oils and fluids, and impacts to land use are expected to be SMALL.

4.1.2.7 Noise

An observer standing directly under or adjacent to the existing on-site 500 kV transmission line may perceive a low humming sound; however, the transmission lines are placed at such heights that noise from the lines would be beneath the level judged to be audible by most observers.

Construction of the expanded transmission corridor would involve noise from construction equipment and noise from the temporary occupation of the area by construction workers.

The new off-site transmission corridor is proposed to be located through an area where there are no existing transmission lines. The same noise levels and sources as would be added to the on-site transmission system would also be applicable to the off-site corridor. Construction noise would be temporary and short-term as workers and equipment progressed along the route. Transmission line construction noise impacts to land use along the transmission corridors are expected to be SMALL.

4.1.2.8 Corridor Restoration and Management Actions

Measures to prevent erosion and revegetate construction areas along the new off-site transmission corridor would be very similar to those taken on the RBS site and would primarily involve recontouring of the construction area and establishment of permanent vegetative cover. Corridor maintenance during operation is discussed in Subsection 5.1.2.

In the event that construction on the new off-site transmission corridor is begun and at some point the decision made to stop construction and restore the corridor, disturbed areas would be restored consistent with existing and native vegetation and to the contours that existed prior to transmission line construction to the point of landowner approval.

Impacts to land use are expected to be SMALL.

4.1.2.9 Factors Contributing to Potential Cumulative Impacts

The construction of a new off-site transmission corridor would contribute to erosion and water quality degradation, especially in environmentally sensitive areas along the route. Small amounts of mostly agricultural and forestland are likely to be affected along the length of the off-site corridor, but these areas would be very limited in size compared to all of the forest and agricultural land available in the parishes crossed by the transmission corridor.

The overall agricultural and forested land use pattern along the expanded corridor would be minimally altered from its current use in that the grass vegetation under the existing corridor would replace existing forest vegetation or crops. Vegetative cover would be maintained or reestablished to the greatest extent possible beneath the expanded corridor to avoid cumulative erosion and sedimentation impacts to the area.

The on-site transmission system expansion parallels and is adjacent to the existing transmission lines; this location helps minimize clearing of the forest area on the RBS site. There could be localized erosion and siltation impacts resulting from the cleared transmission area and placement of new tower bases that would be absorbed by Alligator Bayou and the wetland areas near the Mississippi River. The on-site transmission line and on-site construction in the main Unit 3 power block area are likely to have some cumulative impacts to the on-site wetlands; however, these wetlands have a natural filtering function that would prevent erosion and siltation impacts from migrating off-site and would also prevent long-term damage to on-site natural resources.

The RBS transmission line construction work would contribute a SMALL impact to cumulative impacts in the area. Cumulative impacts from construction of the RBS Unit 3 project are discussed in Section 4.7.

4.1.3 HISTORIC PROPERTIES

This subsection of the Environmental Report (ER) discusses the effects that RBS Unit 3 construction may have on historic properties positioned within a 10-mi. (16.1-km) radius of the station area. This examination of historic properties is mandated by Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and the National Environmental Policy Act (NEPA) of 1969, which dictate that federal agencies must assess the effects of their undertakings on historic properties, i.e., archaeological sites, isolated finds, standing structures, cemeteries, and traditional cultural properties situated within or immediately adjacent to the areas of potential effect (APE) that may be eligible for listing on the National Register of Historic Places (NRHP). Assessments of eligibility for inclusion on the NRHP must be made for each cultural resource affected by the undertaking.

A two-stage approach was taken to determine the effects of this project on historic properties situated within the APE. This included an intensive Phase I cultural resources survey of the RBS Unit 3 construction footprint, which was conducted in September and October of 2007 by archaeologists affiliated with R. Christopher Goodwin & Associates, Inc. This Phase I cultural resources survey included both intensive pedestrian survey and systematic shovel testing throughout all nondisturbed areas of the construction footprint (refer to Subsection 2.5.3). To determine the presence of historic properties outside of the boundaries of the construction footprint, a review of all previously recorded archaeological sites, historic standing structures, and NRHP properties situated within 10 mi. (16.1 km) of the proposed project area was undertaken. This research involved examination of the data and historic maps currently on file with the Louisiana Division of Archaeology and the Louisiana State Library, and a search of the online NRHP database.

4.1.3.1 Historic Properties Identified Within the Construction Footprint

Although no eligible or potentially eligible cultural resources were identified within or in close proximity to the RBS Unit 3 footprint, two archaeological sites (i.e., Site 16WF36, the Magnolia Plantation Sugar Mill, and 16WF181) were identified within the 2007 study area. These sites were assessed as significant or potentially significant, respectively, applying the NRHP Criteria for Evaluation (36 CFR 60.4 [a-d]; refer to Subsection 2.5.3). Since the Applicant has decided to avoid both properties, no adverse effects to historic properties would occur. The impact to historic resources is considered SMALL.

4.1.3.2 Historic Properties Identified Within 10 mi. (16.1 km) of the RBS

In addition to the two resources identified within the construction footprint, 33 archaeological sites within a 10-mi. (16.1-km) radius have been assessed as eligible or potentially eligible for inclusion on the NRHP (refer to Section 2.1). These include archaeological Sites 16EF007, 16EF068, 16PC062, 16WF007, 16WF004, 16EBR082, 16WF060, 16WF035, 16EBR086, 16EBR135, 16EBR149, 16EBR168, 16EF078, 16EF080, 16EF109, 16EF110, 16EF114, 16PC027, 16PC063, 16WBR038, 16WF039, 16WF156, 16WF175, 16PC025, 16WBR019, 16WF089, 16WF181, 16WF062, 16WF057, 16WF061, and 16EBR179 (Table 2.5-50). Furthermore, a number of cultural resources have been listed on the NRHP. These include six archaeological sites (i.e., 16EBR047, 16EF020, 16EF107, 16WF034, 16EF118, and 16EBR042) and 63 individual structures greater than 50 years in age (Structures 63-186, 63-187, 63-188, 63-394, 63-395, 63-396, 63-397, 63-407, 63-323, 63-324, 63-325, 63-326, 63-327, 63-328, 63-329, 63-330, 63-331, 63-332, 63-333, 63-334, 63-335, 63-336, 63-337, 63-338, 39-596, 39-610, 39-581, 63-149, 63-150, 63-544, 63-545, 63-546, 63-547, 63-273, 63-274, 63-276, 39-569, 39-779, 63-341, 63-342, 63-343, 63-339, 63-340, 63-280, 63-281, 63-282, 63-283, 63-284, 63-285, 63-286, 63-287, 63-288, 63-293, 63-366, 63-367, 63-368, 39-745, 63-250, 63-254, 63-389, 63-390, 63-538, and 39-606 (Table 2.5-50).

A total of 50 historic properties located within 10 mi. (16.1 km) of the RBS were listed on the NRHP. For a description of these properties, refer to Tables 2.5-51 and 2.5-52. This number includes 6 archaeological sites and 63 individual structures greater than 50 years in age. This discrepancy in number, i.e., 50 historic properties versus 69, stems from multiple structures being nominated as a single entity. For example, 16 individual structures were included in the NRHP nomination for Cottage Plantation. Since each structure received a separate identification number from the state of Louisiana, the number of individual resources is higher than the number of listed properties.

None of these historic properties are located within the construction footprint of the proposed RBS Unit 3. Additionally, the Louisiana Division of Archaeology has indicated that it has no viewshed concerns (refer to Section 2.5) related to the RBS Unit 3 project. Construction of the

RBS Unit 3 would not have an adverse effect on historic properties located outside of the construction footprint; therefore, the effect on historic resources is considered SMALL.

4.1.3.3 Historic Cemeteries

A total of 35 historic cemeteries were identified within 10 mi. (16.1 km) of the RBS Unit 3 footprint, although none were found to be within or immediately adjacent to the proposed project footprint. While the NRHP eligibility of many (n=26) of the identified cemeteries has not been assessed, nine cemeteries were recommended as eligible or potentially eligible for inclusion in the NRHP. This number includes three cemeteries associated with the Port Hudson Battlefield, Asphodel Plantation Cemetery, Young Cemetery, the Cemetery of Buhler Plains, Townsend-Lilledy Cemetery, First Baptist Cemetery, and Cottage Plantation Cemetery. Construction poses no immediate effect on these cemeteries, and no viewshed concerns are associated with these cultural resources. Construction of the RBS Unit 3 project would not have an adverse effect on any historic cemeteries; therefore, the effect of construction on these resources is considered SMALL.

4.1.3.4 Traditional Cultural Properties

No traditional cultural properties were identified during the background research completed for the RBS Unit 3 project. As a result, no traditional cultural properties would be affected by construction, and the effect of construction is considered SMALL.

4.1.3.5 Historic Properties Identified Within the Transmission Corridor

No historic properties were identified during the 2007 archaeological inventory of the proposed on-site transmission corridor. Therefore, effects on historic properties within this area are considered SMALL.

4.1.3.6 Unanticipated Discoveries Plan

The impact from the unanticipated discovery of archaeological or historic sites is expected to be SMALL; however, archaeological or historical sites are occasionally discovered during construction projects, regardless of whether the project area has been subjected to a complete and thorough cultural resources survey and archaeological inventory. As a result, the Applicant has developed procedures for inadvertent discovery; they are included in the fleet-wide Evacuation and Backfill Work and Cultural Resources Protection Plan Procedures. These procedures apply to on-site activities.

American Indian Religious Freedom Act

The American Indian Religious Freedom Act (AIRFA) promotes coordination with Native American religious practitioners regarding the effects of federal undertakings upon their religious practices. Consultation will follow NEPA guidelines. Impacts of importance to Native Americans may include flora and fauna, viewsheds, artifacts, and sites. Guidelines for consultation under the

AIRFA have not yet been determined[a]; therefore, all questions on consultations need to be directed to the SHPO.

Disposition of Human Remains

The discovery and/or disturbance of human remains are sensitive issues that must be addressed if the situation arises. It is possible that human remains could be encountered if an unmarked grave or cemetery is affected by the planned undertaking. If, during construction, human remains are discovered inadvertently or cannot be avoided, the Louisiana state guidelines outlined in the Louisiana Unmarked Human Burial Sites Preservation Act (Chapter 10-A of the Louisiana Statutes, Section 680) will be followed. These guidelines specifically stipulate that the law enforcement agency of the jurisdiction where the site or remains are located must be notified immediately if human burial remains are encountered during survey; the NRC also will be contacted immediately. The law enforcement agency shall immediately notify the coroner of the parish where the site or remains are located. Following that notification, they shall also notify the Unmarked Human Burial Sites Board (Board) through the Division of Archaeology within two business days of any discovery, unless circumstances indicate that the death or burial is less than 50 years old or that there is need for a criminal investigation or legal inquiry by the coroner. A qualified professional archaeologist will also investigate the reported discovery within 2 days. Written authorization in the form of a permit issued by the Board shall be obtained prior to any excavation or reinterment of any human burials.

In practice, the Applicant will make a reasonable effort to identify and locate parties who can demonstrate direct kinship with the interred individuals. If such people are located, the Applicant will consult with them in a timely manner to determine the most appropriate treatment of the recovered burials. If the unanticipated discovery consists of Native American human remains or associated funerary remains, the Applicant will consult with the Board and the NRC archaeologist immediately regarding the appropriate measures to handle such a discovery. If it can be determined adequately that the disturbed burials have an affinity to any federally recognized Native American group or to other ethnic groups, a reasonable effort will be made to identify, locate, and notify leaders or representatives of these groups. All activities will comply with the Native American Graves Protection and Repatriation Act of 1990, as amended.

If an association with a specific Native American group or other ethnic group cannot be made, the Applicant will make a reasonable effort to locate and notify those group(s) that may have a legitimate interest in the disposition of the remains, based on a determination of generalized cultural affinity by a recognized professional. Qualified groups will be provided an opportunity to consult in determining the appropriate treatment of the interment. It will be the claimants' responsibility, however, to document and validate their claim. The Applicant or its agents will treat all discovered human remains with dignity and respect until they are reinterred. Any costs that

a. AIRFA became law on August 11, 1978 (Public Law 95-341, 42 U.S.C., 1996 and 1996a) and specified that federal departments, agencies, and other instrumentalities responsible for administering relevant laws were to evaluate their policies and procedures in consultation with native traditional religious leaders in order to determine the appropriate changes necessary to protect and preserve Native American religious cultural rights and practices. The results of this evaluation by the SHPO have not yet been determined. The only change in administrative policy and procedure as a result of evaluations to date was the issuance of Executive Order 13007, Indian Sacred Sites.

accrue as a result of consultation, treatment, curation, etc., will be the responsibility of the Applicant.

The following agencies and/or Native American Tribes will be contacted, as appropriate, in the event of discovery and/or disturbance of unanticipated human remains:

West Feliciana Parish Sheriff's Department
St. Francisville, Louisiana 70775
(225) 784-3109

U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
(800) 368-5642

West Feliciana Parish Coroner
P.O. Drawer 1850
St. Francisville, Louisiana 70775
(225) 635-3256

State Historic Preservation Officer
Department of Culture, Recreation & Tourism,
Office of Cultural Development,
Division of Archaeology
P.O. Box 44247
Baton Rouge, Louisiana 70804-4247
(225) 342-8170

Unmarked Human Burial Sites Board
Department of Culture, Recreation & Tourism,
Office of Cultural Development, Division of Archaeology
P.O. Box 44247
Baton Rouge, Louisiana 70804-4247
(225) 342-8200

Chairman
Tunica-Biloxi Tribe of Louisiana
P.O. Box 1589
Marksville, Louisiana 71351
Phone (318) 253-9767
Fax (318) 253-9791

Chief
Mississippi Band of Choctaw Indians
P.O. Box 6257
Philadelphia, Mississippi 39350
(601) 656-7316

4.1.4 CONCLUSION

Construction of RBS Unit 3 structures would take place within the existing site, where power generating and transmission facilities comprise the main existing land use. Many of the forested areas on the site would be cleared only temporarily during Unit 3 construction and would be allowed to reforest after completion of construction. Other permanent forest clearing and agricultural areas, such as along portions of the expanded on-site transmission corridor and new off-site transmission corridor, represent the loss of only a small percentage of the forested and agricultural areas remaining in the affected parishes.

A SMALL aesthetic impact to the surrounding area would occur with the addition of the 550-ft. NDCT on the RBS site, where no tall structure was previously present. This impact could have an effect on land use in the surrounding area, depending on resident and visitor perceptions of nuclear power plants. This is a potential impact from RBS Unit 3 construction that could be mitigated somewhat from certain vantage points by the forest cover and rolling terrain of the area.

Impacts for both the Unit 3 facilities and the transmission corridor expansion on-site would be minimized by their placement adjacent to existing structures used for the same purposes as the new structures. The impact of RBS Unit 3 transmission corridor construction, particularly resulting from the new off-site corridor, would be SMALL to MODERATE because of its length and the fact that it would affect a large amount of land.

A single property assessed as significant (i.e., 16WF36, the Magnolia Plantation Sugar Mill) applying the NRHP Criteria for Evaluation and a single property assessed as potentially significant (i.e., Site 16WF181) applying the NRHP Criteria for Evaluation were identified as present within the construction footprint of RBS Unit 3 as a result of the Phase I cultural resources inventory. The Applicant has determined that it will modify construction plans to avoid both properties. Therefore, potential impacts to historic properties in the construction area and within 10 mi. of the site, impacts to historic cemeteries, and impacts to traditional cultural properties are expected to be SMALL.

Overall, as discussed previously in this section, impacts to land use on-site and in the vicinity from construction of RBS Unit 3 are expected to be SMALL; impacts from the new off-site transmission corridor are anticipated to be SMALL to MODERATE, depending on the finalized route.

4.1.5 REFERENCES

4.1-1 U.S. Atomic Energy Commission, Directorate of Licensing, *Final Environmental Statement Related to Construction of River Bend Nuclear Power Station Units 1 and 2*, Gulf States Utilities Company, Docket Numbers 50-458 and 50-459, p. 141, September 1974.

4.1-2 U.S. Nuclear Regulatory Commission, *Final Environmental Statement Related to the Operation of River Bend Station*, NUREG-1073, Docket No. 50-458, January 1985.

4.1-3 U.S. Nuclear Regulatory Commission, "Final Rulemaking on Limited Work Authorizations," SECY-07-0030, February 7, 2007.

4.1-4 U.S. Nuclear Regulatory Commission, "10 CFR Parts 2, 50, 51, 52, and 100, Limited Work Authorizations for Nuclear Power Plants; Final Rule," *Federal Register*, Volume 72, Number 194, October 9, 2007.

4.1-5 Center for Planning Excellence, "West Feliciana Parish Comprehensive Plan Kick-Off," posted September 27, 2007, Website, http://www.planningexcellence.org/component/option,com_jcalpro/Itemid,99999999/extmode,view/extid,12/, accessed January 14, 2008.

4.1-6 Fregonese Associates, Presentation for West Feliciana Parish Comprehensive Plan, "Implementing the Community's Vision, 2007," Website, http://www.westfelicianatogether.com/documents.html.

4.1-7 Clark, S., "A Bridge Too Near," *Business Report.com*, Website, http://www.businessreport.com/news/2007/may/08/bridge-too-near/, accessed May 18, 2007.

4.1-8 U.S. Department of Agriculture Natural Resources Conservation Service, "Web Soil Survey," Website, http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx, accessed November 20, 2007.

4.1-9 Farmland Protection Policy Act, Subtitle I of Title XV, Section 1539-1549.

4.1-10 U.S. Nuclear Regulatory Commission, *Environmental Impact Statement for an Early Site Permit (ESP) at the Grand Gulf ESP Site*, Section 8.0, Docket No. 52-009-ESP, April 2006.

4.1-11 Maloney-Mujica, L. A., "Comprehensive Planning in Louisiana," Master's Thesis, Louisiana State University, Department of Environmental Studies, 2008.

4.1-12 Southwest Power Pool, "System Impact Study Report (PID 208)," 1594 MW (1684 MW Gross) Plant, Fancy Point, Mississippi, January 10, 2008.

4.2 WATER-RELATED IMPACTS

This section describes site preparation activities, hydrological alterations that could result from plant construction activities, and the physical effects of hydrological alterations on other water users. Subsection 4.2.1 addresses hydrologic alterations. Subsection 4.2.2 addresses the water use impacts of plant construction activities and impacts to water quality.

Impacts to surface water bodies would be SMALL on account of the implementation of a construction SWPPP and continued compliance with existing regulatory permits and applicable regulations. Impacts to wetland areas and groundwater resources are expected to be minimal while construction activities are taking place.

4.2.1 HYDROLOGIC ALTERATIONS

This subsection of the Environmental Report (ER) identifies and describes the hydrologic alterations that could result from proposed construction activities.

4.2.1.1 Site Preparation and Station Construction

Construction of the RBS Unit 1 resulted in alterations to the plant site. Approximately 753 ac. (Reference 4.2-1) of the 3330-ac. site were affected by construction; however, permanent structures and facilities occupy only about 266.9 ac. (Reference 4.2-1), not including the plant access roads and pipeline right-of-way (ROW).

Construction of the new facility would result in additional alterations of the site; however, much of the new construction would be conducted in areas that were previously disturbed during construction of the existing facility. Construction of a new facility is estimated to require approximately 364 ac. Impacts to developed, forested, and grassed areas are indicated in Figure 4.3-1 and listed in Table 4.3-1. Previously disturbed and not previously disturbed impact areas are differentiated in the table.

Clearing of additional land for RBS Unit 3 construction is discussed for each type of facility in this subsection. The locations for the new facilities to be constructed for RBS Unit 3 are provided in Figures 2.1-3 and 2.1-4. Figure 2.1-3 covers a larger area and shows the site, area roads, and facilities at the Mississippi River. Figure 2.1-4 provides a closer view of the site area and includes a legend of RBS Unit 3 facilities to be constructed. The background in Figures 2.1-3 and 2.1-4 is an aerial photograph, which illustrates areas that are forested, previously disturbed, or grassed.

Construction impacts would be reduced and effectively managed by the development and implementation of a site-specific construction SWPPP. SWPPPs typically address employee training; installation of silt fences, straw bales, slope breakers, and other erosion prevention measures; preventive maintenance of equipment to prevent leaks and spills; procedures for storage of chemicals and waste materials; spill control practices; revegetation; regular inspections of control measures; and visual inspections for discharges that may be detrimental to water quality.

Water sources used during construction are provided in Table 4.2-1.

Intake Structure, Intake Pipelines, Pipelines, and Discharge Pipelines

Makeup water (cooling tower makeup and other raw water needs) for a new facility would be supplied primarily from the Mississippi River. Existing structures and components would be used by the new facility, which would minimize construction impacts.

For RBS Unit 1, an excavated embayment was constructed in the Mississippi River along the east bank at about River Mile (RM) 262.5. A barge slip and the plant makeup water intake screens are located in the embayment, which provides protection from main channel debris and navigation. Access to the embayment area is obtained from the north and south by River Road, which runs parallel to the river along the natural levee, and from the east (and the plant area) by River Access Road. Embayment banks are gently sloped and employ riprap protection to -12 ft. msl (about 19 ft. below mean low water level) to reduce the effects of river bank erosion. Riprap stone size is 16 to 20 in. By agreement with the USACE, dredged material from embayment construction was deposited at acceptable bed elevations in the river. The bottom elevation in the embayment is -12 ft. msl (Reference 4.2-1).

Periodic dredging of the embayment is required because of sediment transport in the river. Dredging activities typically occur no more than once per year. The volume of material removed is not tracked because it is placed back into the river; however, the volume of material removed is estimated to be less than 20,000 cu. yd. per removal. According to USACE (General Permit) NOD-23, the removal and deposition of dredged material shall not exceed 125,000 cu. yd. (References 4.2-2 and 4.2-3). The volume of material dredged from the embayment area, siltation due to deposition of the material in the river, and any impacts to Unit 1 caused by dredging operations are not anticipated to change due to Unit 3 construction or operation. Since the construction of the embayment area, no maintenance has been performed on the slope stabilization. Required maintenance to the embayment area's slope stabilization is not anticipated.

A combined station water system is to be used for Units 1 and 3. The existing pump house and support systems would be used. The existing intake screens located in the embayment would be replaced in order to meet the intake velocity requirement (≤0.5 ft/sec at the screen). For the combined station water system, two pairs of intake screens would be connected to the existing intake pipelines. Removal of the existing intake screens and installation of the new screens would result in a slight increase in turbidity during the construction process. Replacement of the screens will be coordinated to minimize impacts to Unit 1 operations.

An existing 36-in. diameter pipeline is used to convey makeup water from the pump house to the Unit 1 clarifiers. An additional 36-in. diameter pipeline would be installed along the existing pipeline route from the pump house to the Unit 3 clarifiers. Material excavated for installation of the additional 36-in. diameter pipeline would be reused as fill material if of suitable quality. Any excess material would be removed from the pipeline route.

The Unit 1 cooling tower blowdown pipeline and the clarifier sludge discharge pipeline exit the plant area adjacent to one another and cross Alligator Bayou along the south side of River Access Road. Both pipes exit to the Mississippi River within the riprapped portion of the river embankment, approximately 610 ft. downstream of the intake structure. The pipelines are buried in the roadbed and do not interfere with surface water flow in Alligator Bayou and West Creek.

The center line of both outfalls is at -3 ft. msl, about 10 ft. below mean low water. There is no impact to river navigation.

For RBS Unit 3, a cooling tower blowdown pipeline will be installed along the existing route, sized for the combined Unit 1 and 3 discharge flows. The effluent discharge line size at the river is 36 in. in diameter. The outfall configuration and location will match the Unit 1 pipeline. The discharge velocity at the pipe exit will be 3 fps.

Since existing structures and components would be used by the new facility, the anticipated impact of hydrologic alterations is SMALL and does not warrant further mitigation measures.

Power Block

The proposed Unit 3 power block is located just west of the Unit 1 power block. Facilities to be constructed in the Unit 3 power block area are provided in Figure 2.1-4, and include the Reactor Building, the Turbine Building, the Radwaste Building, main and auxiliary transformers, as well as several additional buildings and tanks.

A majority of the footprint of the Unit 3 power block is located over an excavation that was created for RBS Unit 2, which was never constructed. The area at the top of the excavation (approximately Elevation 94 ft. NGVD) is about 16 ac. (Reference 4.2-4). The bottom elevation of the Unit 2 excavation ranges from Elevation 64 ft. to 68 ft. NGVD. A berm currently in place around the top of the Unit 2 excavation prevents surface runoff from entering the Unit 1 plant area. The Unit 2 excavation will be filled in during Unit 3 construction.

Currently, precipitation over the excavation area contributes primarily to groundwater. Ponded water in the excavation has occasionally been pumped out.

During Unit 3 construction, when the design plant grade elevation is reached, stormwater runoff would be generated in the area and discharged to West Creek. Much of the Unit 3 power block area is impervious; thus, the volume of runoff and sediment discharged to West Creek would increase during the construction phase and during Unit 3 operation.

Dewatering of the construction area is discussed in Subsection 4.2.2.1. Dewatering associated with construction of the facilities in the Unit 3 power block area is estimated to produce a discharge of 10,000 gpm (22.3 cfs). This flow would be discharged to the Fabriform-lined ditch located just west of the Unit 3 power block, which will be relocated prior to Unit 3 construction. A depth of flow of 4 in. in the ditch is estimated for this discharge. The flow depth was determined by solving Manning's Equation:

$$Q = (1.49/n)\ A\ R^{2/3}\ S^{1/2}$$

Where:

Q = Discharge (cfs).

n = Manning's Roughness Coefficient = 0.030 for the Fabriform-lined ditch.

A = Flow Area (square feet).

R = Hydraulic Radius = Flow Area/Wetted Perimeter (feet).

S = Channel Slope = 0.00193 ft/ft in the plant area.

For a flow depth of 0.34 ft. (4 in.), the flow area is 21.08 sq. ft., the wetted perimeter is 62.68 ft., the hydraulic radius is 0.3363 ft., and the discharge is 22.24 cfs. The velocity for this discharge was determined by dividing the discharge by the flow area, yielding a velocity of 1.06 ft/sec. The dewatering discharge of 22.3 cfs in the Fabriform-lined ditch portion of West Creek is insignificant compared to the peak flow of 6,699 cfs in West Creek that results from the probable maximum precipitation (FSAR Subsection 2.4.3.4.2).

Stormwater discharge from RBS Unit 1 primarily drains west to the Fabriform-lined portion of West Creek. This watershed includes the Unit 3 power block area. During RBS Unit 3 construction, stormwater runoff from this area would continue to be routed west to the Fabriform-lined portion of West Creek.

Cooling Tower and Construction Support Areas

The proposed mechanical draft and natural draft cooling towers are located southwest of the Unit 3 power block in an area that is partially forested. A portion of the area has been previously disturbed. The service water cooling tower is located just west of the Unit 3 power block in an area that was previously disturbed. New construction would result in increased runoff and silt loads to West Creek and to Alligator Bayou as a result of heavy earthmoving activity and loss of vegetative cover. Construction of a pipeline extending across West Creek from the proposed cooling tower area would involve disturbance of the stream channel; however, the effect would be temporary in nature. The pipeline will be installed across half of the stream channel at a time to allow for conveyance of dewatering and stormwater flows.

The proposed construction areas west of the Unit 3 power block area are primarily forested. Because of the rugged topography in portions of this area, extensive grading and leveling may be required. Deforestation would tend to increase erosion, siltation of streams, and leaching of nutrients, and may also increase flood flow. The greatest impacts tend to occur during logging and clearing activities.

The spoil fill and aggregate stockpile areas southwest of the Unit 3 power block are in previously disturbed areas. Use of these areas may also result in increased runoff and silt loads to Alligator Bayou.

Local Lakes

There are a number of small farm ponds in the local watershed area, but few natural lakes (Reference 4.2-1). Twenty-four ponds existed within the site boundary prior to construction of Unit 1, with a total surface area of 28.6 ac. (Figure 4.2-1). Five ponds with a combined total surface area of approximately 1.7 ac. were removed during Unit 1 construction. An additional pond with a surface area of 0.5 ac. would be removed during Unit 3 construction. Following Unit 3 construction, 18 small farm ponds would exist in the local watershed area, with a total surface area of 26.4 ac. Subsection 4.3.1 discusses the impacts to the ecology of the RBS site from removal of the farm pond during Unit 3 construction.

Local Streams

Plant area runoff flows to West Creek, which drains about 1.0 sq. mi. before joining the main stem of Grants Bayou. During Unit 1 construction, a 110-ft. wide (50-ft. base width) Fabriform ditch was constructed in the plant area to contain West Creek flow and to minimize the potential for plant flooding during extreme rainfall events. The Fabriform-lined portion of the ditch is approximately 2800 ft. in length. Prior to Unit 3 construction, the Fabriform-lined portion of the ditch would be shifted to a location just west of its current alignment. The ditch would be shifted to provide room for the construction of the new facilities. The new ditch alignment is shown in Figure 2.3-16. The ditch bed gradient for West Creek is shown in Figure 2.3-17.

Although increased intensity of stormwater discharges may occur during construction because of increased impervious surface areas or decreased vegetative cover, standard engineering stormwater management practices pursuant to the site's LPDES stormwater management program would adequately mitigate any potential adverse impact. Therefore, the anticipated impact of hydrologic alterations due to the construction of facilities on-site is SMALL and does not warrant further mitigation measures.

4.2.1.2 Transmission Facilities

Entergy has determined that a new transmission line should connect the Fancy Point 500 kV Substation (located near the proposed Unit 3) to its existing Hartburg-Mount Olive 500 kV transmission line that extends from southeast Texas to north-central Louisiana. This connection would require a new 500 kV transmission line to interconnect with the Entergy grid. A route selection study identified the potential routes for the new transmission line, which ranged in length from approximately 140 to 170 mi.

The new line would likely be built on self-supporting lattice steel structures in accordance with Entergy standards. It is expected that these structures would be supported on drilled pier foundations or be placed on pilings, depending on the soil conditions. The structure base would measure approximately 45 ft. by 45 ft. The typical span length is anticipated to be 1000 ft., resulting in an average of approximately five structures per mile. In addition to the transmission line, a new switching station, approximately 1000 ft. by 1000 ft., would be required at the tap point with the existing Hartburg-Mount Olive 500 kV transmission line.

Clearing of forested and other areas would be required along the 148-mi. transmission line route involving approximately 3334 ac., which includes the corridor only. Laydown and other areas outside the corridor would not be defined until the route is finalized. Additional construction impacts would result from erecting the structures and providing access to the structure locations. Clearing, earthwork, and crushed rock surfacing would be provided at the new switching station. Construction activities along the transmission line route and at the new switching station would result in increased stormwater runoff, erosion, and siltation of streams.

A construction stormwater permit would be required for construction along the ROW for the new off-site transmission lines. Construction would be managed in accordance with the stormwater management program and engineering BMPs established for that portion of the project. A Clean Water Act Section 404 permit would be required from the USACE, supported by a LDEQ Section 401 Water Quality Certification, prior to construction within any jurisdictional floodplain and wetland areas, and would regulate and specify avoidance, minimization, and mitigation of the impacts of any construction activities along the route of the transmission line ROW.

Policy procedures manage acquisition, ROW and facility siting, vegetative management practices, and land disturbance. These procedures include requirements for written planning documents and work permits whenever earthwork or land disturbance is anticipated, spanning of "navigable" waters of the United States is required, or when any work that is within the 100-year floodplain or near wetlands is planned. Established environmental protection engineering and environmental protection practices would be used to mitigate any potential adverse impacts due to transmission line construction. Therefore, the off-site hydrological alteration impacts due to the construction of new off-site transmission and distribution facilities would be SMALL.

4.2.1.3 Off-Site Construction

Improvements were made to local roads and bridges leading to the RBS site during construction of the existing plant, and road and bridge construction resulted in some alterations to surface water. 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. An increase in normal maintenance activities may be required due to increased traffic during the construction phase. Construction of new or modification of existing docking facilities is not planned for RBS Unit 3 construction. Therefore, no off-site hydrologic alterations are anticipated, and any impacts due to off-site construction would be SMALL.

4.2.2 WATER USE IMPACTS

The discussion of construction phase water use impacts is divided into surface water and groundwater environments. The RBS area is an area of abundant water supplies, and the temporary needs for construction would not impact the availability of water for other water users, as discussed in the following subsections.

Plans to control the construction activities, materials of construction, and construction site would minimize any impacts of construction-related runoff/effluent to surface water and groundwater quality and the usability of the water by others. Baseline water use information is provided in Subsection 2.3.2, and background water quality information is presented in Subsection 2.3.3. A summary of expected water usage during the construction phase for RBS Unit 3 is provided in Table 4.2-1.

4.2.2.1 Construction-Related Impact

The primary effluent from construction would be stormwater runoff and construction excavation dewatering flow from wells. These flows are discussed further in this subsection. Any incidental water released to construction surfaces and the ground that does not evaporate on-site, such as dust control water, concrete mix water, or surface cleaning water, would be managed with construction stormwater. Materials, supplies, chemicals, and fuels to be used during construction would be managed and used in a way to minimize potential losses to stormwater runoff. Herbicides and pesticides are not planned to be used.

Dewatering effluent from dewatering wells at the perimeter of the construction area would be discharged to the stormwater drainage system at an average rate of 10,000 gpm during the construction excavation phase of approximately 9-months' duration. The Applicant plans to discharge the dewatering effluent under Louisiana's General Permit Number LAR10000-AI 83363 for Stormwater from Construction Activities. This permit includes authorization of discharge of "uncontaminated excavation dewatering." The Applicant plans to apply for coverage under this permit prior to the beginning of construction at the site. Data in Table 2.3-20 provide background information on groundwater quality. The impact of the potential increased flow in stormwater discharges of this uncontaminated excavation water is discussed in Subsection 4.3.2.2.

Dewatering during the period of RBS Unit 3 construction is estimated to cause potential drawdown in surficial aquifer wells within a 4-mi. radius of the RBS during the construction dewatering period. Since the drawdown is from a surficial aquifer that yields water of varying quality and quantity, the impact to other potential users in the 4-mi. radius would be SMALL. The deeper aquifers that yield water of reliable drinking quality and quantity would not be affected by the surficial dewatering.

The Applicant will construct a new wastewater treatment plant before construction of RBS Unit 3 begins, consisting of two trains, each capable of treating up to 40,000 gpd. This treatment plant is separate from the existing wastewater treatment plant for Unit 1. Any additional effluent not permitted for treatment or discharge under facility discharge permits or construction stormwater permits will be transported batch-wise to an off-site state-approved treatment facility. This could include spilled materials, testing materials, or any other effluent not specifically permitted for discharge. The existing RBS wastewater discharge limits, outfalls, and receiving water bodies are summarized in Subsection 5.2.2 and Table 5.2-1. Water bodies are discussed in Subsections 2.3.1, 2.3.2, and 2.3.3.

Because of the abundance of surface and groundwater supplies in the RBS area, the availability of West Feliciana Water District public water, the predominant use of deeper aquifers as the preferred potable water source in the area, and the Applicant's commitment to assist any surficial aquifer water user with legitimate needs associated with the drawdown, the impact of dewatering to local water users is determined to be SMALL.

The RBS area is an area of abundant water supplies, and the temporary needs for construction would not impact the availability of water for other water users, as discussed in the following subsections. In addition, plans to control the construction activities, materials of construction, and construction site would minimize any impacts to surface water and groundwater quality and the usability of the water by others.

4.2.2.2 Surface Water

Surface Water Quantity Impacts

With abundant water available from the Mississippi River, river water used for cooling at RBS Unit 1 can be usable as a backup source for construction purposes for applications where river water quality is adequate. As noted in Subsection 2.3.2, Mississippi River water is primarily used for industrial and power generation purposes in West Feliciana Parish. Figure 2.3-26 shows that RBS Unit 1 withdraws up to 15,403 gpm (or about 22.2 million gallons per day [Mgd]) of river water, and Subsection 5.2.2 describes the planned withdrawal of about 25,524 gpm of Mississippi River water for a new RBS Unit 3.

Subsection 2.3.2 (for current operation of RBS Unit 1) and Subsection 5.2.2 (for planned operation of RBS Units 1 and 3) note the lack of impact to other water users or water supply needs associated with the operation of RBS Units 1 and 3.

Subsection 4.2.1 discusses the limited hydrologic alterations of the RBS site associated with construction.

Surface Water Quality Impacts

Two primary accountabilities would limit the impacts of construction activities to surface water quality:

1. The existing LPDES permit for RBS Unit 1 includes limitations for stormwater runoff discharge from the RBS with associated monitoring and reporting requirements (Reference 4.2-5). These requirements for RBS Unit 1 will continue during the construction phase for RBS Unit 3.

2. A construction stormwater permit will be obtained from the LDEQ. Construction impacts for RBS Unit 3 would be reduced and effectively managed by complying with a construction stormwater permit and developing/implementing a site-specific construction SWPPP. The SWPPP will establish the plan to minimize erosion, control sediment, manage construction materials/activities, and reduce the impact of any surface runoff from the construction site to the waterways in the site vicinity.

Both of these primary accountabilities demonstrate the goals and required limits for minimizing impacts to water quality during the construction period. Both accountabilities are further described below and in Subsections 4.2.1 and 5.2.2. Subsection 2.3.3 presents baseline water quality data.

Existing Stormwater Protection. Stormwater runoff from RBS Unit 1 is managed under the LPDES permit (Reference 4.2-5), with the limits shown in Table 5.2-1, and under a permit-required SWPPP that defines the best management procedures used to minimize any contamination of runoff from the site. Runoff contamination from Unit 1 during the regular operations period is minimal due to limited exposure or handling of materials outdoors at the site, use of the procedures outlined in the SWPPP to minimize any contamination of runoff from precipitation, and feedback from the monitoring and inspections of the facility (i.e., if concerns are identified, corrective actions are taken).

Key aspects of the SWPPP include the following:

- Site Evaluation, Assessment, and Planning - This part of the plan identifies the potential sources of stormwater runoff contamination and reviews prevention methodology.
- Best Management Practices - The SWPPP identifies the best methods to manage operations and materials on-site to minimize contact of contaminants with stormwater runoff and to minimize erosion.
- Good Housekeeping Plans - Materials, supplies, chemicals, and fuels are managed and used in a way to minimize any potential losses to stormwater runoff. Techniques are specified in the SWPPP for these materials.
- Inspections and Maintenance - A key element of the SWPPP is an active inspection program to ensure proper use of the methods defined in the plan and to provide feedback for changes and improvements that are suggested based on observations. The SWPPP is a living document with active feedback from the inspection process. Responsible parties are assigned in the SWPPP for conducting inspections, taking timely corrective action as necessary, confirming adequate maintenance of controls, and modifying the SWPPP to deal effectively with changes and observations.
- Training and Recordkeeping - Effective use of the SWPPP requires initial training and refresher training for key operating staff. The SWPPP specifies training needs and the means for effective communication of identified issues and revised procedures. Records are maintained of inspections, training, and activity logs that are available for government inspectors.

Continued compliance with the existing LDEQ water discharge permit for RBS Unit 1 would provide protection to the waterways first receiving the runoff (presented in Table 5.2-1 for permit conditions and in Figure 5.2-1) and ultimately for the Mississippi River, which receives all site discharges directly or indirectly. This compliance for RBS Unit 1 applies continuously, including the construction period for a new RBS Unit 3.

Additional Construction Stormwater Protection. A construction stormwater discharge permit will be obtained from LDEQ prior to the beginning of Unit 3 construction. The permit will require the development and use of a site- and project-specific construction SWPPP that will establish the plan to minimize erosion, control sediment, and reduce the impact of any surface runoff from the construction site to the waterways in the site vicinity. Key aspects of the construction SWPPP include the following:

- Site Evaluation, Assessment, and Planning - This part of the plan identifies the responsible parties for proper management of the site and identifies the nature and sequence of the construction activity. Basic needs, such as identification of adequate construction water supplies and any site dewatering needs, will be reviewed. Site evaluation includes planning of any hydrological alterations, water drainage patterns during the construction phase, and accountability of quantities of stormwater to be managed. Receiving waters are verified, potential sources of pollution are identified, and detailed maps are prepared in this phase. Such tools as phased grading, control of stockpiled soil, design of appropriate haul roads, and paving schedules are part of the planning process.

- Erosion and Sediment Control Best Management Plans - The construction SWPPP will include the site-specific plan to minimize erosion and sediment loss during the construction period, with appropriate use of run-on flow diversion, stormwater collection ponds, silt fences, seeding/revegetation plans, and the use of other surface stabilization techniques. Protection of existing runoff drains from sediment loss is part of the planning.

- Good Housekeeping Plans - Minimization of vehicle trackout will be planned with the design of appropriate exits from the construction site. Needs for water application for dust control will be evaluated along with the need to maintain all controls. Materials, supplies, chemicals, and fuels to be used during construction will be managed and used in a way to minimize any potential losses to stormwater runoff. Such tools as covered storage, secondary containment, and unloading procedures will be specified in the plan for these materials. A fueling plan will be included for any planned on-site fueling of construction equipment. Waste management will be included in the SWPPP.

- Post-Construction Best Management Plans - The SWPPP will also include interim plans for the period after construction and prior to unit startup (when an updated operating facility SWPPP will be implemented in accordance with a combined RBS Unit 1 and Unit 3 LPDES permit, as issued by the LDEQ, to be effective by the startup date of Unit 3). This plan will include any transition from construction controls to operational controls, including any transition of discharge points and related controls.

- Inspections and Maintenance - A key element of the construction SWPPP would be an active inspection program to ensure proper use of the methods defined in the plan and to provide feedback for changes and improvements that are suggested based on observations. The construction SWPPP is a living document with active feedback from the inspection process. Responsible parties will be assigned in the SWPPP for conducting inspections, taking timely corrective action as necessary, confirming adequate maintenance of controls, and modifying the SWPPP to deal effectively with changes and observations.

- Training and Recordkeeping - Effective use of the SWPPP will require initial training and refresher training for construction staff and participants, including subcontractors. The SWPPP will specify training needs and the means for effective communication of identified issues and revised procedures. Records will be maintained of inspections, training, and activity logs to be available for government inspectors.

A primary concern with runoff from a construction site is the loss of soil and the impact of soil on water quality. The construction SWPPP will address minimization of soil loss. Past studies at the site (including the groundwater survey summarized in Table 2.3-20) have not indicated signs of soil contamination or any reason to believe that construction activities would release contaminants to the Mississippi River.

An additional construction activity with potential impacts to surface water quality is the construction associated with modifications to river water intakes and any river dredging associated with construction. Details about these issues are presented in Subsection 4.2.1. Ongoing maintenance of the RBS embayment in the Mississippi River is discussed in Subsection 5.2.2.2.2.

In summary, construction plans and permit limitations would minimize any temporary impacts to surface water quality from construction of RBS Unit 3 and the impacts are expected to be SMALL.

4.2.2.3 Groundwater

Groundwater Quantity Impacts

As noted in Subsection 2.3.2.2.2, plant domestic use water for the existing RBS Unit 1 has been supplied from two on-site wells located in the Pascagoula Formation Zone 3 Aquifer.

The Applicant obtains drinking water from the West Feliciana Water District, which has an adequate supply for future additional needs.

The total use rate of the on-site well water and public water for the existing RBS Unit 1 and a new RBS Unit 3 is planned at a maximum of 315 gpm. This total amount can be provided by the West Feliciana Water District, if necessary. Groundwater/public water usage at the RBS is low compared to the usage of surface water (RBS Unit 1 withdraws up to 15,403 gpm of river water).

Construction activities are estimated to require about 165,000 gpd, or 114 gpm of water, for concrete batch plant operation, dust suppression, and sanitary needs. Lower quality surficial aquifer water may be used for applications with less critical water quality needs. The 114 gpm of water for construction is less than the 200 gpm to be used by RBS Unit 3 during future operations, as shown in Figure 3.3-1.

A recommended planning number for drinking water consumption for workers in hot climates is 3 gpd for each worker (Reference 4.2-6). Based on the maximum estimated construction worker population of 3150 workers, about 9450 gpd (approximately 6.5 gpm) of drinking water would be used.

Dewatering activities will occur during the construction excavation phase of approximately 9-months' duration. The construction dewatering would cause drawdown over an approximate 4-mi. radius area in the surficial aquifer. Since the drawdown is from a surficial aquifer that yields water of varying quality and quantity, the impact to other potential water users in the 4-mi. radius would be limited. The deeper aquifers that yield water of reliable drinking quality and quantity would not be affected by the surficial dewatering. Therefore, impacts are expected to be SMALL.

Groundwater Quality Impacts

Subsection 2.3.3 presents baseline water quality data. As a result of changes in seepage patterns due to the temporary redirection of surface flows for construction and stormwater runoff control, recharge of groundwater will be modified during the construction phase. As building construction and paving progresses, the surface area allowing seepage of precipitation into the groundwater would be effectively reduced, with slightly increased runoff and slightly decreased seepage for an approximately 43-ac. impervious developed site.

The impact of this reduction in seepage rate is expected to be minimal (SMALL) to groundwater quality and groundwater quantity. Use of the construction SWPPP and the materials housekeeping elements of the SWPPP would limit any loss or potential seepage of construction materials/supplies into the groundwater.

In correspondence dated February 2008, the Applicant notified the EPA and LDEQ of potential plans to utilize Pascagoula Formation water for RBS Units 1 and 3; however, as of 2008, the Applicant replaced its use of this water based on arrangements with the West Feliciana Water District. The EPA sole source aquifers in the area include the Southern Hills Regional Aquifer, which includes the Pascagoula Formation.

Construction activities would not require additional use of Pascagoula Formation groundwater from the on-site RBS wells. No additional impacts to this formation are anticipated as a result of RBS Unit 3 construction.

4.2.2.4 Aquatic Biota

Modification of the intake structure (as discussed in Subsection 4.2.1) on the east shore of the river would entail temporary loss of the edge habitat of the Mississippi River in the affected areas. Construction activities directly affecting the river would center on accessing the intake during construction. These activities would be expected to take place during low river levels, so river biota would be exposed to SMALL direct impacts.

Construction of the trenches for modifications to the intake and discharge pipelines (as discussed in Subsection 4.2.1) would directly affect surface water drainage and seepage. However, the construction would be primarily along the existing heavy haul road for RBS Unit 1 and, with controls used as specified in the construction SWPPP, incremental impacts to surface and groundwater are expected to be minimal. The pipes would be buried, so there would be no permanent alteration of surface water flow patterns.

Subsection 4.3.2.2 provides additional detail on the ecological impacts of facility construction.

4.2.2.5 Water Use/Water Quality Regulations

Appropriate USACE and LDEQ permits would be obtained for construction in any floodplain or wetland areas. The USACE regulatory authority is based on Section 10 of the Rivers and Harbors Act of 1899, which prohibits the obstruction or alteration of navigable waters of the United States without a permit, and Section 404 of the FWPCA, which prohibits the discharge of dredged or fill material into waters of the United States without a permit. Other laws that may affect the processing of applications for USACE permits include the NEPA, the Fish and Wildlife Coordination Act, the Endangered Species Act, the Coastal Zone Management Act, the NHPA, the Deepwater Port Act, the Federal Power Act, the Marine Mammal Protection Act, the Wild and Scenic Rivers Act, the National Fishing Enhancement Act (Reference 4.2-6), and Section 401 of the FWPCA.

Water discharges would be monitored in accordance with applicable LPDES permit requirements and state water quality standards at the time of construction. Construction stormwater permit requirements, including compliance with the SWPPP, are discussed above.

Construction standards for any additional water supply wells, if needed, would be in accordance with applicable standards published in the LDEQ groundwater use and protection regulations, and necessary permits would be obtained from the LDEQ.

4.2.2.6 Water Use Impact Conclusions

Adequate water is available for RBS Unit 3 construction. Total water needs would be lower during construction than during future operation. Despite the use of an SWPPP and the safeguards discussed above, brief increases in surface water turbidity are expected as a result of runoff from construction zones. Impacts to aquatic ecology and any downstream water uses are estimated to be minimal for short and sporadic periods, as discussed in Subsection 4.3.2.2.

The assimilation capabilities of the Mississippi River, as discussed in Subsection 2.3.3, would tend to minimize the impact of any short-term runoff from the construction site. Compliance with the terms of the operating and construction stormwater permits and the use of controls in the operating and construction SWPPPs are expected to minimize any impacts to water users and the environment.

As noted above in the discussion on groundwater, the impact of changes in water seepage patterns from expanded impervious areas as a result of construction is expected to be minimal (SMALL) to groundwater quality and groundwater quantity, and additional mitigation measures are not warranted. Use of the construction SWPPP and the materials housekeeping elements of the SWPPP would limit any loss or potential seepage of construction materials/supplies into the groundwater.

Water use for the construction of RBS Unit 3 would not limit water supplies from the Mississippi River or Pascagoula groundwater formations for any private or federal user of the water sources.

4.2.3 REFERENCES

4.2-1 Gulf States Utilities Company, "River Bend Station Environmental Report, Operating License Stage," Volumes 1-4, Supplements 1-9, November 1984.

4.2-2 U.S. Army Corps of Engineers, "General Permit for Silt Removal in the Mississippi River - EM-19-980-2201, SE NOD-23," August 19,1998.

4.2-3 U.S. Army Corps of Engineers, "General Permit for Silt Removal in the Mississippi River, Permit Time Extension, EM-20-020-2486, SE NOD-23," June 3, 2002.

4.2-4 Entergy Operations, Inc., "River Bend Station Updated Safety Analysis Report" through Revision 19, July 2006.

4.2-5 Louisiana Department of Environmental Quality, "Louisiana Water Discharge Permit - River Bend Station - Permit Number LA0042731," June 2006.

4.2-6 Gulf States Utilities Company, "Grand Gulf Nuclear Station Units 1 and 2 Final Environmental Report (FER)," as amended.

Table 4.2-1
Estimated Water Usage and Source During Construction of RBS Unit 3

Water Usage	Source of Water	Maximum Volume per Day
Current Unit 1 Water Sources		
River Intake Water for Unit 1 (based on Figure 2.3-26)	Mississippi River	22.2 Mgd
Public Water Provided by West Feliciana for Unit 1	West Feliciana Water District (public source)	0.166 Mgd
Available Unit 3 Water Sources		
Public Water Provided by West Feliciana for Unit 3 (Operation or Construction)	West Feliciana Water District (public source)	0.288 Mgd[(a)]
Dewatering Water Used for Construction Activities	Dewatering Wells	14.4 Mgd[(a)]
Water from Other Sources for Construction	Water Trucks from Off-Site	Variable, if needed

a) Available; however, maximum planned total need for construction from all sources is estimated at 0.165 Mgd.

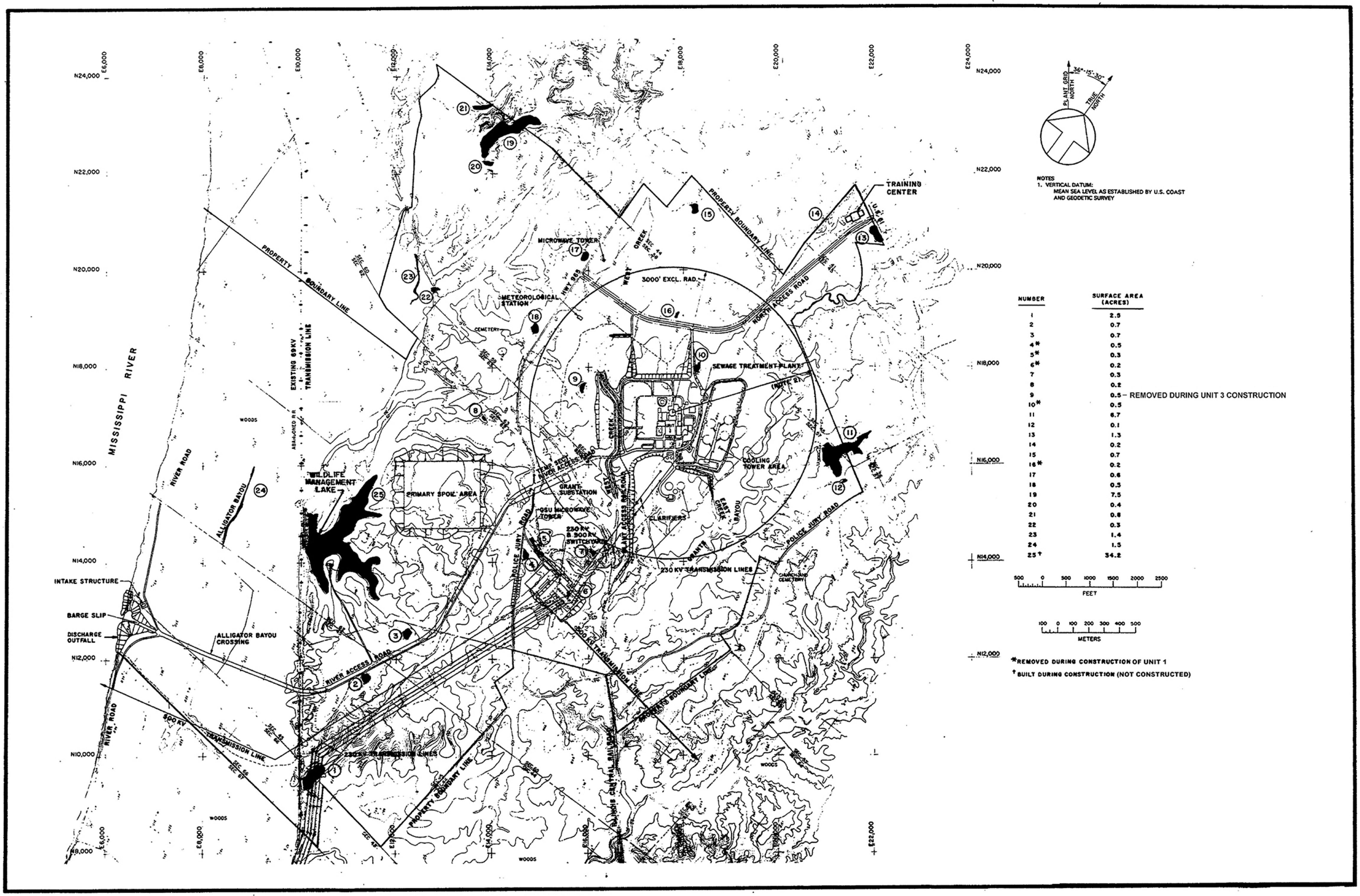

Figure 4.2-1. Site Area Ponds

4.3 ECOLOGICAL IMPACTS

This section describes the potential impacts of construction on the ecological resources at the RBS site and along the off-site transmission ROW. The section is divided into two subsections: Terrestrial Ecosystems and Aquatic Ecosystems. Important schedule dates for activities associated with the project, including construction start and completion, are included in Subsection 1.1.8.

4.3.1 TERRESTRIAL ECOSYSTEMS

This subsection describes the impacts of construction on the terrestrial ecosystems. It addresses only those issues where there appears to be the potential for impacts to resources, as specified in NUREG-1555, Section 4.3.1. A comprehensive description of the terrestrial ecosystems can be found in Subsection 2.4.1.

4.3.1.1 Site and Vicinity

Construction would require the disturbance of approximately 364 ac. of terrestrial area on the RBS site within the impact area shown in Figures 4.3-1 and 4.3-2. The impacts to vegetation (plant communities) are summarized in Table 4.3-1. This is assumed to be the maximum area of impact at any time. Of the 364 ac., 117 ac. are already occupied by structures, pavement, or are otherwise maintained areas (developed areas U1 and B1), resulting in impacts to approximately 247 ac. of the undeveloped terrestrial areas. Permanent impacts would occur to approximately 43 ac. and temporary impacts to about 204 ac. Temporarily disturbed sites would be replanted with natural vegetation following completion of the project.

The site layout has been designed to minimize impacts to the terrestrial ecosystems to the greatest extent possible. Currently developed and previously disturbed grounds would be used to the maximum extent possible. Minimal wetlands (0.2 ac.) would be permanently affected by the project. No threatened, endangered, or otherwise protected species would be affected. Clearing of forested areas has been planned so that wildlife corridors would be avoided, and most of the clearing would be limited to areas adjacent to existing cleared areas. Construction impacts to terrestrial ecosystems are expected to be SMALL.

4.3.1.1.1 Vegetation

Plant Communities

Construction activities would result in the permanent clearing and grubbing of portions of the impact area shown in Figure 4.3-1. Permanent and temporary impacts to plant communities are summarized in Table 4.3-1. New development would affect 247 ac. of undeveloped land; 43 ac. would be permanently affected, and 204 ac. temporarily affected. All of the areas that would be temporarily affected have been previously disturbed by RBS Unit 1 construction (e.g., clearing, grubbing, and deposition of fill material), logging, or prior occupation (e.g., the Magnolia Plantation sugar mill described in Subsection 2.5.3). Forested areas included in Figure 4.3-1 have a canopy with species composition similar to high quality forests in the region; the shrub layer lacks expected species diversity and contains mostly non-native or otherwise invasive species, such as barberry (*Berberis* sp.) and privet (*Ligustrum* sp.). In addition, the ground cover in these areas is mostly absent or dominated by herbaceous species that are non-native or otherwise invasive, such as creeping periwinkle (*Vinca major*) and Japanese honeysuckle (*Lonicera japonica*). The open areas are completely dominated by planted grasses and support an abundance of introduced herbaceous species, as well as invasive shrubs, such as McCartney rose (*Rosa bracteata*) and eastern saltbush (*Baccharis halimifolia*).

The only high quality plant communities (i.e., communities composed of predominantly native species) affected by the project are 12 ac. of upland forest (U2) out of 1893.7 ac. (0.63 percent of the U2 area) located in the area where the cooling towers would be constructed and 0.2 ac. of bottomland forest (B2) out of 304.2 ac. (less than 0.001 percent of the B2 area) where two transmission towers would be placed in the on-site portion of the transmission corridor. Impacts to these plant communities due to project activities are considered SMALL. Mitigation of both permanent and temporary impacts would be in the form of reforestation of cleared areas wherever possible (e.g., construction laydown area, temporary office areas, and temporary parking areas). The RBS property also offers excellent opportunities for enhancing degraded forest and nonforested areas, which will be explored as project development progresses in consultation with interested local agencies.

Important Habitats

The construction layout was designed to minimize encroachment into high quality habitats. Developed and previously disturbed areas have been utilized to the maximum extent possible. Construction activities are expected to result in the clearing of 11.7 ac. in the 550-ac. River Bend Natural Area. The clearing includes 8.1 ac. of bottomland forest ([B2] non-wetland) associated with the barge landing area; however, this area has been disturbed in the past, as evidenced by the presence of scattered, relatively small trees (less than 12-in. in diameter at breast height) and non-native herbaceous species. This area will be reforested following construction. The remaining 3.6-ac. area is bottomland forest ([B2] wetland) and is located along the north side of the on-site portion of the new transmission line. This forested area will be cleared of trees. The placement of two transmission towers is expected to permanently affect 0.2 ac. of this area for the structure footprint, while the remaining 3.4 ac. would be allowed to recover and function as an emergent wetland. Trees cannot be replanted because of safety issues associated with line clearance. The overall impact to the natural area is considered minimal, because all but 0.2 ac. would be replanted or otherwise recovered following construction activities.

Important Plant Species

No state or federally listed plant species have been found or reported on the RBS property, and none are expected to occur within the impact area because of the mostly degraded condition of the affected areas.

4.3.1.1.2 Wildlife

The footprint for RBS Unit 3 is designed to utilize developed and previously disturbed areas to minimize the impact of the project to wildlife. Potential impacts to wildlife from construction activities could include the following:

- Takes or displacement due to equipment movement, clearing, and excavation.

- Hazardous material releases.
- Fugitive dust.
- Noise.

Takes or Displacement of Wildlife. The normal movements of equipment, clearing, and excavation are expected to result in some takes of small wildlife but primarily the displacement of certain wildlife. Mortality is expected to be limited to the least mobile wildlife, such as small mammals and reptiles. Larger mammals and birds leave the area when there is disturbance. Because the affected habitats are, for the most part, previously disturbed areas and of low quality, the disturbed wildlife are expected to be common species that readily adapt to changing environments, such as raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), and striped skunk (*Mephitis mephitis*). Since the project is centralized around the existing facility, wildlife are expected to move outward from the impact area where there is ample habitat to absorb the wildlife that may actually be residing within the impact area. To benefit wildlife, the Applicant will adhere to any permit conditions that may restrict the timing of certain construction activities, such as avoiding primary nesting periods for migratory birds. The potential impact of construction on bird collisions associated with the cooling tower was reviewed by the NRC under NUREG-1437, and it was determined that overall avian mortality was SMALL.

Hazardous Material Releases. The release of hazardous materials due to spills associated with construction activities could affect terrestrial wildlife but is of greater concern to aquatic organisms, as discussed in Subsection 4.3.2. The SWPPP and SPCC Plan required for the project address the actions to be taken if such a spill occurs.

Fugitive Dust. The impact of fugitive dust is expected to be negligible, because access roads and construction sites would be watered as necessary. Emissions from heavy equipment are expected to be minimal (SMALL) because of regularly scheduled maintenance procedures.

Noise. Noise generated by construction activities, including workers and equipment, can affect wildlife. Effects may include physiological changes, abandonment of nests or dens, curtailed use of foraging areas, and other behavioral modifications. Since most of the noise associated with construction would be in close proximity to the existing RBS structures, most of the wildlife in the area have presumably adapted to facility noise levels. This is expected to make the overall impact of construction noise on wildlife SMALL.

Important Habitats

No critical habitat for state or federally protected species is present on the RBS property or in the vicinity. The River Bend Natural Area occupies 550 ac. of the RBS property adjacent to the Mississippi River, and 8.1 ac. of this area would be affected by the project. The impact to wildlife and habitat is considered SMALL. Refer to Subsection 4.3.1.1.

Important Wildlife Species

Section 2.4 includes a discussion of the wildlife species that may occur in the vicinity. No wildlife species listed by the U.S. Fish & Wildlife Service (USFWS) would be affected by the project. The

Louisiana Department of Wildlife & Fisheries (LDWF) noted that, while there are no occurrence records for the long-tailed weasel in the project vicinity, the species, which is rare to imperiled in Louisiana, may occur in the vicinity. No indication of the species being present has been found. Therefore, the on-site project activities are expected to have no effect on the continued existence of the long-tailed weasel in the project vicinity.

4.3.1.1.3 Wetlands

Wetlands in Louisiana are regulated by the USACE under Section 404 of the FWPCA (wetlands and waters). Federally regulated wetlands affected on the project site include approximately 3.4 ac. of bottomland forest (B2) associated with the on-site portion of the new transmission line corridor. The entire area will be cleared of trees for line clearance. Assuming 800- to 1000-ft. spans between towers, two towers would be placed in the wetlands, resulting in a permanent loss of 0.2 ac., assuming a 50 by 50 ft. footprint per tower. This is considered a minimal (SMALL) impact to wetlands.

To date, a wetland delineation of the impact area has not been conducted. However, a wetland delineation will be submitted to the USACE prior to construction activities, requesting that a Jurisdictional Determination (JD) be made for the areas delineated. The results of the delineation will be used to evaluate the level of impacts to wetlands and to adjust the site layout to minimize these impacts to the greatest extent possible. Based on the outcome of the delineation and consultation with the USACE, a mitigation plan will be prepared to address unavoidable impacts. Mitigation is expected to be minimal (SMALL), and permanent losses would be in the form of wetlands enhancement to on-site areas.

4.3.1.1.4 Other Projects within the Area with Potential Impacts

The Audubon Bridge is currently under construction approximately 1/2 mi. south of the RBS property. This project includes the construction of a new road corridor from the river eastward to U.S. Highway 61. The environmental assessment for the project considered threatened and endangered species, overall habitat, and wetlands. Impacts to habitat (forested upland and bottomlands, cropland, and marshlands) and wetlands (approximately 20 ac.) were modest along the 7 mi. by 250 ft. corridor and were significantly greater than those anticipated at the RBS (Reference 4.3-1).

4.3.1.1.5 Consultation

Affected federal, state, and regional agencies will be contacted regarding potential impacts to the terrestrial ecosystem resulting from plant construction. In 2007, the USFWS and the LDWF were consulted regarding state and federally protected species and sensitive habitats, and there appear to be no issues with regard to these topics. The USACE will be consulted following completion of a wetlands delineation of the impact area to request a Jurisdictional Determination of the wetlands identified. If necessary, a permit application will be submitted to the USACE for activities potentially affecting wetlands.

4.3.1.1.6 Mitigation

Opportunities for mitigating unavoidable temporary and permanent impacts to the terrestrial ecosystems would involve the restoration of all habitats disturbed by construction activities. Restoration activities will be implemented through consultation with interested federal, state, and local agencies. In most cases, restoration will be in the form of reforestation, with the exception of areas located beneath the new on-site transmission lines. The new transmission corridor must remain clear of trees to allow line clearance.

Impact to wetlands as part of project development is a matter that must be carefully considered because of the importance of these habitats. Measures must be taken to first avoid impacts and, when that is not possible, to minimize impacts. Work in areas adjacent to wetlands, such as the water pipeline along the bottomland forest areas of River Access Road, will utilize silt fencing to protect the wetland from siltation and entry by construction equipment. Disturbed areas will be revegetated as soon as possible following disturbance in order to avoid impacts from stormwater runoff. Permanent impacts will be mitigated by on-site wetlands enhancement efforts performed in consultation with the USACE.

Other mitigation efforts associated with the project include the following:

- Adherence to permit conditions that may restrict the timing of construction activities based on important biological periods, such as nesting of migratory birds.
- Use of silt fences and temporary or permanent vegetation stabilization to reduce the risk of stormwater runoff and erosion.
- Use of a potential field survey to investigate the potential presence of nesting birds or other small wildlife prior to initiating construction activities.
- Reforestation or replanting upland areas affected by the project with native, mixed deciduous forest vegetation.
- Enhancement (i.e., improvement) of degraded forest areas with the removal of undesirable species and planting of desirable canopy, shrub, and ground cover species.
- Enhancement of degraded open, herbaceous communities through the removal of undesirable species.

4.3.1.2 Transmission Corridors and Off-Site Areas

The Applicant is proposing a new 148-mi. long, 200-ft. wide 500 kV transmission line corridor between the RBS and Natchitoches, Louisiana, where a new switchyard (1000 by 1000 ft.) would intersect an existing 500 kV line between Hartburg, Texas and Mount Olive, Louisiana. The overall impacts resulting from construction are considered SMALL, because route selection has utilized developed or otherwise open lands to the maximum extent possible to avoid impacts to terrestrial resources.

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4.3.1.2.1 Vegetation

Vegetation types found along the Natchitoches route are listed in Table 2.4-5. Route selection attempted to use barren, cultivated, developed, or otherwise degraded or unnatural land, including pine plantations, to the fullest extent to minimize impacts to natural vegetation. In addition, natural forested areas were avoided wherever possible by avoiding national forests, state parks, and other preservation areas that might contain tracts of high quality vegetation. Based on the acres of vegetation types presented in Table 2.4-5, approximately 66 percent of the route is located on degraded or unnatural land; 14 percent crosses nonforested natural areas; and 20 percent traverses natural forest. Impacts to nonforested areas would be SMALL, because the tower bases would affect an area of approximately 50 by 50 ft., or less than 0.01 ac. each. The remainder of those corridor sections would not be affected. Forested areas would require clearing and long-term maintenance to keep tree growth from regenerating.

4.3.1.2.2 Wildlife

The transmission line routing study considered state and federally threatened and endangered species and important habitats, including national forests, state parks, wildlife refuges, and wildlife management areas. It appears that the Natchitoches route avoids these important areas. Final route planning will continue to address wildlife-related issues and will consider any suggestions or requests that may arise through agency consultations (refer to Subsection 4.3.1.1.5) and make appropriate alterations to the route. Potential areas of concern include segmentation of habitat in forested areas and the potential for bird line collisions in areas used heavily by birds. These issues would be addressed and managed through agency consultation.

4.3.1.2.3 Wetlands

The Natchitoches route crosses approximately 684 ac. of wetlands and waters that are potentially regulated by the USACE (refer to Table 2.4-5). According to the routing study, tower spans can be as much as 1000 ft. in length. This allows most of the regulated areas to be spanned without affecting the resource. For crossings greater than 1000 ft., the routing study tabulated wetland crossings on the basis of vegetation type and length of crossing (refer to Table 4.3-2). The Natchitoches route has the fewest long crossings (29 total). Of the 29, only two are wooded. The wooded portion is approximately 3277 ft. in length and would require the placement of an estimated one tower in each wetland. The tower base results in the permanent loss of a 50 by 50 ft. wetland area, or less than 0.1 ac. per tower. Seven emergent herbaceous wetlands greater than 1000 ft. in length are crossed, which would result in an estimated eight towers being placed in wetlands, for a total of 10 towers placed in wetlands. This would result in a total of 1 ac. of permanent wetlands impact as a result of tower construction. The impact of towers placed in open water areas is discussed in Subsection 4.3.2.

4.3.1.3 Terrestrial Ecosystems Impact Summary

The construction impact to plant communities of the RBS site and the off-site transmission corridor, including important habitats and wetlands, would be SMALL. Most impacts to wildlife, including takes and displacement of wildlife, fugitive dust, and noise would be considered SMALL. The project is expected to have a SMALL impact on important species on-site, and agency consultation during the final stages of transmission route development would allow measures to be taken to avoid impacts or minimize impacts. Therefore, it is expected that RBS Unit 3 cooling tower construction would have little effect on regional bird populations.

4.3.2 AQUATIC ECOSYSTEMS

This subsection provides an overview of the construction impacts associated with aquatic ecosystems within the RBS site. Construction activities for Unit 3 would be carried out within the existing 3330-ac. RBS Unit 1 site. Figures 2.4-3 and 2.4-4 contain detailed illustrations as to the location of construction activities. Figure 2.4-7 provides an overview of the aquatic resources in the vicinity of the RBS site. Impacts to aquatic resources during Unit 3 construction are expected to be similar to those documented during the construction of RBS Unit 1 (Reference 4.3-3) because of the location of the construction site within the boundaries of the historic construction footprint. Historically, the NRC concluded that construction activities associated with RBS Unit 1 would result in SMALL impacts to the site's aquatic ecosystems (References 4.3-2 and 4.3-3).

Direct impacts to on-site aquatic resources at the RBS site as a result of Unit 3 construction activities are expected to be minimal. Permanent losses of aquatic habitats would be limited to a single man-made pond (approximately 100 by 50 ft.) located within the 3-ac. area proposed for the construction of offices, as indicated in Figure 2.4-7. Dredging of the barge slip in the Lower Mississippi River (LMR) during construction activities to allow barge delivery of heavy construction equipment and building materials would result in the loss of benthic biota in this area. Dredging would also take place at the intake embayment to allow for the addition of upgraded technology to the existing intake technology. These dredging activities are expected to be similar to those ongoing operations and maintenance (O&M) dredging activities[a] utilized to maintain both the barge slip and the intake embayment under an existing USACE permit (Reference 4.3-4).

Additional impacts to off-site aquatic resources as a result of transmission line construction, as described in Subsection 4.1.2, are also expected to be minimal. It is understood that the final design of the proposed transmission lines and respective corridors would span the aquatic ecosystems crossed. Additionally, transmission tower construction is expected to be limited to terrestrial locations to the maximum extent possible. Subsection 2.2.2 details the water bodies crossed by the new transmission corridors. ROW clearing can occur in areas adjacent to these aquatic resources; however, indirect impacts to aquatic resources are expected to be minimized through preventive measures developed and implemented through a construction SWPPP. These preventive measures may include the use of silt fencing and hay/straw bales to prevent runoff water from entering nearby aquatic resources. Proper authorization from the USACE in conjunction with the LDEQ is expected to be obtained prior to the initiation of any activities that would occur within the boundaries of waters of the United States. Mitigation measures necessary for such activities are expected to be detailed in the acquired permit, as appropriated by state and federal authorities.

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a. The intake embayment is typically dredged once annually to remove excess sediment buildup due to sediment transport in the river (Section 2.3). Although the volume of material displaced is not recorded (material is placed back into the river according to the existing USACE 404 permit), it is estimated that less than 20,000 cu. yd. of sediment is removed during maintenance dredging activities.

Indirect impacts to aquatic systems, such as increased sedimentation and increased water flow throughout intermittent water bodies, are also expected. These effects could cause temporary losses to benthic habitat and biota due to siltation, as well as short-term declines in phytoplankton productivity and zooplankton densities in the immediate area affected by construction. While this may temporarily reduce food resources for forage fish species, these effects would be limited in duration and temporary in nature and would cease upon the completion of Unit 3 construction. Affected aquatic systems are expected to revert to preconstruction conditions upon the completion of Unit 3 construction, and impacts are anticipated to be SMALL.

Other potential impacts include the interruption of fish migration and spawning and fish mortality related to accidental chemical spills. While it is not expected that migratory pathways would be physically barricaded during construction, increased turbidity can act to inhibit migratory cues in some fish species. Contaminants in construction effluents can also act as chemical barriers that inhibit fish migratory behavior. To reduce sediment loading and effluent runoff into on-site water bodies, a construction SWPPP and SPCC plan is expected to be developed and in place prior to the start of construction. Measures detailed in these plans for pollution prevention would be similar to those found in the current RBS SWPPP and SPCC plan, as required by the existing LPDES permit (Reference 4.3-5). These measures include BMPs for preventing and limiting adverse environmental effects of potential chemical spills, including the storage of fuel and other potentially harmful chemicals away from water bodies to prevent direct chemical contamination of aquatic resources.

4.3.2.1 Impacts to the Lower Mississippi River

The existing barge slip in the LMR will be dredged to allow barge access to the RBS site. Additionally, the intake embayment will be dredged to allow for the installation of the new intake screens. Impacts to the LMR associated with dredging activities include increased turbidity and loss of benthic habitat and associated biota (refer to Subsection 2.4.2 for benthic biota speciation). These dredging activities are expected to be similar to those utilized to maintain these areas; therefore, impacts are expected to be SMALL. It is expected that dredged material would be returned to the LMR, as specified by the USACE in the applicable permit (Reference 4.3-4).

Site dewatering is typically addressed in the construction SWPPP. In addition to mitigation from BMPs from the SWPPP, site runoff resulting from dewatering effluent would be buffered by Alligator Bayou. Floodplains naturally function as buffering systems for rivers. Because the Alligator Bayou system encompasses a portion of the floodplain areas associated with the LMR, it is anticipated that Alligator Bayou would buffer excess construction effluent from the LMR. Impacts to Alligator Bayou are further discussed in Subsection 4.3.2.2.

The LMR is characterized by deepwater, strong currents, and coarse-grained substrate. The dynamic nature of the LMR imposes restrictions on its aquatic inhabitants, limiting river speciation to consist mostly of species capable of enduring a wide range of disturbances. These species are adaptable and innately possess the ability to recover from natural environmental stressors, such as increased sedimentation and turbidity and loss of benthic habitat and biota, typically occurring during seasons of heavy rainfall and floodplain inundation. The natural dynamic structure and function of the LMR and the ability of its inhabitants to recover from natural seasonal perturbations lend credence to viewing impacts associated with the construction of Unit 3 as SMALL. This is further substantiated by historic documentation of the effects of construction impacts associated with the construction of Unit 1. These impacts were much larger in extent because site construction affected a much wider area. Historic construction activities caused minimal, temporary disruptions to the biota of the LMR, and water quality did not decline as a result of the construction of Unit 1 (References 4.3-2 and 4.3-3).

Additionally, the LMR exhibits a higher assimilative capacity than other aquatic systems at the RBS site because of its larger size and depth, as well as its high flow rate and natural high level of turbidity. Average ambient sediment load carried past the RBS site by the LMR is estimated to be approximately 31,250 tons/hr (28,350 metric tons/hr) (Reference 4.3-2). Additional sediment load discharged into the LMR from construction activities or resulting from dredging activities in the LMR is estimated to be less than 1 percent of the ambient river sediment load, and no apparent buildup of sediment is expected to be detected below the release. There is little likelihood for any significant detrimental effects on the biota of the river, which characteristically adapt to conditions of high suspended sediment loads and deposition of sediment in low velocity areas of the river. Because of the temporary nature of the construction activities, impacts to biota of the LMR would be expected to be temporary and SMALL.

Equally as important, construction activities conducted in the LMR would not interfere with the commercial or recreational fishing use of the river. Further details related to commercial and recreational fishing impacts can be found in Subsection 5.3.1.2.3.

4.3.2.2 Impacts to Alligator Bayou, Grants Bayou, and On-Site Ponds

As previously mentioned, permanent losses to aquatic biota are expected to be limited to a small man-made pond (approximately 100 by 50 ft.) located on a 3-ac. lot designated for the construction of offices (refer to Figure 4.3-3). This pond was constructed in association with a mill located on the RBS site prior to Entergy's purchase of the land and has no apparent connectivity to other on-site water bodies. Small water bodies such as this typically exhibit low levels of dissolved oxygen (DO) as a result of the stagnant nature of the pond itself. While no formal surveys of aquatic biota have been conducted on the pond, its small size and limited connectivity indicate that few fish species would be able to thrive in this habitat. These species could include fishes such as the mosquitofish (*Gambusia affinis*) and the bullhead minnow (*Pimephales vigilax*) and invertebrates such as the crayfish (*Procambarus and Orconectes* spp.). Those species capable of withstanding the extreme conditions exhibited in this location commonly occur throughout Alligator and Grants Bayous. The species anticipated to be lost during the infilling of this pond would remain well represented in other on-site aquatic systems.

Increased sedimentation and turbidity from erosion and temporary construction discharges have the potential to adversely affect fisheries' resources. A number of different activities can contribute to increased sediment/silt loads into these water bodies, including increased road traffic (dust from traffic settling into water bodies; increased traffic causing minor road erosion), loss of vegetated buffering zones (land clearing removing grasses and shrubs that trap runoff and sediment and silt), and site dewatering (increased water flow carrying sediment and silt in runoff into water bodies). Siltation caused by increased sedimentation could result in the temporary loss of benthic habitats and biota associated with the Alligator and Grants Bayou systems. Increased turbidity could limit phytoplankton productivity and decrease zooplankton densities within these water bodies as well. While this may cause a temporary decline in food sources available to larger aquatic organisms, significant or permanent effects are not anticipated.

Construction activities associated with building the new cooling tower at the RBS site could lead to soil erosion into streams associated with Alligator and Grants Bayous. Erosion may cause some temporary disruption and modification of Alligator Bayou and Grants Bayou, ephemeral water bodies associated with the RBS site. These areas, generally subjected to rapid flow and sediment deposition during local precipitation periods, would likely return to preconstruction conditions subsequent to establishing erosion control. Excavated material removed in association with cooling tower construction would be removed to a designated spoils area (refer to Figures 2.1-3, 2.1-4, and 4.3-3). No aquatic resources are located in the vicinity of this area. Runoff from excess water contained in excavated soils would be controlled by BMPs established in the construction SWPPP. These practices could include the use of silt fences and hay/straw bales to prevent silted runoff from indirectly affecting Alligator and Grants Bayou and its distributaries.

Construction activities entail dewatering at the site for 9 months. It is understood that construction dewatering effluent would be routed into the existing RBS stormwater ditch that discharges into West Creek via an LPDES permitted outfall, as described in Sections 4.2 and 4.3. Dewatering activities are anticipated to last approximately 9 months at an average constant rate of approximately 10,000 gpm, as outlined in Subsection 4.2.2.1. Once conducted into West Creek, dewatering effluent would flow into Grants Bayou, to Alligator Bayou, to Thompson Creek, eventually reaching the LMR. Figure 2.4-7 provides an overview of water bodies in the vicinity of the RBS site. As illustrated, dewatering effluent would be buffered by both Grants and Alligator Bayous before reaching Thompson Creek. Thompson Creek is listed under Section 303 (d) by Louisiana as impaired; however, because effluent would be buffered by the bayou systems before reaching the LMR, impacts to this resource would be SMALL.

On-site dewatering activities may also produce a more constant flow within the intermittent streams and water bodies in the vicinity of the RBS site. As a result, modifications to the aquatic biota of the water bodies on the RBS site may occur, including the alteration of shoreline habitats, siltation, and sediment deposition of surrounding water bodies and erosion of banks and stream/riverbeds. Any such effects would be temporary. Upon termination of construction activities, the affected water bodies would revert to their prior, preconstruction states.

As described in Subsection 4.3.2.1, Alligator and Grants Bayous would act as a buffer zone to the Mississippi River, preventing effluent resulting from Unit 3 construction from reaching the river. Vegetation typically associated with bayou systems (tupelogum, bald cypress, black willow, wire grass, rushes, and various other plants; refer to Subsection 2.4.1 for further details) trap sediment and silt, resulting in habitats that act as a settling ground for sediment. These types of plants thrive in high nutrient conditions, making these areas ideal buffer zones for sediment and silt runoff. The filtering capability of these types of plants also aid in removing potentially harmful nutrients from construction effluents and runoff, further substantiating the benefits of Alligator Bayou and Grants Bayou as natural buffer systems for the LMR and Thompson Creek. Effects to the Alligator and Grants Bayou systems as a buffer system for the LMR and Thompson Creek would be similar to those naturally occurring to these systems during periods of heavy inundation and flooding and, therefore, would be expected to be SMALL.

Bayou and floodplain habitats such as Grants Bayou and Alligator Bayou naturally experience temporary habitat changes during periods of heavy rain and flooding that are similar to those expected as a result of construction activities (e.g., erosion, increased sedimentation and turbidity, and increased water flow). The aquatic biota found in these types of habitats have adapted to survive in dynamic aquatic regimes and can therefore be expected to rebound from these types of effects quickly without significant decreases in overall health and sustainability.

Historically, aquatic resources at and near the RBS site have been subjected to heavy sediment deposition associated with clearing of land for agricultural purposes. Erosion and increased turbidity in and around the water bodies at the RBS site likely occurred as a result of these activities. The presence of established aquatic communities in these water bodies (described in Subsection 2.4.2) demonstrates the ability of these resources to recover from such perturbation. Construction activities at the RBS site are not expected to be as extreme as the process of agricultural land clearing; therefore, impacts to aquatic resources at the RBS site due to construction activities are expected to be SMALL.

4.3.2.3 Aquatic Threatened and Endangered Species

A general review of threatened and endangered (T&E) species located in Louisiana identified four species as having the potential to occur near the RBS site, although none have been documented in studies of historic fisheries associated with RBS. These species include the pallid sturgeon (*Scaphirhynchus albus*, endangered), the rainbow darter (*Etheostoma caeruleum*, threatened), the bluntface shiner (*Cyprinella camura*, imperiled), and the central stoneroller (*Campostoma anomalum*, imperiled). More in-depth discussions of the life history and habitat utilization of each of these species can be found in Subsection 2.4.2.

A formal review of T&E species conducted by the USFWS and the LDWF through the Louisiana National Heritage Program (LNHP) indicated that the only T&E species with the potential to occur near the RBS site was the pallid sturgeon (*Scaphirhynchus albus*). This species has never been documented in studies of historic fisheries performed at the RBS site, nor has it been documented in current impingement studies in progress at another Entergy-owned electric generating facility located downstream (RM 129.9) of the RBS site; therefore, impacts to the pallid sturgeon or any other threatened, endangered, or important aquatic species are expected to be SMALL.

4.3.2.4 Nuisance Species

The zebra mussel and the Asian clam are aquatic nuisance species (ANS) known to occur at the RBS. An ongoing zebra mussel monitoring and control program (ZMMCP), as described in the existing LPDES permit, monitors the occurrence and relative densities of zebra mussels in the LMR, the RBS clarifier influent and effluent, and the clarifier internals (Reference 4.3-5). Construction activities at the RBS may cause a temporary decline in zebra mussel and Asian clam populations in the LMR due to a minimal increase in turbidity. A decline in these species' populations would be considered beneficial because of their status as nuisance species; however, because of the temporary nature of the aforementioned construction impacts and resulting turbidity, no long-term effects on the population number and structure are anticipated. Therefore, impacts are anticipated to be SMALL.

4.3.2.5 Summary

As presented above, impacts to ecological resources at the RBS site related to construction activities are expected to be SMALL. Facility construction would disturb 246 ac. of previously undisturbed terrestrial habitat; however, only 43 ac. would be permanently disturbed. Construction activities would avoid wetlands and wildlife corridors on the main plant site; these areas would be avoided as much as practicable in the on-site and off-site transmission corridors. Dredging of the intake embayment for the intake screen retrofit and barge slip maintenance in the LMR would disturb a small area of benthic habitat. This area is frequently disturbed when routing dredging activities and is not expected to be negatively affected. Additionally, site dewatering could cause temporary, minor changes to downstream stream bed bathymetry. The runoff resulting from dewatering would be buffered by bayous prior to its entering smaller streams, and little impact is expected. Procedures for additional water quality protection measures, such as the use of BMPs to prevent excess construction effluent from reaching nearby water resources and implementation of an SPCC, would be outlined in the construction SWPPP. In accordance with LDEQ requirements, these measures would be in place prior to initiation of construction activities. As a whole, construction impacts to ecological resources at the RBS site would be SMALL.

4.3.3 REFERENCES

4.3-1 Louisiana Department of Transportation, "Final Environmental Assessment: Route LA 10 Mississippi River Bridge, St. Francisville-New Roads, West Feliciana-Pointe Coupee Parishes," 2003.

4.3-2 Gulf States Utilities Company, "River Bend Station Environmental Report, Operating License Stage," Volume 3, Subsection 4.3.2, Supplements 1-9, November 1984.

4.3-3 U.S. Atomic Energy Commission, Directorate of Licensing, *Final Environmental Statement Related to Construction of River Bend Nuclear Power Station Units 1 and 2*, Washington, D.C., 1974.

4.3-4 U.S. Army Corps of Engineers, "General Permit for Silt Removal in the Mississippi River, Permit Time Extension, EM-20-020-2486, SE NOD-23," June 3, 2002.

4.3-5 Louisiana Department of Environmental Quality, "Louisiana Water Discharge Permit - River Bend Station, Permit Number LA0042731," June 2006.

Table 4.3-1
Impacts to Vegetation (Plant Communities) from Construction of Proposed RBS Project

Plant Community	Permanent Impacts (acres)		Temporary Impacts (acres)		Wetland (Federal)	Total (acres)
	Previously Disturbed	Not Prior Disturbed	Previously Disturbed	Not Prior Disturbed		
Upland (U1) Developed Areas	106.2	0	0	0	No	106.2
Upland (U2) Forest	23.4	12.0	95.0	0	No	130.4
Upland (U3) Fields-Grass	6.9	0	13.9	0	No	20.8
Upland (U4) Fields-Shrub/Pine	0	0	83.3	0	No	83.3
Upland (U5) Forest Palustrine Wetland	0	0	0	0	No	0
Bottomland (B1) Developed Areas	0	0	11.1	0	No	11.1
Bottomland Forest (B2) Baldcypress/Tupelogum	0	0.2	0	3.4	Yes	3.6
Bottomland Forest (B3) Tupelogum/Hackberry	0	0	0	0	Yes	0
Bottomland Forest (B4) Hackberry/Boxelder/Ash	0	0	8.1	0	No	8.1
Totals	136.5	12.2	211.4	3.4		Total Impact Area 363.5
	Total Permanent Impact 148.7		Total Temporary Impact 214.8			
	Total Permanent Minus Developed (U1 and B1) 42.5		Total Temporary Minus Developed (U1 and B1) 203.7			Total Impact Area Minus Developed (U1 and B1) 246.2

Refer to Figure 4.3-1 for locations of plant communities.

**Table 4.3-2 (Sheet 1 of 2)
Water and Wetland Statistics by Route
for the Proposed 500 kV Transmission Line**

Wetlands and Open Water (Rank)	No. Crossed	Length (ft.) of Features Crossed	No. Crossed > 1000 ft.	Length (ft.) of Features Crossed > 1000 ft.
	Natchitoches Site (Preferred Route)			
	147.71 mi. (779,909 ft.)			
Emergent Herbaceous Wetlands	43	21,493.00	7	12,180.22
Open Water	224	122,040.17	20	64,859.65
Woody Wetlands	51	12,423.26	2	3277.19
Totals	318	155,956.44	29	80,317.07
	Bienville Site No. 1			
	171.29 mi. (904,411 ft.)			
Emergent Herbaceous Wetlands	58	40,612.01	15	29,645.16
Open Water	242	145,956.21	28	84,968.11
Woody Wetlands	54	12,218.13	2	3277.19
Totals	354	198,786.35	45	117,890.46
	Bienville Site No. 2			
	153.01 mi. (807,893 ft.)			
Emergent Herbaceous Wetlands	35	28,267.00	7	18,777.13
Open Water	246	134,306.21	36	83,096.75
Woody Wetlands	37	10,815.31	2	3647.90
Totals	318	173,388.53	45	105,521.77
	Newton Site			
	147.36 mi. (778,061 ft.)			
Emergent Herbaceous Wetlands	18	8853.60	2	4096.51
Open Water	170	176,379.57	44	136,750.76
Woody Wetlands	24	5460.23	1	2079.65
Totals	212	190,693.40	47	142,926.93

**Table 4.3-2 (Sheet 2 of 2)
Water and Wetland Statistics by Route
for the Proposed 500 kV Transmission Line**

	Sabine Site			
	141.86 mi. (748,021 ft.)			
Emergent Herbaceous Wetlands	12	6449.70	2	4096.51
Open Water	167	163,468.55	43	128,479.83
Woody Wetlands	19	5087.20	1	2079.65
Totals	198	175,005.44	46	134,656.00

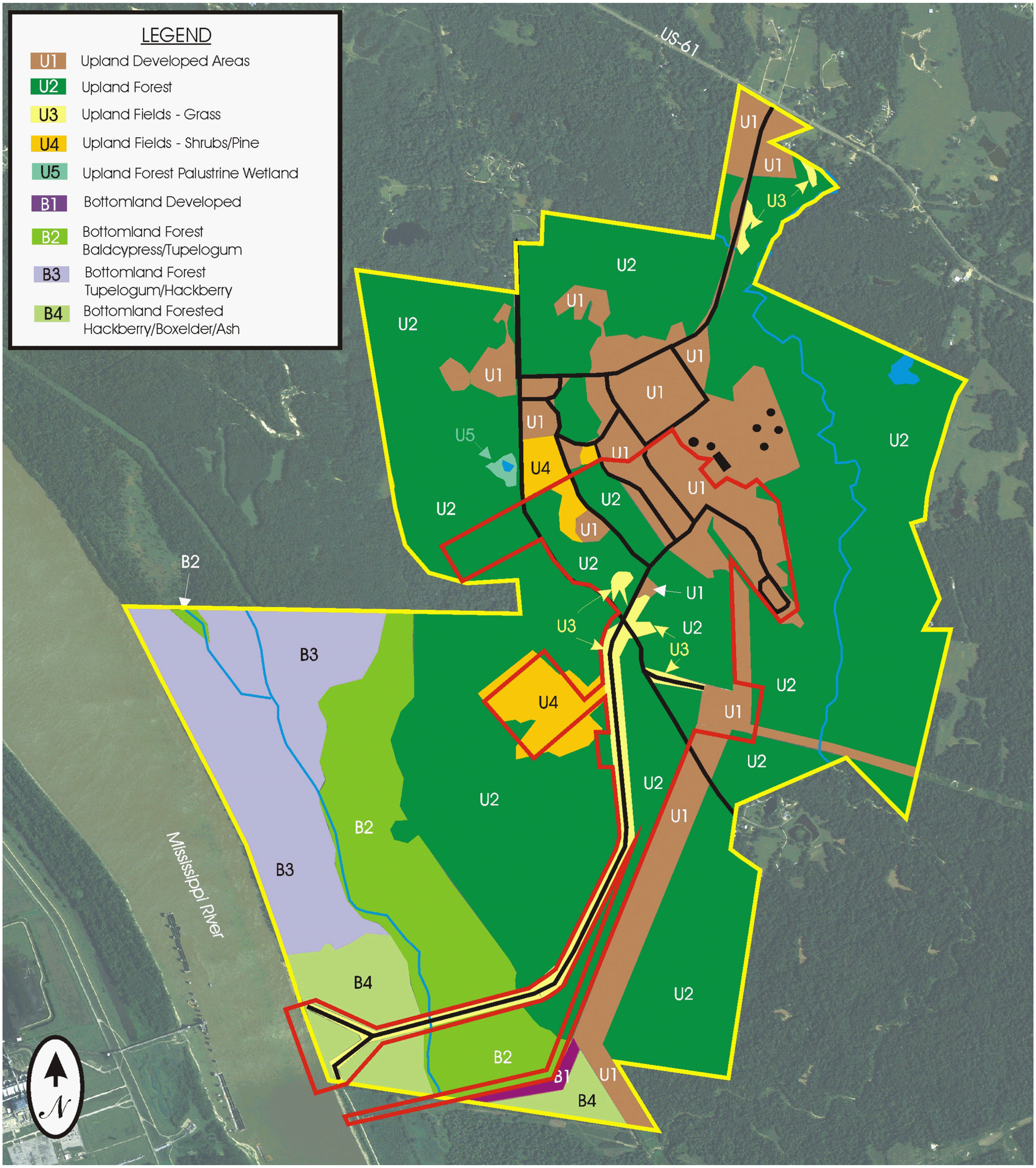

Figure 4.3-1. Impacts to Vegetation (Plant Communities) from Construction of Proposed RBS Project

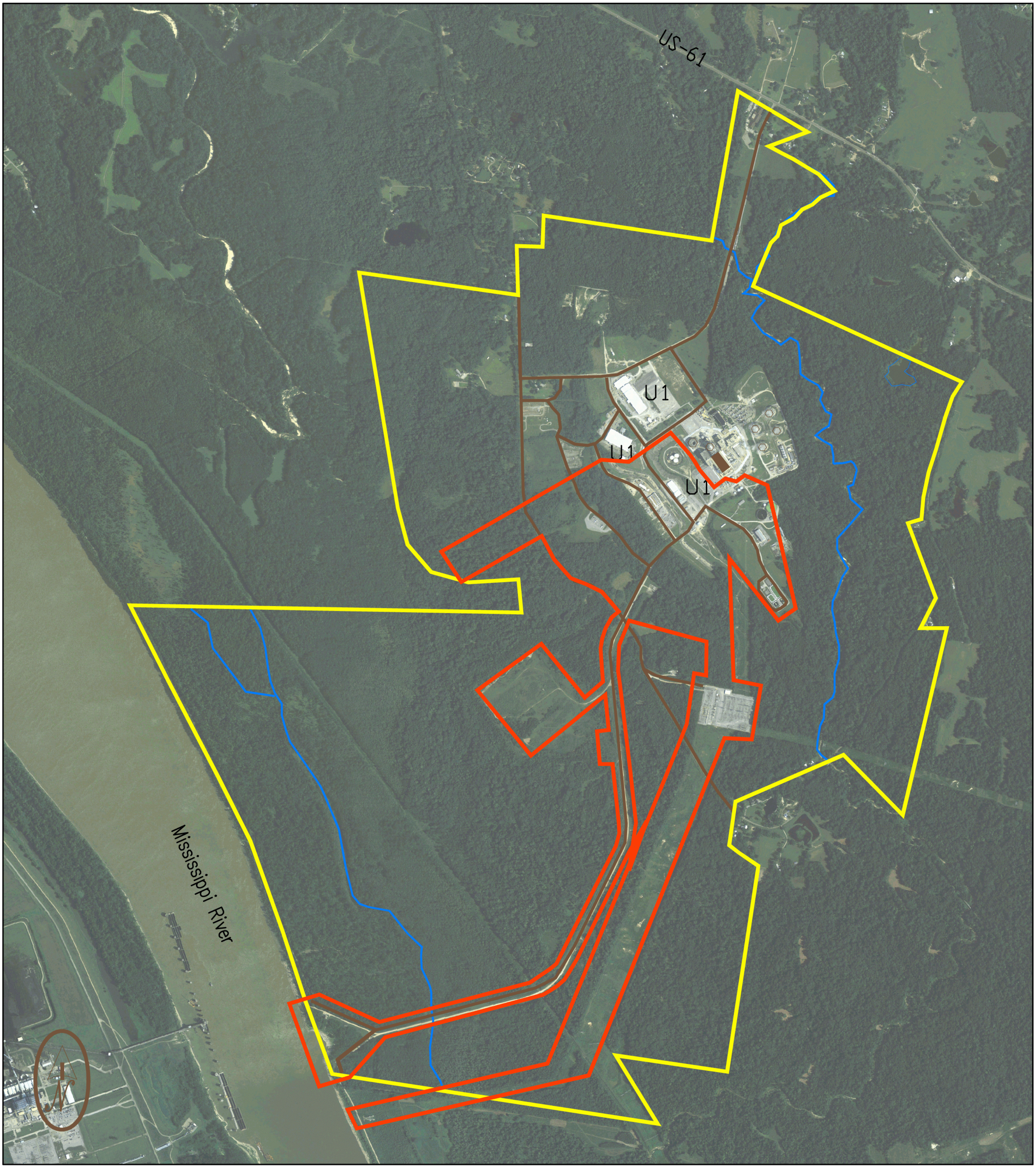

Figure 4.3-2. Aerial Photograph with Impact Area Overlaid

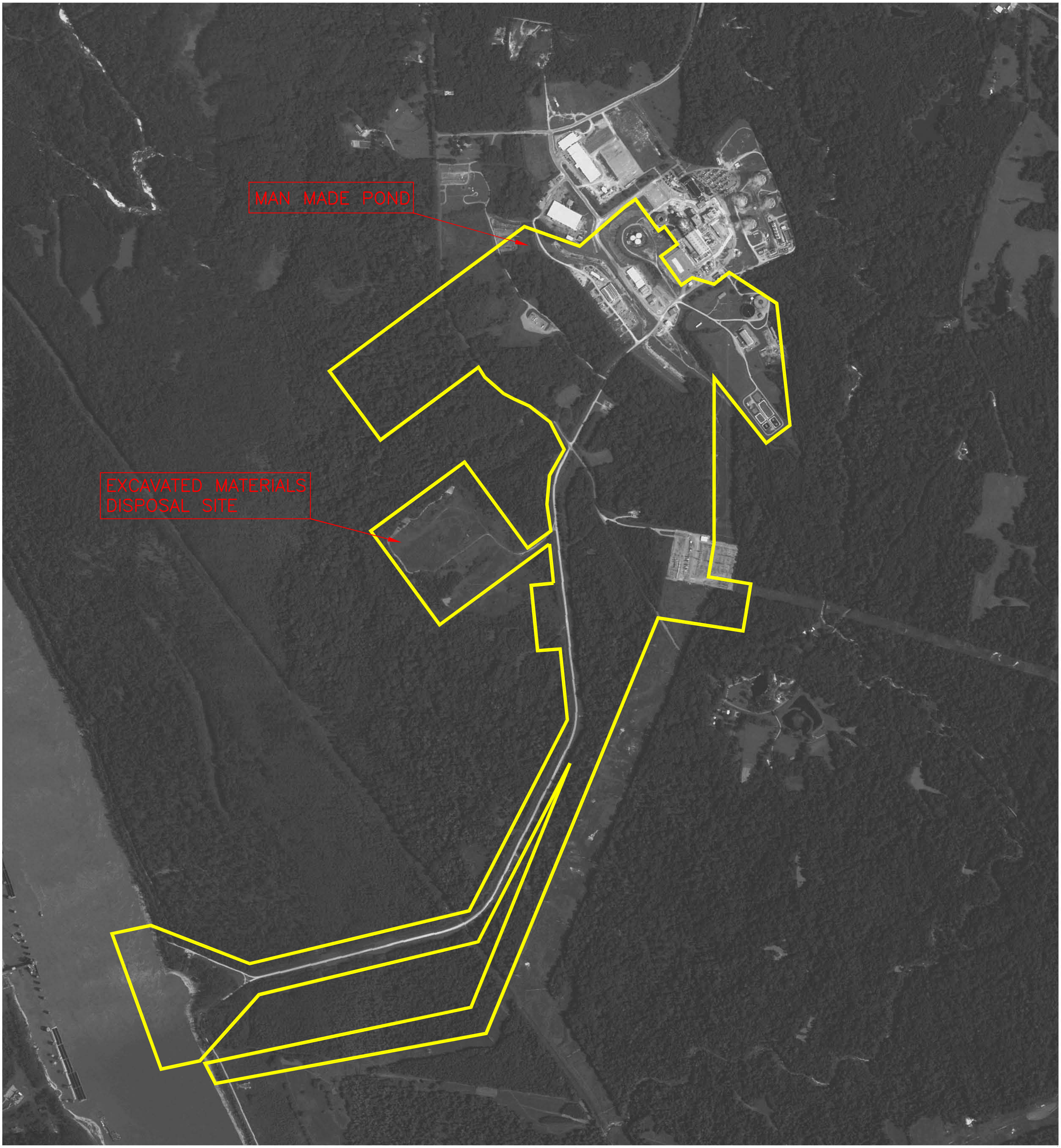

Figure 4.3-3. Potential Areas Affected by Unit 3 Construction (Aerial Photograph, 2005)

4.4 SOCIOECONOMIC IMPACTS

This section discusses the potential for socioeconomic impacts resulting from the construction of RBS Unit 3. The information is organized as follows:

- Subsection 4.4.1 describes the physical impacts of construction on the area.
- Subsection 4.4.2 describes the social and economic impacts of construction.
- Subsection 4.4.3 describes environmental justice issues within the region.

Refer to Subsections 2.5.1 and 2.5.2 for the baseline socioeconomic information, and Subsection 2.5.4 for baseline environmental justice information upon which these construction impact assessments are made.

Generally, the social and economic impacts of power plant construction are a function of the size of the construction workforce, wages paid, and the number of relocating workers relative to the available community facilities and services. During the 60-month construction period for RBS Unit 3 (72 months including nonsafety-related activities), an estimated 8000 man-years (16.6 million hours) of employment, plus $472 million of direct construction wages are projected. The projected peak employment level is 3150 (refer to Figure 4.4-1) and is shown by major discipline and craft in Table 4.4-9. The average employment level during construction is expected to be 2042 workers, including nonsafety-related workers (593 workers on average) and safety-related workers (1446 workers on average). The following impact analysis is driven by these employment figures.

4.4.1 PHYSICAL IMPACTS

Construction activities can cause temporary and localized physical impacts, such as noise, odors, vehicle exhaust, and dust vibration and shock from blasting. This subsection addresses these potential construction impacts that may affect people, buildings, and aesthetics. The impacts on recreation opportunities and transportation are discussed in Section 4.2.

The plant site is relatively isolated, is large in size (approximately 3330 ac.), and has a significant tree buffer between the construction area and off-site permanent populations and structures. These site features help ensure that any temporary negative impacts during construction would be largely contained on the site and adequately controlled with prudent construction practices. Therefore, construction activities are not expected to impact any off-site buildings because of the distance to any such structures. The nearest full-time residence is approximately 2000 ft. from the Exclusion Area Boundary (EAB) (Figure 2.1-3). In the event that pile driving is necessary, the building(s) most vulnerable to shock and vibration would be those within the RBS site boundary. On-site buildings have been constructed to safely withstand possible impacts, including shock and vibration, from the construction activities associated with the proposed activity.

People who live close to or work near the RBS site will be impacted by construction activities (a detailed population description is provided in Subsection 2.5.1). On-site construction workers will incur the largest impact, followed by operational workers at RBS Unit 1 who will incur a similar but smaller proportion of the impacts. Lastly, because the existing population and housing distribution is outside the site boundary, the vulnerability for impacts during construction is expected to be limited primarily to the impact of increased traffic flows and associated noise. There could also be occasional noise from the construction site perceived by local residents, as further discussed in Subsection 4.4.1.1.

The 550-ft. NDCT that serves Unit 3 would be the major aesthetic impact, because it would be visible from nearby areas where no tall structure could previously be seen. The view of the new cooling tower may change perception of the area by making the presence of a nuclear power plant more clearly visible, but it is not likely to cause alteration of land use patterns in the area. Potential aesthetic impacts related to land use are not expected on the site or in the vicinity of the RBS and would be SMALL.

No existing off-site buildings or recreational facilities should be vulnerable to negative impacts during construction, other than the possibility of longer commuting times to destinations during shift changes at RBS Unit 3. Similarly, no change in the distribution of people should occur, and the primary impact on area roads would be increased traffic volume, as discussed in Subsection 4.4.2.4.2. Therefore, the remainder of Subsection 4.4.1 focuses on noise impacts and the potential for air quality impacts.

4.4.1.1 Noise

4.4.1.1.1 Construction Activities

The proposed Unit 3 project is located in West Feliciana Parish, Louisiana, near the town of St. Francisville. There are no existing parish or state regulations regarding construction noise emissions. The town of St. Francisville noise regulations are outlined below for reference purposes only because the project is not located within the town limits. The NRC and EPA guidelines regarding environmental noise are discussed in Subsection 5.8.1.1.

The town of St. Francisville has established maximum permissible sound levels for construction activities during specific times of the day in the town's *Code of Ordinances* (Reference 4.4-1). While the proposed RBS Unit 3 facility would not be located within the town of St. Francisville, the established construction sound level limits can provide guidance. The noise ordinance limits the sound level to 55 dBA at the receiving property line of any zoning district for construction activities occurring between 7:00 p.m. and 7:00 a.m. (Reference 4.4-1).

Human response to sound is highly individualized; annoyance is the most common issue regarding community noise. The percentage of people claiming to be annoyed by noise generally increases as environmental sound levels increase. References 4.4-2, 4.4-3, 4.4-4, and 4.4-5 discuss the subjectivity of changes in sound level. Based on these references, a 3 dB change in a continuous broadband noise is generally considered "just barely perceptible" to the average listener. A 5 dB change is generally considered "clearly noticeable," and a 10 dB change is generally considered a doubling (or halving) of the apparent loudness.

Major construction phases would consist of site preparation, foundation construction, building and equipment erection, and site cleanup/facility startup. Noise emissions would vary with each phase of construction, depending on the construction activity and the associated construction equipment required for each phase. Site preparation would require the use of heavy diesel-powered earthmoving equipment. Examples of this equipment include bulldozers, scrapers, dump trucks, graders, and front-end loaders. Noise emissions during site preparation would be dominated by the diesel engine noise. Foundation construction would primarily involve concrete handling equipment such as concrete trucks, mixers, vibrators, pumps, and pile driving equipment. Some earthmoving equipment would also be required to backfill the foundations. Foundation construction activities would primarily be centered at the power block equipment area. The equipment and building installation would involve diesel-powered earth moving equipment, mobile cranes, equipment delivery, impact wrenches, saws, drills, and air compressors. Again, these activities would primarily be centered at the power block equipment area. Site cleanup and facility startup would generally result in lower noise emissions than the preceding construction phases.

4.4.1.1.2 Construction Equipment Noise Emissions

The variable nature of construction noise is best represented by an average sound level. The average sound levels account for the type and quantity of equipment, the typical usage of each piece of equipment, and typical sound levels of the equipment used during each phase of construction. The typical types of equipment, equipment usage, and equipment noise emissions (at a distance of 50 ft.) for each phase of construction are listed in Table 4.4-1. Estimates of the construction equipment usage and noise levels are based on information provided in References 4.4-6, 4.4-7, and 4.4-8.

4.4.1.1.3 Potential Impacts

The variable nature of construction activity makes it difficult to predict construction noise emissions. While the average noise level is representative of construction activities, certain activities would produce temporary elevations in the noise level, and decreased noise emissions would occur during reduced construction activities. The closest distance between the site construction areas and the nearest noise-sensitive receptor (Receptor R8 on Figure 2.5-21) is approximately 3600 ft. The estimated sound levels from construction equipment at a distance of 3600 ft. have been provided in Table 4.4-1.

If certain construction activities take place during the nighttime hours, the cumulative sound level of construction activities has the potential to cause sound levels at the property boundary of the nearest noise-sensitive receptor that exceed the referenced St. Francisville construction noise limit of 55 dBA (Reference 4.4-1). Limiting noisier activities, such as pile driving, to daytime hours should be sufficient to ensure that this does not occur.

The noise impacts on the surrounding areas due to construction activities would be temporary and are expected to be less than significant when proper mitigation measures are incorporated into the construction activities. Refer to Section 4.6 for a discussion of measures and controls to limit construction noise impacts. Noise impacts due to construction are expected to be SMALL.

4.4.1.2 Air Quality

West Feliciana Parish is in attainment for all EPA-listed criteria pollutants, though five nearby parishes that are part of the Baton Rouge metropolitan area are collectively considered a nonattainment area for ozone, according to the LDEQ (Reference 4.4-9). According to the LDEQ, no other parishes in Louisiana are out of attainment for any other criteria pollutants (Reference 4.4-10). There is one Class I area within 300 km of the RBS site: the Breton National Wildlife Refuge. According to the National Park Service, the closest receptor to the Breton National Wildlife Refuge is located 249 km east-southeast of the RBS site (Reference 4.4-11). Section 2.7 provides further details about the historical air quality in the RBS vicinity.

Air pollution would increase during construction because of emissions from construction activities, such as engine exhaust from worker vehicles and machinery. The vehicles and machinery will comply with applicable government standards during construction, and the relatively isolated nature of the construction area from off-site residences and facilities would help prevent a noticeable impact on air quality beyond the site. Because the West Feliciana Parish is in attainment for all criteria pollutants, the temporary impact of construction activities should not produce noticeable impacts or elevate levels to a significant degree. The cumulative impact on air during construction is projected to be SMALL.

4.4.1.3 Dust

The state of Louisiana has adopted a regulatory code that requires the reasonable control of fugitive emissions, including dust resulting from transportation and various types of equipment. Concerning regulations applicable to general contractors, the LDEQ states, "Air quality regulations require the control of fugitive emissions including dust kicked up by trucks and other equipment, and from equipment such as generators or compressors" (Reference 4.4-12). In addition, Title 33 of the Louisiana Administrative Code (Reference 4.4-13) states the following:

> "§1305. Control of Fugitive Emissions
>
> > A. All reasonable precautions shall be taken to prevent particulate matter from becoming airborne. These precautions shall include but shall not be limited to the following:
> >
> > 1. use of water or chemicals for control of dust in the demolition of existing buildings or structures, construction operations, the grading of roads, or the clearing of land;
> >
> > 2. application of asphalt, oil, water, or suitable chemicals on dirt roads, materials stockpiles, and other surfaces which can give rise to airborne dusts;
> >
> > 3. installation and use of dust collectors to enclose and vent the handling of dusty materials. Adequate containment methods shall be employed during sandblasting or other similar operations;
> >
> > 4. open-bodied trucks transporting materials likely to give rise to airborne dust shall be covered at all times when in motion;
> >
> > 5. conducting agricultural practices such as tilling of land, application of fertilizers and insecticides in such a manner as to prevent dust from becoming airborne;

6. paving roadways and maintaining the roadways in a clean condition;

7. the prompt removal of earth or other material from paved streets onto which earth or other material has been transported by trucking or earth moving equipment, erosion by water or other means."

At the RBS, the construction practices for dust control are consistent with the state requirements. In general, the amount of dust created from construction activities would be manageable because of the paved roads that lead to the parking turn-off areas and the absence of large-scale clearing and leveling of areas. Dust control measures may be appropriate in the laydown area, parking areas, site roads, or construction areas during dry weather periods and would be achieved through the use of a water truck sprayer. Additional dust control may also be required during the initial stages of construction as the result of any necessary site leveling and dirt work. When laydown and other areas are no longer needed as construction progresses, the areas would be re-seeded to ensure that ongoing dust creation does not occur. With these construction practices, the dust impacts should be SMALL.

It is likely that the concrete batch plant on-site may create the largest amount of dust. However, the plant would be equipped with a dust control system that would be checked and maintained on a routine basis, and off-site impacts should be negligible. Given the isolated nature of the plant and the significant tree buffer, the location of the concrete batch plant on-site would likely result in less off-site dust impacts than if concrete were produced off-site and trucked to the construction area.

No blasting is expected at the site and vibration should not be noticeable beyond the site other than occasional noise impacts.

4.4.1.4 Burning Controls

The LDEQ states that, "Open burning of construction debris is forbidden. Construction debris should be disposed of at an approved landfill" (Reference 4.4-12). The construction of RBS Unit 3 will be compliant with the applicable Louisiana regulations and requirements, and waste will be taken to the nearest suitable landfill for disposal. Therefore, impacts are anticipated to be SMALL.

4.4.2 SOCIAL AND ECONOMIC IMPACTS

The social and economic impacts associated with RBS Unit 3 construction are discussed in this subsection. Generally, new investment in a major construction project has a number of positive economic impacts that are driven by employment and income creation, plus increased tax revenues. If negative impacts arise, the primary categories of concern usually include short-term traffic impacts and other impacts that could arise if a large workforce relocates to a region that has limited availability of housing or inadequate community facilities and services. The key information needed to make this determination is the size of the relocating construction workforce relative to the availability of housing and community facilities and services.

Projecting the number of relocating construction workers is inexact, but there are industry studies (although some date to the last period of multiple nuclear construction projects in the late 1970s and early 1980s), that can be useful in developing reasonable projections. The primary studies referenced for the construction impact analysis in this section are listed below, and the abbreviated name of the study used for reference in the remainder of this section is listed in parentheses:

- Denver Research Institute for the Electric Power Research Institute, *Socioeconomic Impacts of Power Plants*, February 1982 (the EPRI study).
- Pijawka, J. and J. Chalmers, "Impacts of Nuclear Generating Plants on Local Areas," *Economic Geography*, Vol. 59, No. 1, Jan. 1983 (the Pijawka study).
- U.S. Nuclear Regulatory Commission, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants,* NUREG-1437, Vol. 1, Washington, D.C., 1996 (the GEIS).
- Malhotra, S. and D. Manninen, *Migration and Residential Location of Workers at Nuclear Power Plant Construction Sites*, Vols. 1 and 2, April 30, 1981 (the Malhotra study).

4.4.2.1 Demographics and Economics

4.4.2.1.1 Demographics

Estimating the number of RBS Unit 3 construction workers that would likely relocate from distant areas to within the region is a function of the availability of qualified construction workers that could commute to the site from their existing residences. An extremely conservative estimate, but one consistent with the definition of the RBS region, is that construction workers would be willing to commute to the site without relocating, provided they reside within 50 mi. of the site. The EPRI study of 12 large coal-fired, nuclear, and oil-fired power plant projects found that whole groups (not just a few individuals) of power plant construction workers often commute one-way to a site even if they live more than 70 mi. away (Reference 4.4-14). If this maximum distance is assumed, it results in a larger number of construction workers who could work on the project without relocating and lessens the possibility of negative socioeconomic impacts related to housing and the demand for community facilities and services. To be conservative and yet cover the range of possible impacts, the following assessment presents results using two different commuting assumptions. The first assumes that construction workers within a 70-mi. radius would be willing to work at the RBS Unit 3 site without relocating closer to the project site, and the second conservatively assumes a 50-mi. maximum commuting distance.

The LandView® 6 software (Reference 4.4-31) was used to determine the number of construction workers residing within 70 mi. and 50 mi. of the RBS Unit 3 site. Results in Table 4.4-2 indicate that a total of 59,497 construction workers lived within a 70-mi. radius in 2000. There were 35,874 construction workers living within the 50-mi. area in 2000. As indicated in Table 2.5-20, the number of construction workers in the Second Regional Labor Market Area, which includes West Feliciana Parish and Baton Rouge, is projected to increase at an annual average growth rate of 1.58 percent. If this growth rate is applied to the number of construction workers in the 70-mi. radius in 2000, then a construction workforce of 74,099 would be expected in 2014, the peak construction period. At the 50-mi. radius, the construction workforce is estimated to be 44,678 in 2014.

Table 4.4-2 also indicates the percentage of the 70-mi. and 50-mi. construction workforce required during the peak construction period. The peak RBS Unit 3 workforce of 3150 would be equal to 4.3 percent of the projected 2014 construction workforce within 70 mi. radius and 7.1 percent of the projected 2014 construction workforce within the 50-mi. radius.

The percentage of the regional workforce required for RBS Unit 3 construction is relatively low considering the industry unemployment rate and elasticity of the construction industry workforce (refer to the following studies), yet it is probable that the existing regional workforce would not provide all project labor and that some relocation of construction workers would occur to fill positions requiring specialized skills and training. In addition, a portion of the construction management, the inspector, and owner's engineering staff would also likely relocate to the region during construction.

The Pijawka and Malhotra studies can help estimate the percentage of the RBS Unit 3 construction workforce that may relocate to the primary impact area (the parishes of West Feliciana, East Baton Rouge, West Baton Rouge, Pointe Coupee, and East Feliciana). The Pijawka study evaluated 12 nuclear power construction projects and quantified the percentage of the construction workforce according to those who were existing residents of the study area, those who moved into the study area for the project, and those who commuted to the plant site from beyond the study area. The study found that, on average, 17.6 percent of the peak construction workforce consisted of those who moved into the study area for the project, 14.7 percent consisted of existing residents of the study area, and 67.7 percent were commuters from beyond the study area (Reference 4.4-15).

The Pijawka study found that the key factor influencing the percentage of in-migrants was the location of nuclear projects within commuting distance of large metropolitan areas with a population of 50,000 or more. On average, the distance from the power plant sites to the nearest city of 50,000 or more was only 40 mi., and this proximity provided both a place for in-migrating labor to reside without significantly increasing the demand for facilities and services, as well as providing a source for construction labor (Reference 4.4-16). Likewise, the EPRI study determined, "where one or more significant population concentrations (communities of 25,000 or more residents) exist within 60 to 70 miles of a power plant site, such concentrations will influence the extent of the impact area. In effect, such communities are likely to be the source of significant numbers of construction workers" (Reference 4.4-17).

The Malhotra study involved 28 surveys at 13 nuclear power plant sites and included 49,000 workers. The study also allows an estimate of the percentage of in-migrating plant construction workers for RBS Unit 3 (Reference 4.4-18). In this study, a mover was defined as a construction worker who moved in order to work at the site. Results of the study indicated that the percentage of construction workers moving for work ranged from 15 to 35 percent (Reference 4.4-19).

The Malholtra study found a higher percentage of relocating workers (a 25 percent midpoint) than the Pijawaka study (average of 17.6 percent). This difference is primarily because the Pijawaka study classified a relocating worker residing outside the study area as a commuter, and limited movers to those workers who relocated to within the defined study area, which was fairly small in some studies. Conversely, the Malholtra study classified all relocating construction workers as movers.

In the case of RBS Unit 3, the issue is to determine an appropriate estimate of the number of relocating workers to the primary impact area. The adopted five-parish primary impact area is fairly large and would be expected to encompass most of the relocating workers, and this tends to favor the adoption of an assumption no lower than 25 percent, the midpoint estimate derived from the Malhotra study.

Another consideration favoring the adoption of a relocating percentage assumption at least as high as the Malhotra study midpoint is that the Baton Rouge metropolitan area is large relative to other cities near nuclear power plant projects that have been studied, and the city would be expected to provide a greater portion of qualified construction workers than were provided by smaller cities near other nuclear projects. For example, of the 13 sites studied in the Malhotra study, 5 did not have a city with a population of 25,000 or larger within a 25-mi. radius of the site, and the average distance to the central city of a standard metropolitan statistical area (SMSA) was 45 mi. (Reference 4.4-20). In a similar pattern, Baton Rouge is larger than 9 of the 12 nearby cities identified in the Pijawka study and, at a distance of approximately 25 mi., is also closer than 9 of the 12 cities of 50,000 or more identified in that study (Reference 4.4-16). These geographical characteristics suggest that RBS Unit 3 construction could involve a percentage of local workers at least as high as the average percentage noted in previous studies. This expectation is further supported by the fact that two solid fuel units would be constructed in the region just prior to RBS Unit 3 construction (refer to Subsection 4.4.2.1.2).

4.4.2.1.2 Economics

For purposes of the impact analysis, it was assumed that 25 percent of the RBS Unit 3 workforce at construction peak would relocate to the primary impact area and 75 percent would be hired locally. This results in a greater percentage of in-migrants than the average in the Pijawka study (17.6 percent) and is equal to the midpoint of the Malhotra study. With a peak construction workforce of 3150, this would imply that 788 construction workers would be expected to relocate to the primary impact area and 2363 construction workers would be non-movers from within the primary impact area. As indicated in Table 4.4-2, this figure represents 3.2 percent of the 70-mi. construction workforce and 5.3 percent of the projected 50-mi. construction workforce in 2014. This would constitute a MODERATE to LARGE, beneficial employment impact. For the reasons listed below, this workforce impact should have no more than SMALL inflationary impacts in the overall construction market:

- Since the RBS Unit 3 construction jobs would be relatively high-paying and of a long duration, it is reasonable to assume that there would be much interest among regional construction firms and workers wanting to be hired for the project. Therefore, provided the region can supply the required number of workers, there should be an abundance of workers for RBS Unit 3 construction.

- The 3.2 percent of the 70-mi. regional construction workforce required at the RBS site would not be expected to produce construction worker shortfalls or a significant increase in construction labor costs in the region, based on industry unemployment levels. In Louisiana, the average unemployment rate in all industries was 5.3 percent from 2000 through October of 2007 (Reference 4.4-21). This unemployment rate was slightly above the 5.0 average rate for all industries nationally. In the construction industry, the national average was 7.7 percent, or 2.7 percentage points above the overall 2000 through 2007 unemployment level (Reference 4.4-22). Assuming that the relationship in Louisiana and the region between the overall unemployment rate and the construction industry unemployment rate is similar to the national average, Louisiana and the region would have had an average construction industry unemployment rate of between 7 and 8 percent during the 2000 to 2007 time frame. If the long-term, average construction industry unemployment rate in the state and region remains reasonably close to these historical levels, the construction industry could easily accommodate the RBS workforce requirements without initiating significant inflationary impacts on regional construction costs and without producing noticeable shortfalls for other projects. This conclusion is reinforced by the following consideration.

- The construction industry is characterized by the ability to add to the size of the labor force quickly in response to the demand for labor. For example, the average annual size of the national construction labor force (employed plus unemployed workers) in 2000 was 8.13 million, but within the year, the size of the construction labor force varied from a high of 8.63 million to a low of 7.67 million workers. This is a difference of 958,000 workers, which represents 11.8 percent of the annual average figure. From 2000 through 2006, this variation averaged 8.3 percent for the construction industry labor force, compared to 2.1 percent for the nation's overall labor force (Reference 4.4-23). This phenomenon occurs because, not only is there significant seasonal variation in employment opportunities in the industry, construction jobs are relatively high-paying and when the demand for construction labor increases, there is a tendency for qualified workers in other industries to respond by entering the construction workforce. Thus, the elasticity of the construction industry workforce would have a softening impact on any inflationary impacts that may be created from a significant increase in demand for construction workers in the region.

- Power plant expansions have been announced at the nearby Big Cajun I and II sites in Pointe Coupee Parish. These planned facilities are a 230 megawatt (MW) multi-fuel unit at Big Cajun I and a 775 MW coal unit at Big Cajun II (Reference 4.4-24). To the degree that these facilities help ensure a well-trained regional construction workforce, RBS Unit 3 construction should be able to utilize at least a portion of this workforce following the completion of these two projects. Having a large regional workforce with power plant construction experience would reduce the potential for negative construction impacts that could result from an inexperienced construction workforce (more relocating workers, inflationary impacts), and would aid the specialized regional construction workers from Big Cajun I and II who would welcome the employment and income benefits created by a third power plant project, though some specialized trades such as welders and electricians would need to become nuclear certified to work on RBS Unit 3.

- The final major workforce assumption concerns the location of residence for the assumed 788 relocated workers at peak construction. A common assumption is that the settlement pattern of construction workers would mirror that of the existing operating staff. The RBS Unit 1 workforce resides predominantly in East Baton Rouge Parish (59 percent), West Feliciana Parish (23 percent), and East Feliciana Parish (7 percent). However, there is evidence that construction worker settlement patterns often differ from those of the permanent operating staff. For example, the EPRI study found in a comparison to the locational pattern of the construction workforce, "the geographic extent of the impact area for permanent workers is typically much more restricted than for construction workers who appear to be willing to commute much further distances" (Reference 4.4-17).

Multiple factors influence the selected place of residence for relocating construction workers. Some workers opt for the amenities of a larger city, while others want to locate in smaller communities where the aesthetics of country living can be enjoyed. Availability of housing and community facilities and services, as well as the time required to commute to the RBS site, also influence relocation decisions.

One of the primary reasons that construction workers may choose to commute longer distances than the operating staff is attributed to the relatively short duration of many craft positions at the site. Although the entire construction duration of RBS Unit 3 is expected to be approximately 5 years, many workers would be at the site for a much shorter period of employment, and consideration of post-construction opportunities would be a significant factor favoring the establishment of a residence for a relocating worker. The Malhotra study reported that 40 to 50 percent of a relocating construction workforce plans to remain in the area following the completion of a power plant. Workers allowing for this possibility, in particular, would tend to select a residence within likely commuting distance of subsequent employment opportunities near the larger cities (Reference 4.4-25). Such considerations would favor relocation in or near the larger communities, particularly Baton Rouge, which is located approximately 24 mi. from the site, well within commuting distance of the RBS. This settlement pattern expectation is further bolstered by the fact that officials in West Feliciana Parish have indicated that there is currently a lack of worker and starting housing available in the parish. If this condition continues, it would act to limit the number of RBS construction workers locating in West Feliciana Parish and boost the percentage of those who would locate in Baton Rouge or in another primary impact area location outside of West Feliciana Parish. In other words, the pattern of relocation would be one of dispersal within the primary impact area.

The expectation that workers would be dispersed in the primary impact area and concentrated in Baton Rouge is supported by Pijawka's study of 12 nuclear power plants that found, for projects located less than 50 mi. from a city of at least 50,000 "a dispersed settlement pattern of movers was observed" as the larger cities became the selected residence for a large percentage of the workforce (Reference 4.4-26).

Another factor that would tend to change the location of workers relative to the RBS Unit 1 worker location is the addition of the John James Audubon bridge, scheduled for completion in 2010. This project would allow for an easy commute from Pointe Coupee and West Baton Rouge parishes and would be expected to result in some settlement of the Unit 3 construction workers in these two parishes. The construction of new power plants at Big Cajun I and II in Pointe Coupee Parish provides additional support for the assumption that these two parishes would be home to some of the RBS Unit 3 construction workforce.

Given the above considerations, it is expected that the relocating workforce would follow a pattern of settlement that, with certain modifications, generally reflects the distribution of the primary impact area labor force. Appropriate modifications include a higher than proportional distribution of RBS Unit 3 construction workers in West Feliciana Parish due to the location of the RBS. Second, a higher than proportional RBS Unit 3 labor force could be anticipated in Pointe Coupee and West Baton Rouge parishes. While the exact distribution of relocating workers cannot be predicted with certainty, an approximate estimate of settlement patterns can be made and is required to develop reasonable projections of impacts on the demand for parish facilities and services.

Table 4.4-3 indicates the percentage breakdown of the 2000 labor force in the primary impact area parishes and provides an assumed settlement pattern of the 788 relocating workers, based on the previous considerations. Rounding up, a total of 63 of the 788 project construction workers are projected to reside in West Feliciana Parish. Thus, while the West Feliciana Parish total labor force is just 2 percent of the primary impact area labor force, 8 percent of the assumed relocating workers at peak are predicted to reside in the parish for the purposes of this impact analysis. Pointe Coupee (65 workers), East Feliciana (54 workers) and West Baton Rouge (66 workers) parishes are projected to account for two times their proportionate share of the primary impact area total labor force, while East Baton Rouge Parish is projected to accommodate the largest number of workers (540), though less than its proportionate share of the total labor force. For purposes of the impact analyses listed below, it was assumed that each worker relocating to the primary impact area would establish a household.

4.4.2.2 Local Housing

Housing impacts would occur as a result of worker relocation. These impacts include added tenants, renters, and buyers for housing units for rent or for sale. This process has the potential for both positive and negative impacts. On the positive side, the added demand for housing would have a beneficial income-generating impact for the current owners of housing properties. On the negative side, an increase in the demand for housing could increase the price for housing, especially the cost of short-term rental properties. This could be an issue in West Feliciana Parish, in particular, where, as stated in Subsection 2.5.2.5, there are currently an insufficient number of worker and starter homes. If this condition persists, the number of relocating project workers to the parish could be lower than the number that might otherwise choose to reside in West Feliciana Parish. However, the parish is currently in the process of studying the need for additional worker and starter housing and ways to better zone the parish for such homes.

Table 4.4-4 lists the number of vacant housing units in the primary impact area in 2000. The table indicates that, of the 200,140 housing units in the primary impact area, a total of 17,371 housing units were vacant. Thus, if each of the 788 projected relocating workers rented or purchased a vacant unit in the primary impact area, it would represent less than 1 percent (0.39 percent) of the total housing stock in 2000, and approximately 4.5 percent of the vacant housing units in 2000. Based on the projected growth of primary impact area housing stock (from Table 2.5-39), a total of 226,398 houses in the primary impact area are forecast for 2014, when the projected 788 relocating workers would demand 0.35 percent of the total housing stock and 4.0 percent of the vacant housing units in the primary impact area (19,650 vacant units, assuming the vacancy rate in 2000 continues). Although not all vacant units would be suitable for rent, the relatively small percentage of vacant housing units involved should not create a significant inflationary impact in the housing market in the primary impact area. Another perspective supporting this conclusion is that, even if all of the 788 relocating workers moved to the primary impact area just prior to construction peak, the percentage increase in the demand of 0.35 percent would be well within the long-term annual average growth rate in the number of housing units for the primary impact area (0.86 percent per year from Table 2.5-39). Furthermore, the housing impact could be smaller than projected if (1) some of the relocating workers share a house or apartment, (2) some permanently relocating workers build new housing, and (3) some workers locate within the region but outside the overall primary impact area. Because of all of these considerations, the impact on the housing market in the primary impact area would be SMALL.

Of the parishes within the primary impact area, the largest impact on housing would be expected to occur in West Feliciana Parish, which has the lowest number of housing units in the primary impact area. The possibility for noticeable impacts is increased, given the occasional demand for additional housing during refueling of RBS Unit 1 every 18 months and the previously indicated current shortage of low-to-moderate priced housing units. Thus, although the overall housing impact on the area should be small, the temporary impacts on the West Feliciana Parish housing market could be SMALL to MODERATE.

The conclusion that any negative housing market impacts in the primary impact area would, at most, be SMALL and temporary is supported by the EPRI study, which found that a "key variable affecting housing impacts is the proximity of the impacted area to a major metropolitan area." Where a relatively large city was nearby, workers largely chose to "live in cities and commute daily to work, rather than moving to towns in the immediate vicinity of the plant" and "housing markets in the small towns closest to the plants…were not seriously affected, while the larger cities easily absorbed the increased demand for housing" (Reference 4.4-27). Similarly, the Pijawka study reported that "impacts on the housing sector in terms of price and overcrowding were temporary and relatively unimportant." In the 12 case studies leading to Pijawka's conclusion, the demand for local housing ranged from 1.2 percent to more than 25 percent of the total housing stock, a significantly higher percentage than is anticipated for RBS Unit 3 construction (0.4 percent of the primary impact area housing, from Table 4.4-4). The Pijawka study also summarized two additional studies, stating that they "support the conclusion that adverse housing impacts were either short-lived or not an important issue in the host communities" (Reference 4.4-28).

The GEIS stated that "moderate and large impacts are possible at sites located in rural and remote areas, at sites located in areas that have experienced extremely slow population growth (and thus slow or not growth in housing), or where growth control measures that limit housing development are in existence or have recently been lifted." However, of the seven case studies reviewed, the GEIS concluded that "in most cases, project-related housing demand was so small or the local and regional housing markets were so large that no large impacts resulted" (Reference 4.4-29). Of the seven projects evaluated, the two projects having a moderate impact on housing required 6.25 and 2.7 percent of the total number of housing units in the study area, and the project having large impacts required 18 percent of the total number of housing units in the study area (Reference 4.4-29).

4.4.2.3 Regional Tax

Regional taxes would be generated in several tax categories as a result of the construction of RBS Unit 3. These tax categories include the following:

- Income taxes on worker incomes.
- Sales taxes on worker expenditures.

- Sales taxes on goods and services purchased in the state.
- Property taxes or payments in lieu of taxes based on the value of RBS Unit 3.
- Additional income and sales taxes would arise through the re-spending of income in the form of direct expenditures on goods and services by construction workers or the purchase of goods and services for the site.

With regard to local purchases of materials and supplies, the state sales tax rate is 4 percent and the local sales tax rate for West Feliciana is also 4 percent. Effective July 1, 2008, the machinery and equipment purchased by a utility will be exempt from the state 4 percent sales tax. West Feliciana Parish has the authority to also exempt the purchase of machinery and equipment from the local sales tax. To date, West Feliciana has not opted to exempt the purchase of machinery and equipment from its 4 percent local sales tax.

Related to property taxes associated with Unit 3, Louisiana has an incentive program, the Industrial Property Tax Exemption program, to encourage capital investment in the state. The Industrial Property Tax Exemption abates, up to 10 years, local property taxes (Ad Valorem) on a manufacturer's new investment and annual capitalized additions. This exemption applies to all improvements to the land, building, machinery, equipment, and any other property that is part of the manufacturing process. Thus, Louisiana and West Feliciana Parish would benefit from property taxes related to the incremental increase in value to the entire RBS site from the additional unit 10 years after the unit is placed in service.

Related to state income taxes, in Louisiana, an individual's personal income is taxed at graduated rates not to exceed 6 percent. Based on assumed total labor costs of $472 million (refer to Subsection 4.4.2.4.6) and assuming an average 4 percent applicable state personal income tax rate, the construction of Unit 3 could generate approximately $19 million in state income taxes.

Discussions with West Feliciana Parish officials underscored the importance of RBS Unit 3 on the local economy from a tax revenue perspective. This was confirmed by members of the West Feliciana Parish Policy Jury, Parish Sheriff, and a member of the West Feliciana Community Development Foundation. The Parish Policy Jury President stated that the community is strongly in favor of a new unit because the existing RBS Unit 1 is depreciating 2 to 3 percent per year, thus reducing the ad valorem benefits provided. The Parish Sheriff indicated that there is overwhelming support for RBS Unit 3 because of the associated tax benefits to the parish. The West Feliciana Community Development Foundation member acknowledged that most local tax revenues for the parish come from the RBS. Therefore, impacts are anticipated to be SMALL.

4.4.2.4 Local Public Services

There is the potential for a number of local public services in the primary impact area to be affected by construction of RBS Unit 3. Key categories of impacts to be evaluated include those on schools, transportation, local taxes, public services, and public utilities. Given that the estimated 788 relocating RBS Unit 3 construction workers are projected to be less than one-tenth of a percent (0.09 percent) of the 50-mi. radius population of 859,874 in 2000, a detailed assessment of the potential impact on the entire region is not provided. Instead, the following discussion is limited to the impacts likely to occur in the five primary impact area parishes of West Feliciana, East Feliciana, West Baton Rouge, East Baton Rouge, and Pointe Coupee.

In discussing the potential impacts on local community facilities and services, it can generally be stated that an increase in the employment and population base would increase taxes and user fees for the funding of continued facilities and services. However, the potential for negative impacts exists and could occur if worker relocation occurred rapidly and outpaced the area's ability to provide for the sudden increase in demand for such services. There could also be a mismatch of timing between when negative impacts are experienced and when added revenues are realized by local community governments. The potential for such impacts is evaluated herein. First, however, it is useful to understand the general findings of previous studies of nuclear and large power plant construction projects.

In general, previous studies have concluded that the degree of impact on local community facilities and services is strongly linked to the geographic location of the project. When projects are located near a large city and allow for both the local hiring of a significant percentage of the project workforce and the dispersal of relocating workers, negative impacts are relatively minor, though benefits are also widely distributed.

For example, the Pijawka study found that, due to the dispersed settlement patterns of in-migrants for plants located near large cities, "such locational characteristics had the effect of reducing the level of mover in-migration, thus diminishing potential adverse effects both on the provision and level of public services and on the social structure of the host community" (Reference 4.4-30). The Pijawka study further concluded:

> "Of the four major public service areas examined - education, transportation, public safety, and social services - the study found that there had been little demand for project-related expansion in public safety and social services. Traffic congestion, however, was found to be a serious problem at most sites. Project-related demands on the school system occurred at some of the sites, but in all these cases successful adjustments were made to absorb the students without deleterious effects on educational quality…of total pupil enrollment at the 12 sites, an average of only 2.9 percent was attributable to the nuclear plants. It should be noted, however, that at the taxpaying sites, plant-generated revenues contributed to an average of 40 percent of total school district revenues" (Reference 4.4-30).

Summarizing another study of the impact of Tennessee Valley Authority (TVA) nuclear plants and the Pilgrim Nuclear Plant in Massachusetts, the Pijawka study states that "because nuclear plants are located near areas having large labor pools, mass in-migration to the host communities was avoided and, consequently, few adverse effects occurred to community services" (Reference 4.4-15).

The GEIS reviewed the impact of the construction of seven nuclear power plants. The summary of socioeconomic impacts stated the following:

> "The significance of any given nuclear power plant to its host area will depend to a large degree on its location, with the effects generally being most concentrated in those communities closest to the plant. Major influences on the local communities

> include the plants effects on employment, taxes, housing, off-site land use, economic structure, and public services…Nuclear power plants can have a significant positive effect on their community environment. These effects are stable and long term. Because these socioeconomic effects generally enhance the economic structure of the local community, nuclear power plants are accepted by the community, and indeed, become a major positive contributor to the local environs" (Reference 4.4-29).

The EPRI study was more pessimistic about the impact on local services because the study included a number of power plants that were distant from larger communities. In such circumstances, small local communities tended to be saddled with a relatively large number of relocating construction workers, and the impacts on public schools, water and sewer facilities, streets and highways, parks and recreation, public safety, and fiscal resources were often a significant and negative factor. This was particularly an issue in the 5 of 12 plants studied that produced no associated property tax revenues because of the exempt status of the owner or prohibitive state or local laws. The EPRI study also noted that local impacts often preceded the receipt of the revenue benefits, and this mismatch tended to cause a temporary degradation in the provision of community services (Reference 4.4-30).

With this background, the potential for impacts of the RBS Unit 3 workforce was evaluated for the primary impact area parishes. The first area of discussion is the impact on education.

4.4.2.4.1 Education

It is estimated that 63 construction workers and families may relocate to West Feliciana Parish, based on the methodology discussed in Subsection 4.4.2. Other primary impact area worker and family allocations include those in East Feliciana (54), West Baton Rouge (66), Pointe Coupee (65), and East Baton Rouge (540). The potential impact on the educational system in these parishes is largely a function of the average number of school-age children per construction household, and the change in the pupil-to-teacher ratio that additional pupils may create. A district's physical ability to accommodate additional students without the need to construct new schools is also a key indicator of the potential for impacts.

The number of additional students expected in the primary impact area parishes from relocating RBS Unit 3 construction workers was estimated by taking the number of relocating workers assumed for each parish times the number of students per household in the primary impact area. From Table 2.5-16 and Table 2.5-40, the number of students per household was calculated to be 0.34 students, on average, for the primary impact area parishes. The resulting number of school-age children projected for the relocating RBS Unit 3 construction workers at peak is shown in Table 4.4-5 to be 21 for West Feliciana, 18 for East Feliciana, 22 for Pointe Coupee, 22 for West Baton Rouge, and 184 for East Baton Rouge. In total, 267 students from relocating RBS Unit 3 construction workers are projected at peak. For all parishes, the increase would represent less than a 1 percent increase in the 2005 - 2006 enrollment; the increase for the primary impact area as a whole would be 0.4 percent. This is a SMALL impact, especially when considering that this percentage increase is below the 0.84 percent 1990 to 2000 average annual growth rate in area population and below the annual average growth rate in primary impact area population (0.5 percent from Table 2.5-9).

Addressing the impact on student-to-teacher ratios, there were 2508 students and 186 full-time equivalent (FTE) teachers in the 2005 - 2006 school year in West Feliciana Parish (from Table 2.5-40). This equates to a 13.5 pupil-to-teacher ratio. An increase of 21 students in the parish at the time of peak construction employment would change the pupil-to-teacher ratio to 13.6, all other things being equal. Similarly, no other parish would experience a change in the student-to-teacher ratios of more than 0.1 pupil per teacher over the levels shown in Table 2.5-40. This is a SMALL impact.

Discussions with an official for West Feliciana Parish Public Schools confirmed that the impact from RBS Unit 3 construction should be SMALL and manageable. The official is a lifelong resident of the parish and recalled that, during RBS Unit 1 construction, there was an increase in the number of students in the school system, but the schools were easily able to handle the increase. The official expects the impacts to be similar or even smaller with RBS Unit 3, because the parish now has more classrooms and excess capacity. For example, the official indicated that the high school could accommodate up to 200 additional students. The official estimated that the middle school and elementary schools were large enough to accommodate more than 100 additional students.

With the exception of East Baton Rouge, authorities for the other primary impact area parish school districts also indicate that the increase in the number of students should be SMALL and manageable.

West Baton Rouge School District officials indicated that the district has seen moderate growth in enrollment for the past 2 years, but experienced decreases in enrollment for the prior 10 years. Of the 10 schools in the district, two schools (including the high school and one middle school) have ample room for additional enrollment, four schools have some room for growth, and the remaining four schools in the southern portion of the parish are experiencing growth and are adding classrooms and modular space. The approach of adding modular rooms has been adopted by the school board as a short-term solution until long-term trends are better understood.

In East Feliciana Parish, the enrollment in 2007 was 2913. District personnel indicated that, overall, up to 1000 students could be added without needing additional capacity. The 10-year trend in the district has been downward, and total enrollment in 1998 was 2871.

In East Baton Rouge, the district is operating near 100 percent of capacity, except in the high schools, according to district officials. This suggests that additional capacity would be needed in the near-term. If the decision to build new schools were made within the next few years, these schools would be in service well before the construction peak at RBS Unit 3.

In summary, the impact on the primary impact area parishes as measured by the increase in the number of students and the change in the student-to-teacher ratio attributable to the RBS Unit 3 construction workforce would be SMALL, though there could be MODERATE impacts on some individual schools should the addition of students occur in districts and in schools that are already at capacity during peak construction periods.

4.4.2.4.2 Transportation

Transportation to the RBS site would include workers and deliveries during the 60-month construction period. These trips would be in addition to the existing 600 operational staff at RBS Unit 1, occasional deliveries to RBS Unit 1, and the RBS Unit 1 maintenance workers traveling to the site for scheduled and unscheduled outages. During an RBS Unit 1 refueling, which occurs approximately every 18 months, an additional 1200 temporary workers may travel to the RBS site.

The number of RBS Unit 3 worker trips to the site is a function of the employment level at the site, the number of workers per car, and the number of shifts during construction. At peak, there would be an estimated 3150 workers. U.S. Census data indicate, that in the area, approximately 12.5 percent[a] of the population share a vehicle when commuting to work (Reference 4.4-31). Typically, the percentage of carpooling construction workers is higher than for the general population, and a carpooling estimate of 20 percent is a reasonable assumption. This would result in approximately 2835 RBS Unit 3 construction worker vehicles entering the site each workday. The following analysis assumes that there are two shifts during construction.

To develop a worst-case estimate of the total site traffic, it was assumed that the 2835 RBS Unit 3 worker vehicles would be divided into two shifts that would coincide with the operating shift at Unit 1. The day shift of RBS Unit 1 was assumed to include 400 workers, plus an additional 1200 workers during a refueling. While the RBS Unit 3 construction schedule may not coincide with the RBS Unit 1 O&M worker schedule since, for example, the construction workforce may be on 10-hour shifts that differ from the RBS Unit 1 schedules, a worst-case scenario for the morning commute would involve 1418 (2835/2) RBS Unit 3 worker vehicles plus (assuming a 12.5 percent commuting rate for Unit 1 O&M staff) 1500 worker vehicles (1600 x 0.9375) during a Unit 1 refueling. The resulting number of vehicles commuting to the site simultaneously for the day shift would be approximately 2918 vehicles, not including deliveries. In addition, there could be approximately 100 vehicles leaving the site at the end of the night shift (or more, depending on the hours of the second shift at RBS Unit 3), and non-RBS vehicular traffic on the roadway would add to the total traffic count.

For the evening commute, the flow would be basically reversed, plus the late shift for Unit 3 construction and Unit 1 operation could be traveling to the RBS site simultaneously under a worst-case scenario. RBS workers would likely enter the RBS Unit 3 parking area via the two routes of North Access Road and State Highway 965. Barring the issuance of passes that assign given percentages of the construction workforce to specific entrances, it is not possible to precisely predict which of the two access roads would be taken by the RBS Unit 3 construction workforce. The selected route would primarily be a function of obtaining access to the site quickly and safely.

The potential for a large number of commuting vehicles raises the possibility that negative and MODERATE to LARGE traffic impacts could occur temporarily during the peak construction period; this would be consistent with the experience at other large power plant projects. In the EPRI study of 12 power plant projects, for example, "traffic problems and congestion were mentioned as a negative factor in all 12 case studies" (Reference 4.4-32).

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a. 85,726 of the 675,078 workers carpooled to work in 2000.

The potential for negative traffic impacts would occur primarily on U.S. Highway 61, though the potential for negative impacts would be reduced significantly (compared to current conditions) by the expansion of U.S. Highway 61 to a four-lane highway north of Baton Rouge. This expansion project could theoretically increase the total passenger car equivalent capacity of the two northbound lanes to approximately 4000 per hour, based on the maximum capacity figure estimated by the Transportation Research Board (TRB). However, in practice, this maximum capacity figure would decrease as vehicles slow to enter the RBS (Reference 4.4-33). Given the dynamics involved, it would be necessary to study the potential for level of service (LOS) impacts arising from the construction of Unit 3.

To gain insight regarding the type of traffic analysis required, discussions were held with a number of officials at the Louisiana Department of Transportation and Development (LDOTD) in Baton Rouge. The LDOTD indicated that a traffic impact rule had been passed requiring a traffic impact study (TIS) to be performed for private developments that have the potential to affect the state or federal roadway network. The model to be used is the LOS model issued by the TRB, which is part of the National Academy of Sciences. The LDOTD also forwarded a department report titled "Traffic Impact Policy for New Access Requests," which discusses the details of the required TIS (Reference 4.4-34). According to the document, a TIS is usually required when (1) a new business, subdivision, or apartment complex is planned and would affect the highway network, (2) additions to any of the above occur that were not part of the initial development, or (3) any development occurs that would generate traffic greater than an additional 100 trips at the peak hour and in the peak direction. Thus, RBS Unit 3 would appear to trigger the first and third criteria.

When access to a state or federal highway is requested or if significant impacts are expected as the result of project development, the development owner/applicant should arrange a preapplication meeting to formally determine if a TIS is required and to outline the standards for the study. If a TIS is required and recent traffic counts are not available, the applicant may be required to gather new traffic count data. The TIS is then performed and the baseline (without the project) LOS (ranging from the best level of service, A, to the worst level of service, F) is determined. The change in the LOS due to the project is measured by adding in the project-related traffic. Depending on the LOS impact, mitigation may be required and the TRB model can run multiple scenarios to determine the best mitigation activities; e.g., the addition of turn lanes or the lengthening of an existing turn bay.

Normally, the LDOTD requires a "B" LOS for through-traffic in rural areas. The LOS is normally allowed to drop to "C" in urban areas. When asked if these same standards apply for temporary construction projects, the LDOTD indicated that it would need to have more detailed information and study results before it could comment.

If mitigation is required and attributed to the private development project, the cost of the mitigation activity is borne by the developer, though in cases where significant economic benefits are associated with a project, the developer/owner may be able to request assistance with the cost of mitigation or modification from other state agencies or the state legislature.

Because of multiple unknown factors and future decisions that would affect the LOS study, some of which (e.g., shift scheduling) could reduce traffic impacts without significant cost, the Applicant has decided not to undertake a detailed LOS traffic analysis at this time. The Applicant will pursue these studies at the appropriate time and in conjunction with the LDOTD.

It is anticipated that there would be no significant impacts on area railways, airports, or bodies of water due to construction activities, although the Mississippi River would likely be used to transport some equipment to the site. Barging in heavy materials and equipment to the site minimizes the impacts associated with the transport of these commodities. The potential for negative impacts, such as congestion on the river, would be minimized because of the existing barge slip created for RBS Unit 1, which would be dredged to allow for barge deliveries to support RBS Unit 3. The Applicant's property encompasses the barge slip and the River Access Road from the river to the power block area. All deliveries of equipment, materials, and supplies would be made by roadway or barge.

4.4.2.4.3 Public Safety and Social Services

The possibility exists that construction activities could result in an increased demand for safety and emergency services at the site, or that workers relocating to the primary impact area parishes could produce a slight increase in demand for such safety and social services. These services could include demands for police, fire, ambulance, and hospital services. However, given the estimated small percentage of additional households in all parishes arising from RBS Unit 3 construction, and given that these additions are well within the long-term historical growth rate of housing and the 0.50 percent forecasted population growth for the area, it is expected that the additional households would represent a SMALL increase in the demand for police, ambulance, or hospital services in the primary impact area. Therefore, the next three sections focus on the potential for increased demands for local services arising from activity at the RBS site.

RBS Unit 3 construction activities have the potential to negatively affect local community public safety facilities and services. However, construction practices would be designed with the specific intent to minimize or eliminate negative impacts, and the expected impact on the following services is SMALL.

A construction safety plan will be developed for the site and will conform to all industry requirements and regulations. This plan would facilitate a safe working environment for the construction workforce. The safety plan would comply with all OSHA requirements, all workers would undergo training to familiarize themselves with the safety plan, and every member of the construction workforce would be required to adhere to the established standards. Examples of proven safety measures include the required use of hard hats in construction areas, the availability of first aid supplies, and the required use of tie lines for those working at elevated heights.

In addition, there would be limited access to the construction area. Security guards would be posted on-site, and a badge system would be used to control personnel access. The site would include security lighting and fire suppression equipment. First aid stations would be established and maintained throughout the RBS Unit 3 construction area. First aid training would also be provided to selected individuals in the construction workforce. Standard procedures would be adopted for spill prevention and containment, injury response, and requests for assistance from local police, fire, and ambulance services.

If outside medical assistance is needed, the nearest emergency responders to the RBS Unit 3 site are the ambulance units at the West Feliciana Parish Hospital located in St. Francisville. If necessary, hospital service could also be provided by the 14 hospitals in the primary impact area; among these hospitals, virtually any specific medical expertise would be available for worker needs. Given that Baton Rouge is approximately 30 minutes from the site and that St. Francisville is approximately 5 minutes from the site, if required, quick transport to a hospital would be available.

The degree to which the Applicant has been able to minimize the need for local police, fire, and hospital services during the construction and operation of RBS Unit 1 is evident in the comments and opinions expressed by local parish safety and medical personnel. An official for the West Feliciana Parish Hospital stated that the hospital was not expected to encounter significant negative impacts due to the construction and operation of RBS Unit 3. The official mentioned that the Applicant is quite self-sufficient with its own health services and that few Entergy employees have come to the West Feliciana Parish Hospital in his/her 7-year tenure. Similarly, the West Feliciana Parish Sheriff's Department indicated that, when RBS Unit 1 was constructed, there were not any significant safety or crime issues or additional staff hired. Looking forward to the possibility of RBS Unit 3 construction and the need for additional staff, the department commented that it anticipated hiring an additional police officer per shift to accommodate the growth associated with the expansion of U.S. Highway 61 and general parish development, and believed that this would be sufficient to accommodate any increased needs arising from RBS Unit 3 construction.

Should firefighting equipment be required that exceeds the RBS on-site capabilities, the West Feliciana fire station personnel would be contacted and assistance would be requested. Similarly, should the on-site security require assistance, the West Feliciana Sheriff’s Department could be contacted. As stated in Section 2.5, the Sheriff’s Department also has cooperative agreements with other parish departments. Furthermore, because the plant is a nuclear facility, the National Guard could be assigned if the security level becomes elevated.

4.4.2.4.4 Public Utilities

Construction of RBS Unit 3 would require on-site electricity, water, and waste facilities. All of these impacts, however, would represent no more than a SMALL increase in demand for local utility services. Section 4.2 discusses the need for construction water requirements and the provision of these needs from on-site sources. Similarly, all sewer services would be handled on-site. In addition, the need for construction power would not place an undue burden on the grid system and, following a short-term net demand for power during construction, RBS Unit 3 would provide a significant increase in installed electric capacity for the region. While the Applicant has recently purchased additional water from Water District 13, this would not significantly affect the district's ability to provide service because Water District 13 has indicated that, even at its peak level of demand, it is operating at only 35 percent of its capacity.

4.4.2.4.5 Recreation, Tourism, Aesthetics, and Land Use

One of the primary advantages of RBS Unit 3 is that it would be built on an existing site. In addition, the delivery of equipment would not require any new roads. Consequently, the impacts on recreation and tourism due to construction should be SMALL. The primary impact would be on the Applicant's property, where the Sportsman's Club hunting activities could be affected during the construction period through increased traffic flow and noise from construction, and the possible increased travel time to other recreational areas if travel occurs during the peak RBS Unit 3 commuting period.

From an aesthetics perspective, the construction of RBS Unit 3 would occur in the heart of the 3300-ac. RBS site, and most of the activity would not be visible from beyond the site. The primary exceptions are the temporary increase in traffic volume that would noticeable, particularly during the peak construction months, plus the NDCT that would be approximately 550 ft. tall and would become visible from beyond the site as construction proceeds, therefore, affecting the visual aesthetics of the area. There would also be an impact associated with the barge slip on the Mississippi River, which would be dredged and extended to River Road so that some of the larger pieces of equipment can be delivered. However, River Road is a very lightly traveled road, and the impacts associated with this visual impact would be SMALL. After construction is complete, the aesthetic and visual impacts associated with construction would recede, with only the cooling tower impact remaining visible from off-site.

It is also very significant to note that the construction of RBS Unit 3 would produce economic benefits while conforming to the objectives established in "Land Use and Growth Management Plan: Strategies, Policies, and Guidelines" for West Feliciana Parish (the Plan). Specifically, RBS Unit 3 will conform to the following long-term goals that relate most directly to the culture in West Feliciana Parish (Reference 4.4-35):

- *Goal: Maintain the natural beauty and rural nature of the parish*. This would be met because RBS Unit 3 would be constructed on the existing site, adjacent to RBS Unit 1.

- *Goal: Preserve agricultural, wildlife habitat, and forestry use or property*. Such areas would be preserved, because the existing site would be used for construction.

- *Goal: Maintain the historic character of the parish*. RBS Unit 3 construction would not affect the historic town of St. Francisville directly, other than the possible visibility of the cooling tower from some locations, and the historic character of the parish would be minimally affected, as discussed in Section 4.6.

- *Goal: Respect the small town character of St. Francisville*. RBS Unit 3 construction would not change the small town character of St. Francisville, and most relocating construction workers are expected to opt for residing in the larger Baton Rouge metropolitan area.

- *Goal: Discourage suburban sprawl and conserve land*. This goal would be met because the existing site would be utilized for construction.

- *Goal: Encourage development of land where infrastructure is already available*. Adequate infrastructure is available or would be built on-site to accommodate the development of RBS Unit 3.

- *Goal: Expand recreational and educational opportunities for the residents*. While not directly contributing to this goal, the parish revenues associated with RBS Unit 3 could be used to further this goal.

- *Goal: Maintain "Greenbelts" and the rural character of roads in the parish*. Construction of RBS Unit 3 would provide temporary negative transportation flow impacts, but should not significantly affect the Greenbelts in the parish because the widening of U.S. Highway 61 is scheduled to occur independent of RBS Unit 3 construction.

- *Goal: Encourage tourism development, "eco-tourism" development, and economic development*. While not directly contributing to the goals of tourism and eco-tourism development, the parish revenues associated with RBS Unit 3 could be used to further this goal. RBS Unit 3 construction would directly contribute to economic development through employment and income creation.

- *Goal: Encourage housing areas for all income groups*. Construction of RBS Unit 3 would not directly affect this goal, though the construction workforce could utilize additional housing that becomes available. RBS Unit 3 operating staff could also choose to construct housing in the parish.

- *Goal: Limit signs and visual clutter*. The construction of the project would not significantly affect visual clutter because the site is surrounded by a significant tree buffer zone and only the cooling tower would be visible from certain locations on U.S. Highway 61 and beyond. It is possible that traffic mitigation measures could require temporary signs near the plant access routes off of U.S. Highway 61.

To achieve these goals, the Plan establishes a number of guidelines that include promotion of compact development patterns and the preservation of open space. Supporting policies include "land development in areas that are already served by infrastructure and discouraging growth in areas where expensive, publicly financed infrastructure must be built" and to "encourage future growth near existing development in order to promote compact growth" (Reference 4.4-35). RBS Unit 3 construction at an existing site is consistent with these guidelines and the designation of the RBS and the future West Feliciana Business Park vicinity as industrial areas. Therefore, land use impacts would be SMALL.

4.4.2.4.6 Local Employment and Income

As discussed above, it is reasonable to assume that approximately 75 percent, or 2363 of the peak construction workers, would be from the existing workforce in the primary impact area; this would be a MODERATE to LARGE area benefit. In addition to the direct employment benefits, there would be employment and income multiplier impacts arising from the construction jobs at the RBS and the local expenditures made during construction.

This subsection estimates the multiplier impacts in the primary impact area associated with the construction of RBS Unit 3.

One way to estimate the multiplier impact of a new investment in a region is through the use of a regional input-output model, which can estimate an expected industry multiplier to be applied to the direct impact estimates. Input-output models typically use an accounting matrix that shows the change in output, earnings, or employment in all industries due to a change in investment in one industry. To estimate the impact of RBS Unit 3, the Regional Input-Output Modeling System (RIMS II model), developed and maintained by the U.S. Bureau of Economic Analysis, was used.

The RIMS II model can produce multipliers for roughly 500 industry classifications and, as a static equilibrium model, can predict the total impact associated with an initial investment, though it does not predict the timing of impacts (Reference 4.4-36).

The RIMS II model requires the user to select a geographical area of study for which multipliers are estimated. Typically, this consists of contiguous counties near the investment location. For the RBS Unit 3 analysis, the primary impact area parishes of West Feliciana, East Feliciana, West Baton Rouge, East Baton Rouge, and Pointe Coupee were selected.

According to the Regional Multipliers User Handbook, the RIMS II model is based on annual data (Reference 4.4-36). Therefore, there was a concern that simply applying the multipliers to the peak RBS Unit 3 employment figure of 3150, which is the peak monthly employment figure, would tend to distort the multiplier effect. The approach taken was to develop levelized annual employment and income figures over the construction period, and to calculate the annual employment and income multiplier impacts arising from RBS Unit 3 construction. Using this method, the average annual employment level at the RBS Unit 3 site was estimated to be approximately 1600 over a 5-year construction period, which can be referred to as 8000 job-years in total (1600 x 5). Based on the 2005 data for Baton Rouge workers and the mix of the construction workforce, the estimated average 2005 salary was $45,175 (Reference 4.4-37). Escalating to the midpoint of construction at 3 percent and applied to the 1600 job-years at the site each year, the project would generate approximately $94.3 million per year in direct wages on an annual average basis. Over a 5-year period, the project would produce approximately 8000 job-years of employment and $472 million in direct earnings.

The multiplier results for the annualized employment and income impacts are summarized in Table 4.4-6. Listed within the table are the direct annual average earnings and job-year figures associated with RBS Unit 3, the RIMS II multipliers, and the resulting total estimated impact on regional earnings and employment. As indicated in the table, the $471.5 million in direct annual construction earnings is projected to generate total primary impact area earnings of $853.7 million, and the 8000 job-years of employment at RBS Unit 3 would generate a total of 15,237 job-years of regional employment.

4.4.3 ENVIRONMENTAL JUSTICE IMPACTS

The purpose of the environmental justice review is to determine if low-income and minority populations would bear a disproportionate share of adverse health or environmental consequences of a proposed project, which in this instance would be the construction of a new reactor at the RBS site. Potential areas of impact that deserve special attention include cultural, economic, and human health impacts.

Based on the analysis presented in Subsection 2.5.4, no parish or county in the region qualifies as a low-income area, although some Census Block Groups (CBGs) within certain counties do qualify as low income. These low-income areas are shown in Figure 2.5-19, which indicates that no CBGs within West Feliciana Parish or East Feliciana Parish are low income, and only one CBG in Pointe Coupee Parish is low income.

U.S. Census data indicate that three parishes in Louisiana and two counties in Mississippi (located partially or wholly in the 50-mi. radius of the RBS Unit 3 site) qualify as minority areas.

These minority areas were indicated in Figure 2.5-18 and because West Feliciana Parish is among the minority areas (51.9 percent minority population), a closer examination at the minority population characteristics is warranted, particularly with relation to the proposed location of RBS Unit 3.

Table 4.4-7 lists the percentage of minority population at various distances from the RBS site. The table indicates that, compared to the 51.9 percent minority population at the parish level, the percentage of minority population at various radii up to 10 mi. from the RBS ranges no higher than a 46.7 percent minority population (at the 0- to 10-mi. radius). The table also indicates that the 1-mi. radius has a 0 percent minority population. This percentage increases to 43.4 percent minority at the 0- to 2-mi. radius, 42.4 percent at the 0- to 3-mi. radius, 37.1 percent minority at the 0- to 4-mi. radius, and 40.3 percent at the 0- to 5-mi. radius. Thus, compared to the state-wide minority percentage of 36.1 percent, the population within a 10-mi. or less radius from the RBS does not qualify as a minority area (which would require more than 50 percent or 20 percent above the state average).

Similarly, Table 4.4-8 and Figure 4.4-2 indicate that of the seven populated CBGs in West Feliciana Parish (Tract 9517.01 BG 4, northwest corner of the parish, is not populated), only two qualify as minority population areas, and these are shown in Figure 2.5-18 as the two shaded CBGs on the western portion of West Feliciana Parish, farthest from the RBS. In Figure 4.4-2, the minority CBGs are Tract 9517.02 BG 1 and Tract 9517.01 BG 5. The remaining five CBGs near the RBS have a minority population of between 23.5 and 44.1 percent. Three of these five CBGs have minority populations below the state average, and the CBG in which the RBS is located has the lowest minority percentage in the Parish, 23.5 percent, some 14 percentage points below the state average.

The following two subsections evaluate the environmental justice concerns in the areas of low-income and minority populations, based on the previous statistics for the region and areas near the RBS.

4.4.3.1 Impacts on Low-Income Areas

For there to be a significant concern that the culture, economy, or human health of low-income populations may be harmed as a result of the construction of RBS Unit 3, or receive a disproportionate share of negative impacts, the following criteria must be considered:

1. A low-income parish or CBG in proximity to the site would need to be present.
2. Negative cultural, economic, or health impacts on such populations would need to be expected.
3. The low-income areas would be expected to encounter a disproportionate share of negative impacts from the construction of RBS Unit 3.

The socioeconomic analysis found that no low-income parish or county exists in the 50-mi. radius of RBS Unit 3 and there is only one nearby CBG in Pointe Coupee Parish that qualifies as low income. Thus, based on the definition of low-income populations, the first criterion listed above only marginally applies.

The remaining discussion addresses the second and third criteria and uses information from previous sections to support the conclusion that (1) very minimal cultural and health impacts would be expected, while the economic benefits associated with RBS Unit 3 would be significantly positive, and (2) the low-income CBG would not encounter a disproportionate share of any negative impacts.

The potential health impacts on local populations from construction of RBS Unit 3 are expected to be limited to minor noise impacts and possibly impacts related to the increased emissions and delays associated with worker vehicles and transportation of materials and supplies to the site. These impacts are temporary impacts primarily limited to the RBS site, areas adjacent to the site, and the roadway network near the site. Because of the limited geographic nature of such impacts, the nearest low-income CBG in Pointe Coupee Parish would not be affected.

Concerning cultural impacts, a culture can be defined as "the ideas, customs, skills, arts, etc., of a given people in a given period" (Reference 4.4-38). Previous discussions have indicated that because of the expected concentration of the relocating workforce in the Baton Rouge area, only a limited number of workers would be expected to relocate in West Feliciana Parish and in the nearest low-income CBG in Pointe Coupee Parish. This implies that the potential for a significant change in culture that could theoretically be brought about by a change in population mix is minimal. There is no reason to expect that the cultural impacts on any low-income populations would exceed the impacts on the population as a whole. In fact, it is likely that any negative impacts during construction would be borne primarily by populations near the RBS site, where average income levels were previously shown to be much higher than the parish average.

Related to economic impacts, the previous socioeconomic impact sections have concluded that the impacts of RBS Unit 3 construction are almost wholly positive and beneficial to the region. Primary benefits include employment and income benefits, and increased tax revenues. Though the most significant economic benefit would occur in West Feliciana Parish as a result of increased property tax revenues, all areas in the primary impact area would benefit economically from the project. Generally, low-income populations can be assumed to benefit from these impacts to a comparable degree as other regional populations. In summary, the impacts on low-income populations is projected to be SMALL.

4.4.3.2 Impacts on Minority Populations

The same process followed in the previous section for low-income populations can be applied to determine whether minority populations would be negatively and disproportionately affected by the construction of RBS Unit 3. That is, for there to be a significant concern that the culture, economy, or human health of minority population areas may be harmed as a result of the construction of RBS Unit 3 or receive a disproportionate share of negative impacts (1) minority Parish individuals or minority CBGs in proximity to the site would need to be present, (2) negative cultural, economic, or health impacts on such populations would need to be expected, and 3) the minority areas would be expected to encounter a disproportionate share of negative impacts from the construction of RBS Unit 3.

West Feliciana Parish is classified as a minority parish, and thus meets the first criterion listed above. However, because the eastern CBGs in the parish, including the CBGs containing the RBS, do not qualify as minority population areas, any impacts that are limited to the plant site and the immediate area near the site would not affect a minority CBG. Similarly, populations in the 0- to 1-mi. radius through the 0- to 10-mi. radius are not classified as minority populations; therefore, environmental justice concerns for minority population areas would not be an issue. Even so, there are some minorities residing in the area near the RBS. As explained in Subsection 4.4.3.1, the expected impacts on health and culture should be neutral or very minor near the site. Thus, it can be concluded that any negative cultural or human health impacts on minorities would be temporary, SMALL, and would not disproportionately affect minorities in the immediate project vicinity.

4.4.3.3 Isolated Population Impacts

The conclusions above - that there would be no environmental justice impacts - were reinforced by each parish official interviewed on the topic. This is an important confirmation, because it is possible that small groups of low-income or minority populations could be present and not detected at the CBG level. These potential populations could be involved in subsistence activities near or on the site and could be affected by RBS Unit 3 construction.

The West Feliciana Parish Sheriff's Department did not believe environmental justice to be relevant, because it indicated that there are few minorities living near the plant site. It emphasized that there would be near-universal support for the facility because it would bring employment, tax, and income benefits to the entire parish and this would benefit minority and low-income populations. A member of the West Feliciana Community Development Foundation concurred with this opinion; this individual has great familiarity with the issue of environmental justice, given a background in the petro-chemical industry. This individual concluded that environmental justice would not be a factor with RBS Unit 3; there was no knowledge of any individuals who subsist on fishing, wildlife, or farming that would be negatively affected by construction or operation of RBS Unit 3, given its location on a large, existing site. This opinion regarding the lack of subsistence living in direct association with the existing RBS site is in agreement with that of Entergy. This individual believes that RBS Unit 3 would be very positive for the parish and have far-reaching effects, such as helping to boost the retail industry in the parish. Likewise, a member of the West Feliciana Police Jury cited the fact that RBS Unit 3 would be constructed on an existing site, near a minimally populated area, and that no one would be displaced from their homes because of the project. It was believed that the community would welcome the construction jobs and that the entire parish would benefit from a new unit. Therefore, impacts are anticipated to be SMALL.

4.4.4 SUMMARY

The potential for negative environmental impacts during construction would largely be minimized through the application of routine construction procedures and the location of RBS Unit 3 at an existing and relatively remote site. Routine procedures include those in the areas of site security, employment screening, fire protection, medical preparedness, spill containment measures, dust suppression, and other measures.

In the area of noise control, standard control measures for construction equipment, such as the use of silencers on diesel powered equipment exhausts, are expected to be employed to limit the noise emissions from station construction. Additionally, administrative measures should be employed to mitigate construction noise impacts. These administrative measures include limiting the types of construction activities during nighttime and weekend hours, notifying all affected neighbors of planned activities, and establishing a construction noise monitoring program, which should ensure a SMALL noise impact to the nearest noise-sensitive receptors.

As discussed above, the primary concern regarding pathways that could potentially cause negative impacts are the pathways associated with the volume of traffic that would be accessing the site during the peak and other months of construction, plus noise impacts near the site. With regard to this issue, it is expected that no low-income or minority group is likely to be disproportionately affected due to the distribution of these groups in the parish. Also, to help reduce safety impacts and delays on U.S. Highway 61 affecting populations near the site or in transit on the highway, the potential for traffic impacts and appropriate mitigation will be studied through a full LOS analysis at the appropriate time prior to construction. The traffic studies will follow that described in the LDOTD Traffic Impact Policy for New Access Requests (Reference 4.4-34).

The project is anticipated to bring significant economic benefits to the primary impact area. It is expected that the benefits to any low-income or minority group will be proportionate to the impact on the entire parish population. These benefits will include lower property taxes and the direct and indirect income and employment impacts arising from the project.

4.4.5 REFERENCES

4.4-1 Town of St. Francisville, Louisiana, *Code of Ordinances*, Section 8-79, "Unnecessary Noise, April 26, 2005, Website, http://library2.municode.com:80/mcc/home.htm?view=home&doc_action=setdoc&doc_keytype=tocid&doc_key=dc8793ddcb54dbd723a7c0ff20c8628c&infobase=14277, accessed September 10, 2007.

4.4-2 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., "Chapter 7 - Sound and Vibration" in *2001 ASHRAE Handbook - Fundamentals*, 2001.

4.4-3 Bies, D. A. and C. H. Handsen, *Engineering Noise Control*, Unwin Hyman, London, 1988.

4.4-4 Egan, M. D., *Architectural Acoustics*, McGraw-Hill Publishing Company, 1988.

4.4-5 Bolt, Beranek and Newman, Inc., *Fundamentals and Abatement of Highway Traffic Noise*, Report No. PB-222-703, 1973.

4.4-6 U.S. Environmental Protection Agency, "Noise Emission Standards for Construction Equipment," Document PB-250 430, 1975.

4.4-7 U.S. Environmental Protection Agency, "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances," Document NTID300.1, 1971.

4.4-8 Bolt, Beranek and Newman, Inc., *Power Plant Construction Noise Guide*, Report No. 3321, 1977.

4.4-9 Louisiana Department of Environmental Quality, "Procedures for Modeling 8-Hour Ozone Concentrations in the Baton Rouge 5-Parish Area," September 2006, Website, http://www.deq.state.la.us/portal/Portals/0/AirQualityAssessment/Engineering/Ozone/LADEQ_ModelingProtocol_Draft_073106.pdf, accessed July 31, 2007.

4.4-10 U.S. Environmental Protection Agency, *US EPA Green Book*, 2007, Website, http://www.epa.gov/air/oaqps/greenbk/, accessed July 31, 2006.

4.4-11 National Park Service, "Class I Receptors, National Park Service Database," 2007, Website, http://www2.nature.nps.gov/air/Maps/Receptors/index.cfm, accessed August 1, 2007.

4.4-12 Louisiana Department of Environmental Quality, "General Contractors," Website, http://www.deq.louisiana.gov/portal/tabid/1811/Default.aspx, accessed October 10, 2007.

4.4-13 Louisiana Administrative Code, LAC Title 33, Environmental Quality, Part III - Air, Chapter 13 - Emission Standards for Particulate Matter, Subchapter A - General, p. 105, Website, http://www.deq.louisiana.gov/portal/Portals/0/planning/regs/title33/33v03.pdf, accessed October 9, 2007.

4.4-14 Denver Research Institute and Browne, Bortz and Coddington for the Electric Power Research Institute, *Socioeconomic Impacts of Power Plants*, Chapter 4, p. 4, February 1982.

4.4-15 Pijawka, J., and J. Chalmers, "Impacts of Nuclear Generating Plants on Local Areas," *Economic Geography*, Vol. 59, No. 1, p. 72, January 1983.

4.4-16 Pijawka, J., and J. Chalmers, "Impacts of Nuclear Generating Plants on Local Areas," *Economic Geography*, Vol. 59, No. 1, p. 67, January 1983.

4.4-17 Denver Research Institute for the Electric Power Research Institute, *Socioeconomic Impacts of Power Plants*, Chapter 4, p. 2, February 1982.

4.4-18 Malhotra, S., and D. Manninen, *Migration and Residential Location of Workers at Nuclear Power Plant Construction Sites; Forecasting Methodology* (Volume 1) and *Profile Analysis of Worker Surveys* (Volume 2), Prepared by Pacific Northwest Laboratory for the U.S. Nuclear Regulatory Commission, p. 17, 1981.

4.4-19 Malhotra, S., and D. Manninen, *Migration and Residential Location of Workers at Nuclear Power Plant Construction Sites; Forecasting Methodology* (Volume 1) and *Profile Analysis of Worker Surveys* (Volume 2), Prepared by Pacific Northwest Laboratory for the U.S. Nuclear Regulatory Commission, p. 18, 1981.

4.4-20 Malhotra, S., and D. Manninen, *Migration and Residential Location of Workers at Nuclear Power Plant Construction Sites; Forecasting Methodology* (Volume 1) and *Profile Analysis of Worker Surveys* (Volume 2), Prepared by Pacific Northwest Laboratory for the U.S. Nuclear Regulatory Commission, p. 89, 1981.

4.4-21 U.S. Department of Labor, Bureau of Labor Statistics, Local Unemployment Statistics, Louisiana, Series ID LASST22000003, Website, http://data.bls.gov/cgi-bin/surveymost?la+22, accessed December 12, 2007.

4.4-22 U.S. Department of Labor, Bureau of Labor Statistics, Labor Force Statistics from the Current Population Survey, Series ID LNS14000000, Website, http://data.bls.gov/PDQ/servlet/SurveyOutputServlet?data_tool=latest_numbers&series_id=LNS14000000, and Series ID LNU04032231, Website, http://data.bls.gov/PDQ/servlet/SurveyOutputServlet, accessed December 19, 2007.

4.4-23 U.S. Department of Labor, Bureau of Labor Statistics, Website, http://www.bls.gov/webapps/legacy/cpsatab1.htm, accessed August 29, 2007.

4.4-24 NRG Energy, Inc., "Form 10-K," p. 27, 2006.

4.4-25 Malhotra, S., and D. Manninen, *Migration and Residential Location of Workers at Nuclear Power Plant Construction Sites; Forecasting Methodology* (Volume 1) and *Profile Analysis of Worker Surveys* (Volume 2), Prepared by Pacific Northwest Laboratory for the U.S. Nuclear Regulatory Commission, p. 21, 1981.

4.4-26 Pijawka, J., and J. Chalmers, "Impacts of Nuclear Generating Plants on Local Areas," *Economic Geography*, Vol. 59, No. 1, p. 71, January 1983.

4.4-27 Denver Research Institute and Browne, Bortz and Coddington for the Electric Power Research Institute, *Socioeconomic Impacts of Power Plants*, Chapter 7, p. 1, February 1982.

4.4-28 Pijawka, J., and J. Chalmers, "Impacts of Nuclear Generating Plants on Local Areas," *Economic Geography*, Vol. 59, No. 1, p. 76, January 1983.

4.4-29 U.S. Nuclear Regulatory Commission, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, Final Report, NUREG-1437, Vol. 1, pp. 27-28, May 1996.

4.4-30 Pijawka, J., and J. Chalmers, "Impacts of Nuclear Generating Plants on Local Areas," *Economic Geography*, Vol. 59, No. 1, p. 77, January 1983.

4.4-31 Land View® 6 on DVD with MARPLOTS® , a Viewer for EPA, Census Bureau and USGS data and maps, December 2003, Website, http://landview.census.gov.

4.4-32 Denver Research Institute and Browne, Bortz and Coddington for the Electric Power Research Institute, *Socioeconomic Impacts of Power Plants*, Chapter 8, p. 6, February 1982.

4.4-33 Transportation Research Board National Research Council, *Highway Capacity Manual Special Report 209*, pp. 2-4, Washington, D.C., 1985.

4.4-34 Louisiana Department of Transportation and Development, "Traffic Impact Policy for New Access Requests," March 2005.

4.4-35 West Feliciana Parish, "Land Use and Growth Management Plan: Strategies, Policies, and Guidelines," January 1998.

4.4-36 Bureau of Economic Analysis, "Regional Multipliers: A User Handbook for the Regional Input-Output System (RIMS II)," Website, http://www.bea.gov/scb/pdf/regional/perinc/meth/rims2.pdf, accessed March 25, 2008.

4.4-37 U.S. Department of Labor, "May 2006 Metropolitan and Nonmetropolitan Area Occupational Employment and Wage Estimates, Baton Rouge, LA," Website, http://www.bls.gov/oes/current/oes_12940.htm#b47-0000, accessed March 24, 2008.

4.4-38 *Webster's New World Dictionary*, Second College Edition, William Collins and World Publishing Co., Inc., p. 345, 1974.

4.4-39 Bureau of Economic Analysis, RIMSII Multiplier, "Primary Impact Area of West Feliciana Parish, East Baton Rouge Parish, West Baton Rouge Parish, Pointe Coupee, and East Feliciana," March 2008.

Table 4.4-1
Estimated Construction Equipment Noise Emissions

Equipment	L_{eq} (a)(b)(c) at 50 ft. (dBA)	L_{eq} at 3600 ft. (dBA)
Backhoe	80	43
Grader	82	45(d)
Dozer	83	46(d)
Front-End Loader	83	46(d)
Compactor	80	43
Trencher	74	37
Pile Driver	89	52(d)
Truck, Large	77	40
Concrete Vibrator	67	30
Concrete Saw	68	31
Mobile Crane	70	33
Stationary Crane	68	31
Diesel Generator	79	42
Air Compressor	76	39
Welder	68	31
Grinder	75	38
Forklift	76	39
Manlift	76	39

a) Average sound pressure level at 50 ft. (15 m) horizontal distance from the equipment.

b) Based on information provided in Reference 4.4-3 and information available from previous similar projects.

c) Energy average sound pressure level at 50 ft. (15 m) horizontal distance from the equipment for work shifts of 7 to 10 hours.

d) Indicates activities that are most likely to produce temporary perceptible changes in ambient sound level at the nearest noise-sensitive receptors during nighttime hours.

Table 4.4-2
Construction Workforce within a 70-Mi. and 50-Mi. Radius of the RBS

Category	70-Mi. Radius	50-Mi. Radius
Total Area Construction Workers, 2000	59,497	35,874
Projected Area Construction Workers, 2014	74,099	44,678
RBS Unit 3 Peak Employment Projection, 2014	3150	3150
RBS Unit 3 Peak Employment as a Percentage of 2014 Area Const. Employment	4.3	7.1
RBS Unit 3 Peak Employment from the Region if 75 percent are Hired Locally	2363	2363
RBS Unit 3 Employment from the Region as a Percentage of 2014 Region Const. Employment	3.2	5.3

Source: Reference 4.4-31.

Table 4.4-3
2000 Regional Labor Force in the Primary Impact Area and the Assumed Allocation of RBS Unit 3 Relocating Workers at Peak

Primary Impact Area Parish	2000 Labor Force	Parish Percent of Projected Impact Total	Assumed Workers Relocating at Const. Peak	Assumed Relocating Workers to Area Parishes[(a)]
West Feliciana	4798	2.0	788	788*.02*4 = 63
East Feliciana	8261	3.4	788	788*.034*2 = 54
West Baton Rouge	10,152	4.2	788	788*.042*2 = 66
Pointe Coupee	9732	4.1	788	788*.041*2 = 65
East Baton Rouge	206,885	86.3	788	788-248 = 540
Total	239,828	100.0	788	788

a) West Feliciana was assumed to have four times its percentage of the primary impact area total labor force locate in the parish; East Feliciana, Pointe Coupee, and West Baton Rouge were assumed to have two times their relative percentage of the total primary impact area labor force. The number of workers in these three parishes (248) was subtracted from the East Baton Rouge share.

Source: Reference 4.4-31.

Table 4.4-4
Regional Labor Force in 2000 for the Primary Impact Area and the Assumed Allocation of RBS Unit 3 Relocating Workers at Peak

Primary Impact Area Parish	Housing Units, 2000	Vacant Housing Units, 2000	Assumed RBS Unit 3 Relocating Households	Relocating Households (as % of Total Housing Units)	Relocating Households (as % of Vacant Housing Units)
West Feliciana	4485	840	63	1.4	7.5
East Feliciana	7915	1216	54	0.7	4.4
West Baton Rouge	8370	707	66	0.8	9.3
East Baton Rouge	169,073	12,708	540	0.3	4.3
Pointe Coupee	10,297	1900	65	0.6	3.4
Total	200,140	17,371	788	0.4	4.5

Source: Reference 4.4-31.

Table 4.4-5
Assumed Primary Impact Area of Relocating Worker Households and Students

Primary Impact Area Parish	Assumed RBS Unit 3 Relocating Households	Average Students per Household in the Primary Impact Area	Projected Additional Students from Relocating Construction Workers
West Feliciana	63	0.34	21
East Feliciana	54	0.34	18
West Baton Rouge	66	0.34	22
East Baton Rouge	540	0.34	184
Pointe Coupee	65	0.34	22
Total	788	0.34	267

Note: Average number of students per household calculated from Table 2.5-40 and Table 2.5-16.

Table 4.4-6
Projected Multiplier Impacts Associated with RBS Unit 3 Construction

Period	Impact Category	Earnings	Employment
Construction	Direct	$471.5 million	8000 job-years
	RIMS II Multiplier	1.8104	1.9046
	Total Impact	$853.7 million	15,237 job-years

Source: Reference 4.4-39.

Table 4.4-7
Minority Population and Housing Data (by Distance from RBS Unit 3)

Mile Range	Population	White	Minority[a]	Housing Units	People / House	Percent Minority
0-1	41	41	0	23	1.8	0.0
0-2	483	273	210	240	2.0	43.4
0-3	1772	1021	751	753	2.4	42.4
0-4	3047	1917	1130	1327	2.3	37.1
0-5	4566	2725	1841	1863	2.5	40.3
0-10	24,756	13,200	11,556	9455	2.6	46.7
Louisiana	4,468,976	2,856,161	1,612,815	1,847,181	2.4	36.1

a) A minority individual is defined as an individual who is "American Indian or Alaskan Native; Asian: Native Hawaiian or Pacific Islander; or Black races; or Hispanic ethnicity" (Reference 2.5-46).

Source: Reference 4.4-31.

Table 4.4-8
West Feliciana Census Block Group Minority Data

Tract	CBG Code	Population	White	Minority[a]	Minority Percent	Individual in Poverty Percent
9517.01	1	1360	760	600	44.1	29.98
9517.01	5	1792	595	1197	66.8	38.52
9517.01	4	0	0	0	0	0
9517.02	1	5496	1570	3926	71.4	0.00
9518.00	1	1333	890	443	33.2	17.73
9518.00	2	2100	1227	873	41.6	15.25
9518.00	3	1866	1330	536	28.7	8.36
9518.00	4[b]	1164	891	273	23.5	16.34
Louisiana		4,468,976	2,856,161	1,612,815	36.1	19.64

a) A minority individual is defined as an individual who is "American Indian or Alaskan Native; Asian: Native Hawaiian or Pacific Islander; or Black races; or Hispanic ethnicity" (Reference 2.5-46).

b) CBG location of RBS Unit 3.

Source: Reference 4.4-31.

Table 4.4-9
Workforce Labor Breakdown

PEAK CONSTRUCTION CRAFT LABOR REQUIREMENTS			
Craft Labor Description	**Craft Percent**	**Peak Personnel Preconstruction**	**Peak Personnel Construction**
Carpenters	10	80	140
Electricians/Instrument Fitters	18	140	260
Iron Workers	18	140	260
Insulators	2	10	30
Laborers	10	80	140
Masons	2	15	25
Millwrights	3	25	40
Operating Engineers	8	55	120
Painters	2	15	25
Pipefitters	17	125	260
Sheet Metal Workers	3	20	45
Teamsters	3	20	45
Total Construction Labor	100	755	1450
PEAK ON-SITE LABOR REQUIREMENTS			
Personnel Description	**Craft Percent**	**Peak Personnel Preconstruction**	**Peak Personnel Construction**
Craft Labor	70	755	1450
Craft Supervision	5	45	110
Site Indirect Labor	7	50	160
Quality Control Inspectors	2	20	40
NSSS Vendor and Subcontractor Staffs	4	10	120
Engineering, Procurement, and Construction Contractors	3	30	70
Owner's O&M Staff	6	70	130
Startup Personnel	2	20	50
NRC Inspectors	1	0	20
Total On-Site Labor	100	1000	2150

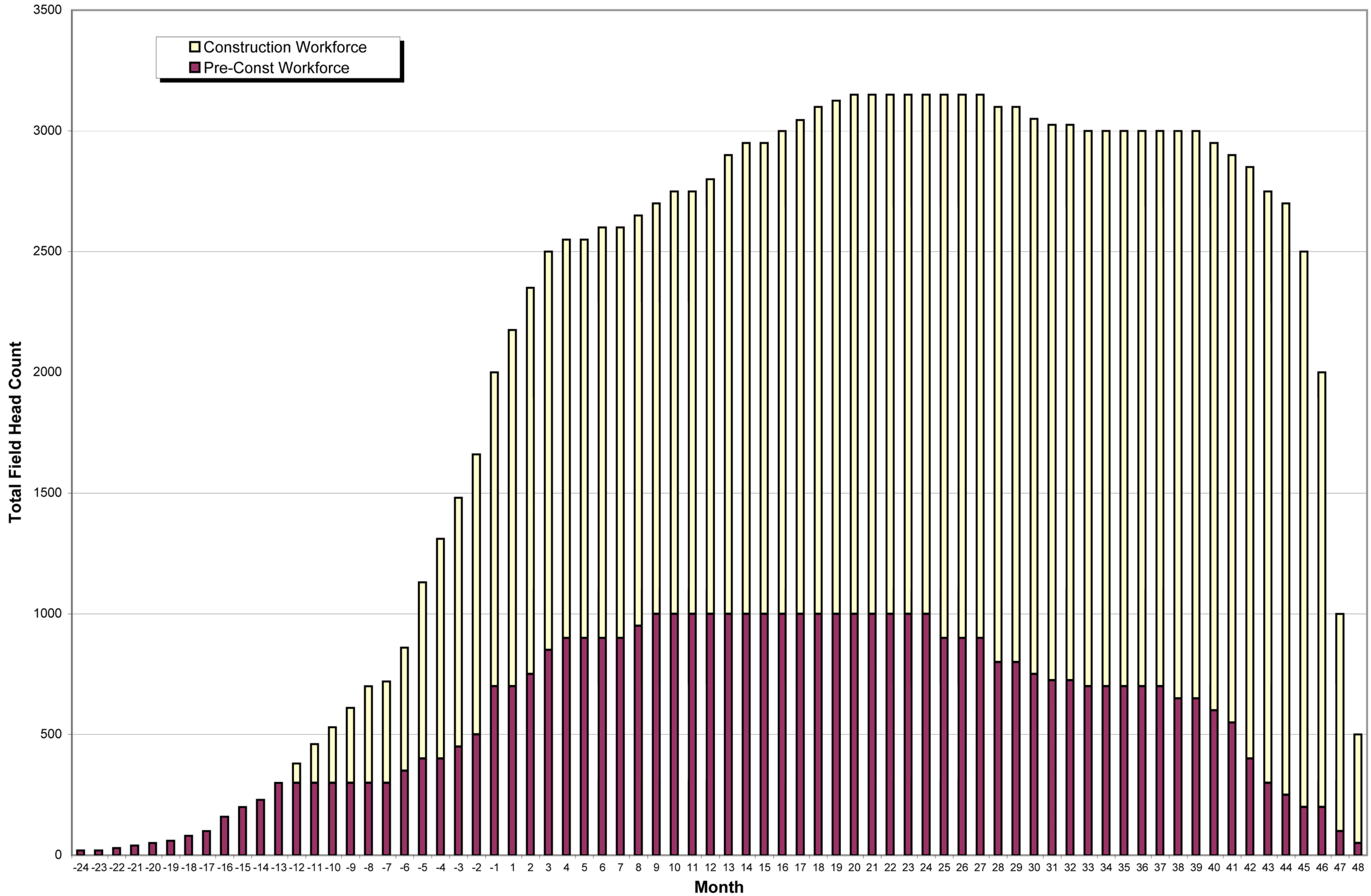

Figure 4.4-1. Estimated Construction Workforce over the Construction Duration

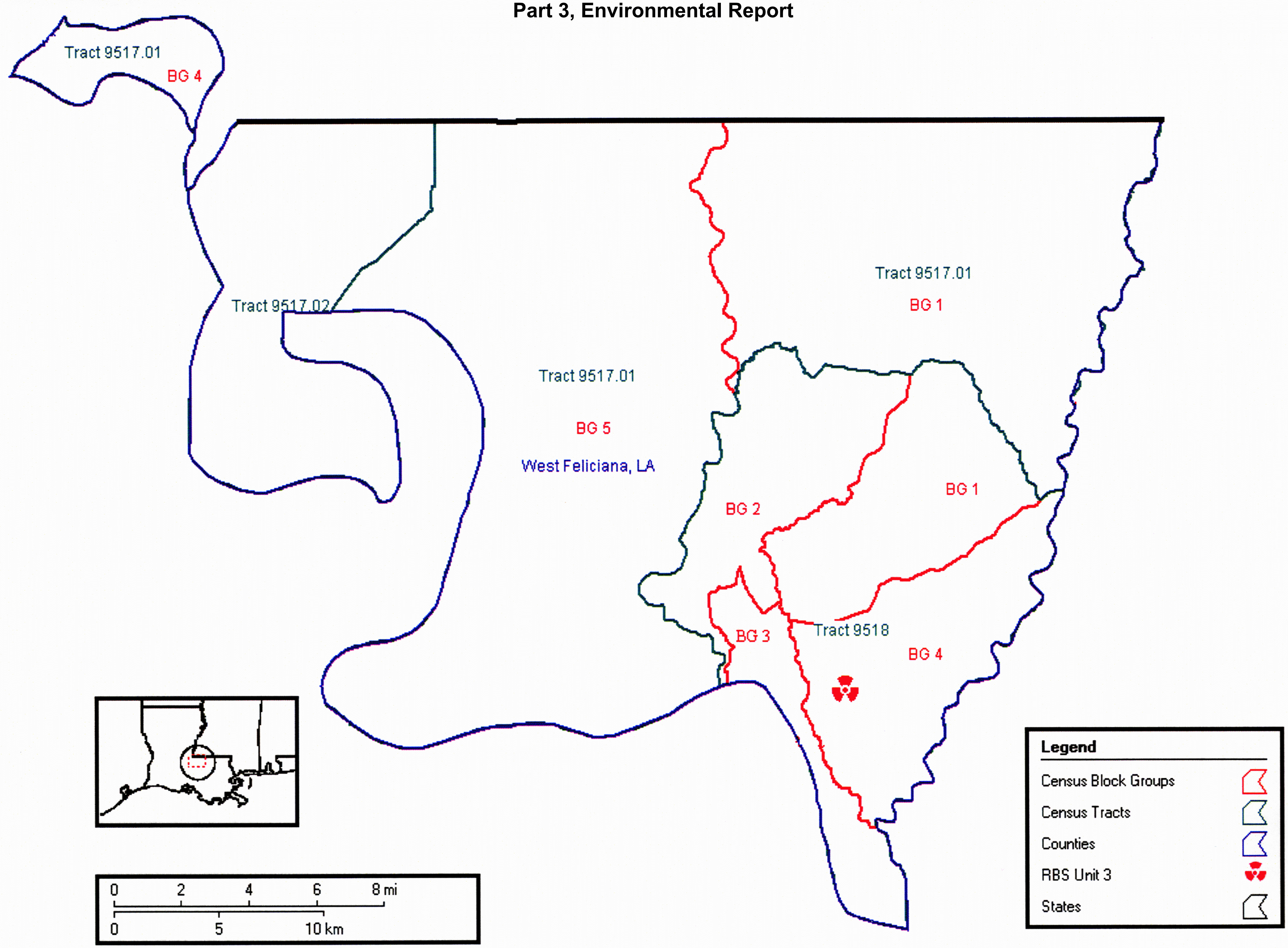

Figure 4.4-2. West Feliciana Census Block Group Identification

4.5 RADIATION EXPOSURE TO CONSTRUCTION WORKERS

This section evaluates the potential radiological dose impacts to construction workers at the proposed new facility location on the RBS site resulting from the operation of the RBS Unit 1 nuclear plant.

4.5.1 SITE LAYOUT

The proposed RBS Unit 3 is located to the southwest of RBS Unit 1. RBS Unit 1 is expected to be operating normally during the construction period for RBS Unit 3. Construction support areas such as offices, parking, warehouses, and laydown areas are also located to the south and west of the new facility location.

Figure 4.5-1 shows the construction areas relative to the existing RBS Unit 1 power block and associated facilities.

4.5.2 RADIATION SOURCES

Construction workers at a new facility on the site could be exposed to radiation from a range of sources associated with the normal operation of RBS Unit 1. These sources include direct radiation, radiation from gaseous and liquid effluents, and radiation associated with on-site dry waste and spent fuel storage.

Figure 4.5-1 shows the location of the primary sources of radiation from RBS Unit 1 relative to the construction areas, as discussed below.

4.5.2.1 Direct Radiation Sources

A large portion of the radiation dose to construction workers is expected to be due to the skyshine from the nitrogen-16 (N-16) source present in the operating RBS Unit 1 main turbine steam cycle. The N-16 activity present in the reactor steam in the main steam lines, turbines, and moisture separators provides an air-scattered radiation dose contribution to locations outside the RBS Unit 1 structures as a result of the high energy gamma rays that it emits as it decays. The RBS Unit 1 USAR, Table 11.1-7 (Reference 4.5-1), indicates an N-16 specific activity of 50 µCi/g for normal water chemistry. Operations with hydrogen water chemistry (HWC) lead to dose rates that drop below 1 mR/yr at 1900 ft. from turbine center line (Reference 4.5-1, Subsection 12.4.2.2).

4.5.2.2 Radiation from Gaseous Effluents

RBS Unit 1 releases airborne effluents to the environment via three gaseous effluent release points. These points are the Radwaste Building vent, the Fuel Building vent, and the main plant exhaust vent. The main plant exhaust is the primary release point and includes the Reactor Building vent, Auxiliary Building vent, Turbine Building vent, piping, standby gas treatment system exhaust, and Off-Gas Building vent exhausts. The expected radiation sources (nuclides and activities) in the gaseous effluents are listed in the RBS Unit 1 USAR, Table 11.3-1 (Reference 4.5-1).

4.5.2.3 Radiation from Liquid Effluents

RBS Unit 1 releases radioactive liquid effluents via the radwaste discharge pipe, which are diluted by mixing with the minimum cooling tower blowdown flow of approximately 2200 gpm. The annual expected releases of activity to the environment in liquid effluents are presented in the RBS Unit 1 USAR (Reference 4.5-1, Table 11.2.4). These effluents are released directly to the Mississippi River via an underground pipe from the Unit 1 site. Construction activities at the river for a new facility would be primarily upstream of the RBS Unit 1 release point for liquid effluents.

4.5.2.4 Radiation from Solid Waste Storage and On-Site Spent Fuel Storage

Other sources that exist outside of RBS Unit 1 plant buildings with the potential for a direct radiation dose contribution to construction workers are the condensate storage tank, the temporary dry active waste storage facilities, and the two turbine rotor modular enclosures. The minimal activity within the tank, temporary dry active waste storage facilities, and the two turbine rotor modular enclosures produces a negligible dose rate at the Restricted Access Boundary (Reference 4.5-1, Subsection 12.4.2.1).

An Independent Spent Fuel Storage Installation (ISFSI) is located west of the RBS Unit 1 Turbine Building and immediately adjacent to the proposed construction area for the RBS Unit 3 power block.

4.5.3 MEASURED AND CALCULATED RADIATION DOSE RATES

Measured and reported data from RBS Unit 1 are available for gaseous and liquid effluents. This information is reported annually to the NRC as part of the Radiological Effluents Monitoring Program (REMP) for the operating unit.

Direct measured data are very limited for evaluation of the dose rates from direct radiation (N-16 skyshine) or from the ISFSI. Calculations have been developed in this section to estimate the dose rates from these sources.

4.5.3.1 Dose Rate from Direct Radiation Sources

RBS Unit 1 measures the radiation dose at various distances using thermoluminescent dosimeters (TLDs) near the exclusion area boundary. As shown in Figure 4.5-1, these TLDs are beyond the boundary of the expected construction areas. Measurements from these instruments that are used to determine dose would underestimate the construction worker dose because of their locations relative to the construction areas.

RBS Unit 1 also measures direct radiation dose inside of the Protected Area (PA). Results of these radiation surveys are documented and capture values that are greater than a threshold of 2 mR/hr. Using the threshold dose rate would greatly overestimate the dose to construction workers.

The RBS added TLDs to measure radiation exposure at the PA and ISFSI boundary in 2006. These limited measurements for 2006 are shown in Table 4.5-1.

RBS Unit 1 performed detailed calculations and evaluations as a part of implementation of the use of HWC controls. The detailed calculations included radiation surveys at the PA boundary and analysis to evaluate the expected dose rates at those locations. Measured data show that the HWC analysis is appropriate for estimating direct radiation dose rates from N-16 skyshine.

The distance from the RBS Unit 1 Turbine Building centerline to the nearest construction impact area is about 360 ft. The estimated bounding dose rate at this location due to N-16 is 41 mrem/yr. The far side boundary of the power block construction area is more than 1395 ft. from the centerline. At this point, the dose rate drops to less than 3 mrem/yr. The average dose rate across the power block construction area is 10 mrem/yr.

4.5.3.2 Dose Rate from Gaseous Effluents

Environmental radiological monitoring data obtained from the RBS Annual Radiological Environmental Operating Report and from the RBS Annual Effluent Release Report were used to assess any potential radiological impact on construction workers due to the operation of RBS Unit 1. The data from these reports are considered representative for the RBS ER site dose evaluations.

As stated in the radiological reports for 2004 through 2006 (References 4.5-2, 4.5-3, and 4.5-4), the airborne effluent doses presented in Table 4.5-2 were computed for members of the public at locations at or within the site boundary. Consideration of site boundary locations as well as unrestricted areas within the site boundary provides assurance that off-site doses would not be substantially underestimated while attempting to provide an accurate dose calculation. The most limiting location of the three annual reports for a dose to a member of the public was used for this estimate and is shown in Table 4.5-3.

4.5.3.3 Dose Rate from Liquid Effluents

The radiological reports for 2004 through 2006 provide a summary of off-site doses for water-related exposure pathways (References 4.5-2, 4.5-3, and 4.5-4).

As stated in the radiological reports, the liquid effluent doses presented in Table 4.5-4 were computed for the maximum exposed individual.

4.5.3.4 Dose Rate from On-Site Spent Fuel Storage

The ISFSI is located directly adjacent to the RBS Unit 3 power block construction area. As with the areas inside the PA, dose rates at the ISFSI boundary are measured, but values are not recorded unless they are greater than the threshold value of 2 mrem/hr. Using the threshold dose rate would greatly overestimate the dose to construction workers.

A site-specific calculation of dose rates from the ISFSI was performed for the RBS Unit 1 installation. This calculation determined an expected dose rate at the controlled area boundary per cask of 1.35E-05 mrem/hr. The controlled area boundary is approximately 2296 ft. from the ISFSI.

The dose rate can be estimated as a function of distance to the ISFSI using the site-specific analysis results and based on an expected number of casks to be in place during the construction period.

A maximum of 40 spent fuel casks can be stored in the ISFSI. Since the installation in 2005, a total of seven casks have been loaded and stored on-site. RBS Unit 1 plans for additional casks and estimates the loading and placement of 19 casks by the time construction begins. There could be as many as 31 casks loaded by the end of the construction period. Over the course of the construction period, the work focus would shift from earth and civil work outdoors to equipment installation and testing inside the structures. The structures provide some measure of shielding from the ISFSI exposure. For the estimate of dose to construction workers, a total of 27 casks were assumed to be in place for an average year of construction.

The distance from the ISFSI centerline to the nearest construction impact area is about 120 ft. Assuming 27 casks in the ISFSI, the estimated dose rate at this location is 0.13 mrem/hr. The far side boundary of the power block construction area is more than 1000 ft. from the ISFSI. At this location, the dose rate drops to 0.002 mrem/hr. The average dose rate for the power block construction area is 0.016 mrem/hr.

Table 4.5-1 shows TLD measurements taken from the ISFSI fence for the year 2006. These measurements include the impact of the ISFSI as well as direct radiation from N-16 skyshine. The methodology described above for determining direct radiation and ISFSI dose rates would overpredict the annual dose as 580 mrem near the "Dry Fuel West" TLD. The 2006 measured dose at this location was 112 mrem.

4.5.4 CONSTRUCTION WORKER DOSE ESTIMATES

The overall estimate of dose to construction workers considers an occupational exposure period of 2080 hours per year, and a construction workforce of 3150. All annualized dose estimates developed in this section were based on a 2080-hr. year. Where there is a strong variance in the dose rates over the construction areas, such as with direct radiation from skyshine or from the ISFSI, an average rate for the power block construction area was used. The power block construction area is the area nearest these contributors and also a primary area of construction activity.

Contributions from each type of source are developed below, and a total estimated dose is provided in the conclusions.

4.5.4.1 Dose Estimate from Direct Radiation Sources

An average dose rate of 10 mrem/yr for the RBS Unit 3 power block construction area was used to determine an estimate of the total dose estimate for N-16 skyshine.

4.5.4.2 Dose Estimate from Gaseous Effluents

Table 4.5-2 provides the estimated doses to critical organs, total body, and skin.

4.5.4.3 Dose Estimate from Liquid Effluents

Liquid effluents are released to the Mississippi River via the discharge outfall at the existing barge slip. The location and the workers subject to exposure from the liquid effluent are limited to work in the area of the barge slip and raw water intake. The work location is upstream of the effluent release point.

The whole-body dose reported in References 4.5-2, 4.5-3, and 4.5-4 was a maximum of 0.001 mrem. The GI-LLI dose for the same year was 0.015 mrem. These values will be used as conservative annual estimates of dose to construction workers from liquid effluents.

4.5.4.4 Dose Estimate from On-Site Spent Fuel Storage

An average dose rate for the power block construction area of 0.016 mrem/hr was determined for the ISFSI dose rate. The estimated annual dose per worker is 33 mrem/yr.

4.5.5 SUMMARY AND CONCLUSIONS

The annual dose to an individual construction worker from all three pathways is summarized in Table 4.5-5 and compared to the public dose criteria in 10 CFR 20.1301 and 40 CFR 190 (Reference 4.5-5) in Table 4.5-6 and Table 4.5-7, respectively. Since the calculated doses meet the public dose criteria of 10 CFR 20.1301 and 40 CFR 190, the workers would not need to be classified as radiation workers. Table 4.5-8 shows that the doses also meet the design objectives of 10 CFR 50, Appendix I, for gaseous and liquid effluents.

The maximum annual collective dose to the construction workforce (3150 workers) is estimated to be 139 person-rem.

It is concluded that annual construction worker doses attributable to the operation of RBS Unit 1 for the proposed construction areas for a new facility would be SMALL since it would be a fraction of 10 CFR 20 and 10 CFR 50 Appendix I limits. Thus, monitoring of individual construction workers would not be required. Construction workers are to be treated as if they were members of the general public in unrestricted areas.

4.5.6 REFERENCES

4.5-1 Entergy Operations, Inc., "River Bend Station Updated Safety Analysis Report" through Revision 19, July 2006.

4.5-2 Entergy Operations, Inc., *River Bend Station, Unit 1 - 2006 Annual Effluent Release Report*, 2006.

4.5-3 Entergy Operations, Inc., *River Bend Station - Annual Radiological Environmental Operating Report*, 2005.

4.5-4 Entergy Operations, Inc., *River Bend Station - Annual Radiological Environmental Operating Report*, 2004.

4.5-5 40 CFR 190, "Environmental Radiation Protection Standards for Nuclear Power Operations."

Table 4.5-1
TLD Dose (mrem/yr) for 2006[a]

Location on Protected Area Fence	mrem/yr (8760 hr.)
Area West Fence No. 1	18
Area West Fence No. 2	244
Dry Fuel South	91
Dry Fuel North	176
Dry Fuel West	112

a) There were seven casks loaded and in place in the ISFSI in 2006.

Table 4.5-2
Doses to Members of the Public On-Site from Gaseous Releases from RBS Unit 1

Year	Location from Main Plant Stack	Critical Organ Dose Annual (mrem)	Total Body Dose Annual (mrem)	Skin Dose Annual (mrem)	Annual Duration Factor
2004	994 m	6.58E-03	1.63E-03	2.76E-03	5.48E-02
2005	115 m	8.40E-05	1.02E-04	9.68E-05	4.57E-03
2006	115 m	3.60E-02	1.74E-01	1.36E-01	4.11E-02

Source: References 4.5-2, 4.5-3, 4.5-4.

Table 4.5-3
Estimated Doses to Construction Workers from Gaseous Releases from RBS Unit 1

	Critical Organ Dose Annual (mrem)	Total Body Dose Annual (mrem)	Skin Dose Annual (mrem)	Annual Duration Factor
2006	3.60E-02	1.74E-01	1.36E-01	4.11E-02
For 2080 hr. per yr	2.08E-01	1.00E+00	7.85E-01	2.37E-01

Table 4.5-4
Liquid Effluent Dose (mrem)

		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
GI-LLI	2004	0.00E+00	2.71E-03	4.25E-03	1.05E-02	1.46E-02
	2005	0.00E+00	1.67E-03	1.28E-02	3.54E-04	8.28E-03
	2006	2.09E-03	5.36E-04	9.69E-04	1.73E-04	4.81E-03
Whole Body	2004	0.00E+00	2.11E-04	3.57E-04	7.39E-04	1.12E-03
	2005	0.00E+00	1.52E-04	9.12E-04	3.03E-05	6.26E-04
	2006	1.40E-04	3.73E-05	7.87E-05	1.15E-05	3.31E-04

Source: References 4.5-2, 4.5-3, 4.5-4.

Table 4.5-5
Annual Dose to a Construction Worker by Source (mrem/yr)[(a)]

	Direct	Gaseous	Liquid	ISFSI	Total
Critical Organ	-	0.2	0.015	-	0.22
Skin	-	0.8	-	-	0.8
Whole Body	10	1.0	0.001	33	44
TEDE	10	1.06	0.006	33	44

a) 10 CFR 20 requires that the dose to an individual from radioactive effluents also meet 40 CFR 190 limits.

Table 4.5-6
Comparison of Construction Worker Public Dose to 10 CFR 20.1301 Criteria

Type of Dose	Annual Dose Limits	Estimated Dose
Whole-body dose equivalent	100 mrem	44 mrem
Maximum dose rate in any hr.	2 mrem/hr	<< 1 mrem

Table 4.5-7
Comparison of Construction Worker Public Dose from Gaseous Effluent Discharges to 40 CFR 190 Criteria[a]

Type of Dose	Annual Dose Limits	Estimated Dose
Whole-body dose	25 mrem	1 mrem
Thyroid doses	75 mrem	< 1 mrem
Other organ doses	25 mrem	< 1 mrem

a) 10 CFR 20 requires that the dose to an individual from radioactive effluents also meet 40 CFR 190 limits.

Table 4.5-8
Comparison with 10 CFR 50 Appendix I Criteria for Effluent Doses

	Annual Dose (mrem)	
	Annual Limit	**Estimated Dose**
Whole-body dose from liquid effluents	3	0.001
Organ dose from liquid effluents	10	0.015
Whole-body dose from gaseous effluents	5	1.0
Skin dose from gaseous effluents	15	0.785
Organ dose from all effluents	15	0.22

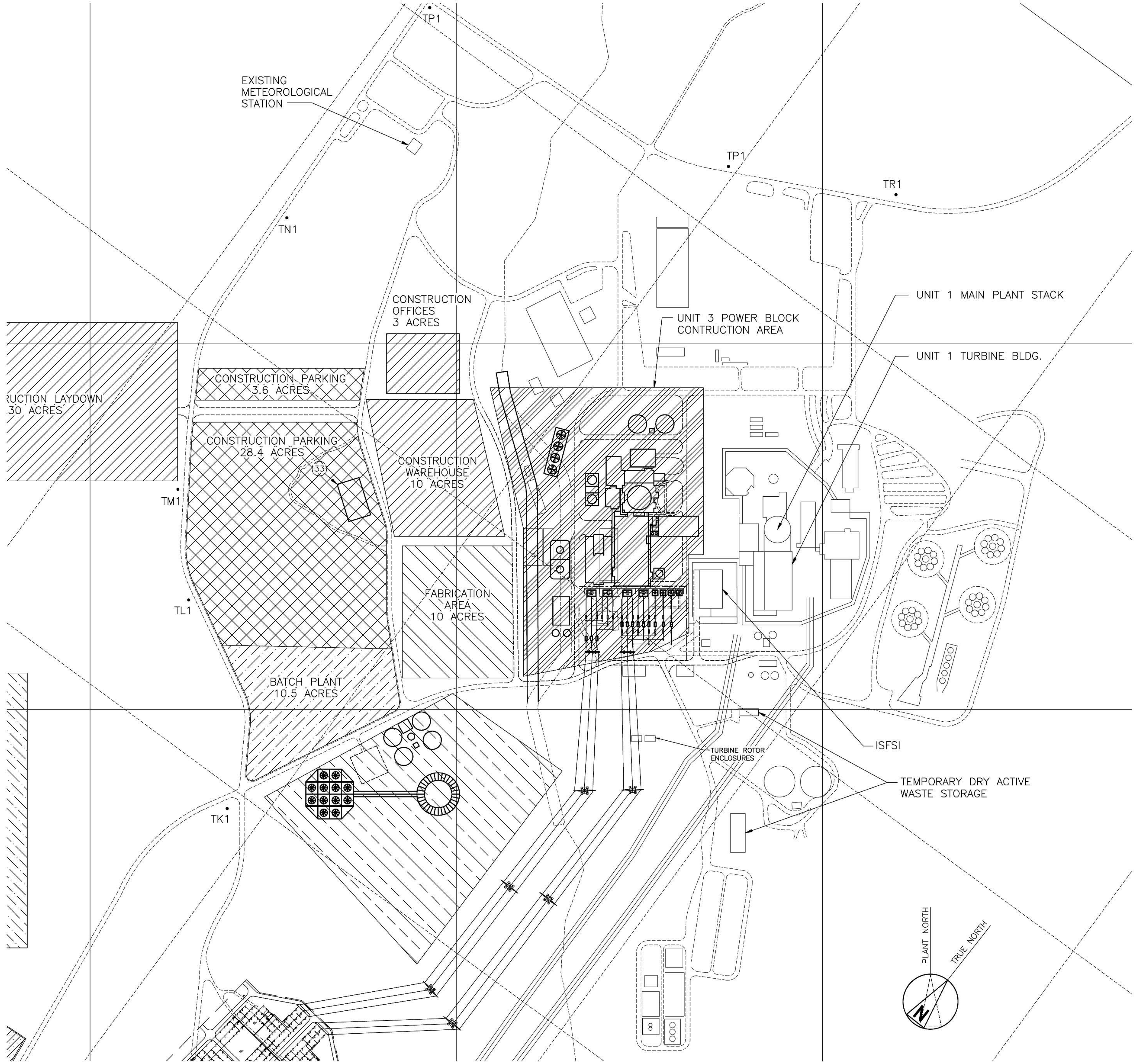

Figure 4.5-1. Radiation Sources from RBS Unit 1

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4.6 MEASURES AND CONTROLS TO LIMIT ADVERSE IMPACTS DURING CONSTRUCTION

This section summarizes the adverse environmental impacts of construction created by RBS Unit 3 preconstruction and construction activities, along with associated measures and controls to limit these impacts. Potential adverse environmental impacts to air, water, land, wildlife, and people during preconstruction and construction activities of RBS Unit 3 would be prevented or minimized through compliance with applicable federal, Louisiana, and local laws and regulations; construction industry best practices; project permits; and project plans. Refer to Section 1.2 for a listing of permits applicable to RBS Unit 3.

4.6.1 ADVERSE ENVIRONMENTAL IMPACTS

Table 4.6-1 provides the cause-and-effect relationships between potential environmental factors from both preconstruction and construction activities and the corresponding affected environmental resources, as discussed in Sections 4.1 through 4.5 and 4.7. The difference between the two activities is that construction activities involve SSCs and risk-significant, nonsafety-related SSCs (as defined in DCD Chapters 17 and 19) and, therefore, must receive NRC approval through the NRC COL issuance process before construction can begin. Preconstruction activities do not require NRC approval before construction can begin.

Table 4.6-1 lists environmental factors such as noise versus environmental receptors (resources), that is, the topics described in Sections 4.1 through 4.5. The table also summarizes measures and controls that have been identified for mitigating construction impacts. The significance indicators provided in Table 4.6-1 are designated using the following descriptors: SMALL (S), MODERATE (M), or LARGE (L); these significance indicators are defined in Section 1.1. Finally, Table 4.6-1 provides estimates of the percentage of impacts attributable to "construction" and "preconstruction" activities, as well as the basis for the estimates.

4.6.2 MEASURES AND CONTROLS TO LIMIT ADVERSE ENVIRONMENTAL IMPACTS

The measures and controls described in Table 4.6-1 are considered reasonable from practical, engineering, and economic viewpoints. They are based on statutes, regulatory requirements, or accepted practices within the construction industry and would not present an unreasonable or undue hardship on the Applicant.

4.6.3 SUMMARY OF POTENTIAL RBS UNIT 3 ADVERSE ENVIRONMENTAL IMPACTS

The overall impacts from construction of RBS Unit 3 are expected to be SMALL for the environmental resource areas evaluated in Sections 4.1 through 4.5. Exceptions to this trend include the following:

- SMALL to MODERATE land use impacts associated with converting significant tracts of land along a 148-mi. off-site transmission corridor to utility use (Subsection 4.1.2).
- SMALL to MODERATE impacts to agricultural fields, forest, and open space along transmission corridor (Subsection 4.1.2).

- SMALL to MODERATE local housing impact in West Feliciana Parish (Subsection 4.4.2.2).
- MODERATE impact on some individual schools should an increase in students occur in districts and schools that are at peak capacity (Subsection 4.4.2.4.1).
- MODERATE to LARGE traffic impacts (Subsection 4.4.2.4.2).

4.6.4 REFERENCES

None.

Table 4.6-1 (Sheet 1 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

Impact/Impact Description		Preconstruction		Construction		Potential Mitigation Measures	Basis for Estimate[c]
		Significance[a]	Impact Percentage[b]	Significance[a]	Impact Percentage[b]		
4.1	**Land Use**						
4.1.1	*The Site and Vicinity*						
4.1.1.1	Site and General Vicinity Land Use Impacts	S	95	S	5	Acreage not containing permanent structures would be reclaimed after construction to the maximum extent possible and would be paved, graveled, or allowed to reforest naturally.	**4.1.1.1, 4.1.1.5, 4.1.1.6 (95/5 split)** The new RBS Unit 3 site excavation (refer to Figure 2.1-4) would involve disturbing approximately 364 ac. of land use during preconstruction activities. The removal of the no-longer used three standby service water storage tanks' chemical cleaning contents and the demolition of the tank structures that currently reside in the previously planned RBS Unit 2 excavation would have been undertaken. Spoils, backfill, and topsoil storage areas are to be established in the southwestern parts of the RBS site. Clearing and grubbing of the site would begin with the removal of trees and vegetation. Topsoil is to be removed to a storage area in preparation for excavation. The switchyard and cooling tower areas are to be brought to grade in preparation for later foundation installation. Ninety-five percent of all on-site construction activities will occur as part of preconstruction activities. Preconstruction activities will have a SMALL impact on land use in the environment for most of their duration.
4.1.1.2 and 4.1.1.3	Land Use Plan and Zoning Compliance (a) West Feliciana Parish (b) Pointe Coupee Parish	S	100	S	0	(a), (b)--No impacts to land use planning in West Feliciana and Pointe Coupee Parishes are expected; therefore, no mitigation measures are required.	
4.1.1.4	Transportation and Rights-of-Way (a) Roads/highways (b) Barge traffic (c) Railway service	S	70	S	30	(a) Staggered shifts; use of traffic control measures. (b) Barge deliveries scheduled to avoid conflicts with majority of existing barge traffic in the area. (c) None – Railways will not be used.	
4.1.1.5	Agricultural and Soil Issues (a) Erosion (b) Sediment load through runoff to Mississippi River (c) Soil compaction (d) On-site grading activities (e) Spoils disposal	S	95	S	5	(a), (b), (d)--SWPPP measures such as stormwater collection ponds, silt fences, seeding, revegetation plans, surface stabilization techniques. (c) Construction machinery confined to designated construction impact area. (e) Spoils disposal area restricted to the same 54.7-ac. area used for RBS Unit 1. SWPPP and BMP measures implemented to stabilize spoils pile and prevent runoff and sedimentation.	

Table 4.6-1 (Sheet 2 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

Impact/Impact Description		Preconstruction Signifi-cance[(a)]	Preconstruction Impact Percent-age[(b)]	Construction Signifi-cance[(a)]	Construction Impact Percent-age[(b)]	Potential Mitigation Measures	Basis for Estimate[(c)]
4.1.1.6	Ecological Impacts (a) Natural and forested area disturbance and clearing (b) Impacts to water courses, wetlands, floodplains	S	95	S	5	(a) Construction activities confined to the designated impact area; natural revegetation of disturbed areas allowed. (b) SPCC Plan, limit time extent of dewatering, SWPPP erosion control measures, compliance with dredging and intake permits, span or avoid most wetland areas.	Construction activities involving placement of the nuclear island will occur after general site preparation has been completed and after the RBS Unit 3 COL has been received. The 5 percent impact is the result of its expected contribution during the identified impacts with the addition of RBS Unit 3 site complex. The area that would be converted to long-term plant use for Unit 3 is estimated to be about 43 ac., while the remaining 204 ac. that are not associated with Unit 1 would be disturbed on a short-term, temporary basis. This impact is anticipated to be SMALL. It is assumed that spoils disposal would be confined to the existing 54.7 ac. spoils area used for RBS Unit 1. The Applicant also expects a SMALL impact associated with stormwater runoff, which will be generated when the design plant grade elevation is reached. The runoff will discharge to West Creek (drainage ditch). Much of the Unit 3 power block area will be impervious; thus, the volume of runoff and sediment discharged to West Creek will increase. Ecological impacts would occur largely in the same proportion as the clearing of the site, making the impacts to vegetation, wildlife, and waters about the same percentage split as the general land use impact activities, with 95 percent of impacts occurring during preconstruction and 5 percent during construction.
4.1.1.7	On-Site and Off-Site Recreation Impacts (a) Traffic, noise, dust increases (b) Use of recreation areas	S	70	S	30	(a) Reduction of construction activities on weekends. (b) Minimal impacts with hunting and other recreational areas.	
4.1.1.8	Aesthetics	S	100	S	0	Forested area buffer around site diminishes cooling tower visual impact.	
4.1.1.9	Air Quality Impacts - Dust, smoke, vehicle engine exhaust	S	70	S	30	Idling of equipment and vehicles would be minimized, water spraying would be implemented in dry weather, materials in open truck beds would be covered, barriers and windbreaks would be used. Construction would be carried out in compliance with the construction air permit for RBS Unit 3.	
4.1.1.10	Pipelines (a) New on-site pipeline for increased parish water supply to Unit 3 (b) Existing pipelines in the vicinity	S	100	S	0	(a) Coordination of water pipeline plans with overall construction would prevent impacts. (b) Distance from the construction area precludes pipeline impacts.	

Table 4.6-1 (Sheet 3 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

Impact/Impact Description		Preconstruction		Construction			
		Significance[(a)]	Impact Percentage[(b)]	Significance[(a)]	Impact Percentage[(b)]	Potential Mitigation Measures	Basis for Estimate[(c)]
4.1.1.11	Spill Prevention, Control, and Response (a) Vehicle fueling, loading, maintenance (b) Material storage and handling	S	70	S	30	(a), (b)--The site SPCC Plan and LPDES permit; these contain measures to prevent and address spills. (a) Vehicle-related activities would be conducted in an enclosed building or a bermed and lined area designated for spill containment. (b) Materials would be stored appropriately to prevent spills, and appropriate containers, berms, barriers, and other measures would be used to prevent and mitigate spills.	**4.1.1.2, 4.1.1.3, 4.1.1.8, 4.1.1.10 (100/0 split)** Impact on land use planning and zoning compliance would be SMALL since RBS Unit 3 development would be consistent with existing and planned development and zoning in West Feliciana Parish. The impact is listed as 100 percent in the preconstruction phase because any impacts on planning and zoning would be addressed very early in the project. Aesthetic impacts will first occur during preconstruction as the cooling tower progresses to its full 550 ft. height (100 percent). No additional visual impacts would occur during the construction phase. During the construction phase, impacts to planning, zoning, and aesthetics are not anticipated. Impacts to pipelines are expected to be SMALL during preconstruction or construction; any impacts would be anticipated to be concurrent with the largest amount of site clearing, which would occur during preconstruction (100 percent).
4.1.1.12	Solid Waste	S	50	S	50	Littering would be prohibited; all wastes would be separated as appropriate for recycling, reuse, or disposal and placed and stored in appropriate containers. Solid waste pickup would be scheduled at a frequency appropriate to the amount of waste generated.	
4.1.1.13	Noise	S	70	S	30	Standard noise dampening devices on trucks and other equipment are expected to be sufficient to keep off-site noise levels below allowable thresholds.	

Table 4.6-1 (Sheet 4 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

Impact/Impact Description	Preconstruction Significance[a]	Preconstruction Impact Percentage[b]	Construction Significance[a]	Construction Impact Percentage[b]	Potential Mitigation Measures	Basis for Estimate[c]
						4.1.1.4, 4.1.1.7, 4.1.1.9, 4.1.1.11, 4.1.1.13 (70/30 split) The highway access to the RBS will experience an increase in traffic during construction activities; however, the overall impact is considered SMALL. The Applicant has assumed that construction activities may involve an additional 2150 construction workers to the 1000 construction workers that will already be on-site performing preconstruction activities, or 3150 construction workers total (Section 4.4) This represents a 30/70 split between preconstruction and construction workforce activities; however, with the large amount of truck and barge traffic that will occur during the preconstruction phase, this will flip the traffic projection to a 70/30 split, with preconstruction now dominant. Therefore, the 70/30 represents the approximate percentages of traffic impacts that are expected to occur in the preconstruction and construction phases. During high traffic periods, construction shifts will be staggered, and all three plant entrances will be used to mitigate traffic congestion on U.S. Highway 61. Barge deliveries will be scheduled as needed, with the majority of deliveries likely needed just before the start of the construction phase (70 percent). Larger equipment deliveries would continue as each piece of equipment is needed during the construction phase (30 percent).

Table 4.6-1 (Sheet 5 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

Impact/Impact Description	Preconstruction Signifi-cance[a]	Preconstruction Impact Percent-age[b]	Construction Signifi-cance[a]	Construction Impact Percent-age[b]	Potential Mitigation Measures	Basis for Estimate[c]
						Recreation impacts during construction are expected to be closely related to the initial impact caused during preconstruction activities, or a 70/30 split. Although the arrival of 2150 additional construction workers will begin approximately 12 months following the start of preconstruction activities, the initial impact to the area will be from the preconstruction phase. This impact will be offset as additional tax revenues flow to the community to support the continued rise in construction workers. Spill prevention, air quality, and noise impacts would be closely related to land use impacts. Preconstruction excavation of the site will have the greatest impact on the environment as a result of vehicle fueling, material handling, noise and air emissions in clearing and preparing the site (70 percent). Construction equipment and noise would be present, but at lower levels during construction activities, representing a lesser degree of impact (30 percent).

Table 4.6-1 (Sheet 6 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

Impact/Impact Description	Preconstruction Significance[a]	Preconstruction Impact Percentage[b]	Construction Significance[a]	Construction Impact Percentage[b]	Potential Mitigation Measures	Basis for Estimate[c]
						4.1.1.12 (50/50 split) Solid waste impacts were split evenly between preconstruction and construction on the basis that the amount of waste generated and requiring removal during preconstruction may be greater with vegetation removal than with waste generated by a larger workforce during construction activities. A new waste treatment facility will also be in place to support the larger construction phase workforce. Therefore, the impact of the waste would be essentially equal during preconstruction and construction activities because of the implementation of waste minimization measures along with appropriate waste storage and waste pickup schedules.

Table 4.6-1 (Sheet 7 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

Impact/Impact Description		Preconstruction Significance[a]	Preconstruction Impact Percentage[b]	Construction Significance[a]	Construction Impact Percentage[b]	Potential Mitigation Measures	Basis for Estimate[c]
4.1.2	*Transmission Corridors and Off-Site Areas*						
4.1.2.1	Planning and Zoning - West Feliciana, Pointe Coupee, Avoyelles, Grant, and Rapides Parishes	S	100	S	0	Minimal impacts to land use planning in the parishes crossed by the transmission line are expected; therefore, no mitigation measures are required. Coordination and consultation with local officials, landowners, and protected area staff members near the route may occur to further ensure minimal impacts.	**4.1.2.1 - 4.1.2.9 (100/0 split)** The impact is listed as occurring 100 percent during the preconstruction phase because any impacts associated with constructing a new 500 kV transmission line to transmit power from RBS Unit 3 to the grid interconnection both on-site and off-site will be completed during the preconstruction phase of the project. The total construction area anticipated to be disturbed is approximately 3334 ac. within a 200-ft. wide corridor along a 148-mi. line length.
4.1.2.2	Transportation and Rights-of-Way - Road, railroad, and utility crossings	S	100	S	0	Minimal transportation impacts. Construction activity at crossings and any traffic flow impacts would be temporary; underground utility lines would be located and avoided during construction of tower foundations	
4.1.2.3	Agricultural and Soil Issues - Reduction in agricultural land use	S-M	100	S	0	Construction activities would be confined to the 200-ft. corridor as much as possible. BMPs similar to those observed in the SWPPP for the RBS site would be implemented along the transmission line route. Existing access roads would be used to the maximum extent possible, and they would be graveled to the extent needed to prevent fugitive dust emissions. Heavy equipment access points to the corridor would be restricted to the minimum practicable number. Vegetation would be left in place in as many areas as possible along the corridor to reduce erosion potential. BMPs would be used to prevent proliferation of noxious and invasive vegetation.	

Table 4.6-1 (Sheet 8 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

Impact/Impact Description	Preconstruction		Construction		Potential Mitigation Measures	Basis for Estimate[c]
	Significance[a]	Impact Percentage[b]	Significance[a]	Impact Percentage[b]		
					Plan and schedule construction activities, when practical, to minimize temporary disturbance, displacement of crops, and interference with farming activities. Provide transmission corridor work schedule to all landowners along the corridor that could be affected by construction. Make landowners aware that they can continue agricultural use under transmission lines after the new corridor is constructed. Limit construction activities and vehicular traffic to the defined transmission corridor area and existing access roads. Place new towers parallel to existing towers, where practical, to enhance maneuverability of farm equipment. Restore compacted soil on properties used for cropland. Avoid damaging crops and compensate farmers for crop damage that is unavoidable.	

Table 4.6-1 (Sheet 9 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

Impact/Impact Description		Preconstruction Significance[(a)]	Preconstruction Impact Percentage[(b)]	Construction Significance[(a)]	Construction Impact Percentage[(b)]	Potential Mitigation Measures	Basis for Estimate[(c)]
4.1.2.4	Ecological Impacts (a) Vegetation and forest habitat loss (b) Impacts to water features (c) Wildlife disturbance	S	100	S	0	(a) Construction area would be limited to the 200-ft. corridor as much as possible. Corridor area would be allowed to revegetated and/or be reseeded. (b) Vegetation clearing within 50 ft. of surface water would be hand cleared without the use of mechanical equipment. Water features would be avoided to the extent possible during placement of transmission towers. Previously disturbed areas would be used when impacts to water features could not be avoided. Coordination and consultation with local officials, landowners, and protected area staff members near the route may occur to further ensure minimal impacts to water features. (c) Route selection study avoided important wildlife areas. Construction area would be confined to 200-ft. corridor whenever possible.	
4.1.2.5	Recreation and Aesthetics (a) Recreation area crossings (b) Visual impacts	S	100	S	0	(a) Route selection study avoided major recreation areas. Recreation area crossings, or crossings of the most sensitive features of the area, would be avoided. (b) Visual impacts would be limited through shielding by forested areas along portions of the route and confining construction work to the 200-ft. corridor.	
4.1.2.6	Spills	S	100	S	0	Measures similar to those implemented on-site in the RBS SPCC Plan would be observed in the transmission line construction corridor.	
4.1.2.7	Noise - Construction equipment and worker noise	S	100	S	0	Minimal construction noise impacts. Noise from construction of the transmission corridor would be temporary and short-term as workers move down the line.	

Table 4.6-1 (Sheet 10 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

Impact/Impact Description		Preconstruction Significance[a]	Preconstruction Impact Percentage[b]	Construction Significance[a]	Construction Impact Percentage[b]	Potential Mitigation Measures	Basis for Estimate[c]
4.1.2.8	Corridor Restoration and Management Actions	S	100	S	0	Measures similar to those implemented on-site in the RBS Unit 3 SWPPP would be observed in the transmission line construction corridor for erosion control. Minimum number of access roads for personnel and vehicular traffic would be used. Activities would be restricted to 200-ft. corridor.	
4.1.2.9	Factors Contributing to Potential Cumulative Impacts	S	100	S	0	All mitigation measures listed above for transmission corridor land use impacts would be enacted to minimize potential cumulative impacts.	
4.1.3	*Historic Properties*						
4.1.3.1	Historic Properties Identified Within the Construction Footprint	S	100	S	0	Minimal historical property impact. Historic properties on-site would be avoided. An Unanticipated Discoveries Plan would be implemented.	**4.1.3.1 - 4.1.3.5 (100/0 split)** The impact is listed as occurring 100 percent during the preconstruction phase because any impacts associated with the 312-ac. impact area that had not previously been affected by RBS Unit 1 would be completed prior to any construction activities. The evaluation did not include the off-site transmission corridor since the route is not finalized. Historic properties information for the off-site transmission corridor would be determined when the route is finalized.

Table 4.6-1 (Sheet 11 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

Impact/Impact Description		Preconstruction Significance[a]	Preconstruction Impact Percentage[b]	Construction Significance[a]	Construction Impact Percentage[b]	Potential Mitigation Measures	Basis for Estimate[c]
4.1.3.2	Historic Properties Identified Within 10 mi. (16 km) of the RBS	S	100	S	0	Negligible impacts from construction or viewshed concerns.	
4.1.3.3	Historic Cemeteries	S	100	S	0	Negligible impacts from construction or viewshed concerns.	
4.1.3.4	Traditional Cultural Properties	S	100	S	0	Negligible traditional cultural properties identified.	
4.1.3.5	Historic Properties Identified Within the Transmission Corridor	S	100	S	0	Negligible historic properties identified in the on-site transmission corridor.	
4.2	**Water-Related Impacts**						
4.2.1	*Hydrologic Alterations*						
4.2.1.1	Site Preparation and Station Construction (a) Runoff and silt loads from earthmoving activities (b) Erosion and sedimentation from forest clearing (c) Turbidity increase from relocation of West Creek drainage ditch and from the removal and replacement of the existing intake screens	S	95	S	5	(a), (b), (c)--Implementation of the SWPPP and LPDES permit would reduce construction impacts. Silt fences, straw bales, slope breakers, and other erosion prevention measures may be used. Use of existing structures and areas adjacent to existing pipelines would reduce impacts. (a), (b), (c)--Preventive maintenance of equipment would prevent leaks and spills. Proper storage of chemicals and wastes, observance of spill control measures, revegetation, regular inspection of erosion control measures, and visual inspection would reduce impacts.	**4.2.1.1 (95/5 split)** As with Land Use described in Subsection 4.1.1 above, 95 percent of all on-site excavation and soil removal activities will occur as part of preconstruction activities. Preconstruction activities will have a SMALL water-related impact since the site will comply with its construction SWPPP and LPDES permit requirements to prevent runoff, leaks, spills, and chemical wastes from reaching and impacting waters on the RBS Unit 3 site and within the RBS vicinity.

Table 4.6-1 (Sheet 12 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

Impact/Impact Description		Preconstruction Significance[(a)]	Preconstruction Impact Percentage[(b)]	Construction Significance[(a)]	Construction Impact Percentage[(b)]	Potential Mitigation Measures	Basis for Estimate[(c)]
4.2.1.2	Transmission Facilities - Runoff, erosion, siltation	S	100	S	0	Off-site transmission line water impacts would be reduced by the BMPs established for transmission line construction and operation. Planning documents and work permits for water crossings and floodplain and wetland work would be implemented.	**4.2.1.2, 4.2.1.3 (100/0 split)** The impact is listed as occurring 100 percent during the preconstruction phase because any water-related impacts associated with off-site construction would be associated with the new 500 kV transmission line that is needed to transmit power from RBS Unit 3 to the grid interconnection both on-site and off-site. This activity will be accomplished completely within the preconstruction phase of the project. No transmission work will occur under construction phase NRC jurisdiction.
4.2.1.3	Off-Site Construction	S	100	S	0	Minimal off-site construction impacts. The existing road system is adequate for construction of a new facility; no new or modification of existing docking facilities is planned and, therefore, no off-site hydrologic alterations are anticipated	

Table 4.6-1 (Sheet 13 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

Impact/Impact Description		Preconstruction Significance[(a)]	Preconstruction Impact Percentage[(b)]	Construction Significance[(a)]	Construction Impact Percentage[(b)]	Potential Mitigation Measures	Basis for Estimate[(c)]
4.2.2	*Water Use Impacts*						
4.2.2.1	Construction-Related Impacts (a) Stormwater runoff (b) Dewatering flows	S	95	S	5	These items will be handled as surface water issues identified in Subsection 4.2.2.2 (a) and (b).	**4.2.2.1, 4.2.2.2, 4.2.2.3, 4.2.2.4 (95/5 split)** **As with Land Use described in Subsection 4.1.1** above, estimates on construction-related effluents and surface water are based on the impact that construction activities would have on water released to construction surfaces and the ground that does not evaporate on-site, such as dust control water, concrete mix water, or surface cleaning water. 95 percent of all on-site construction activities and impacts, including those to surface water and aquatic biota, will occur as part of preconstruction activities. Preconstruction activities will have SMALL water use impacts since the site will comply with its construction SWPPP and LPDES permit requirements to prevent runoff, leaks, spills, and chemical wastes from reaching and impacting waters, water uses, and aquatic biota on the RBS Unit 3 site and within the RBS vicinity. Herbicides and pesticides are not planned to be used.
4.2.2.2	Surface Water (a) Stormwater runoff (b) Dewatering flows	S	95	S	5	(a) Minimal impacts - RBS Unit 3 use of Mississippi River water would be only 0.0002 percent of river flow and would not affect other users. (b) Provisions of RBS Unit 1 LPDES permit would be observed during Unit 3 construction; Unit 3 construction stormwater permit and SWPPP would be implemented to minimize soil loss and erosion, control sediment and minimize turbidity increases in surface waters, and manage construction materials and activities to reduce impacts to surface waters.	

Table 4.6-1 (Sheet 14 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

Impact/Impact Description	Preconstruction Significance[a]	Preconstruction Impact Percentage[b]	Construction Significance[a]	Construction Impact Percentage[b]	Potential Mitigation Measures	Basis for Estimate[c]
4.2.2.3 Groundwater (a) Aquifer drawdown (b) Increased impervious areas	S	95	S	5	(a) Aquifer drawdown from 9-month dewatering period to support nuclear island and power block construction activities would be investigated and the appropriate mitigation measures implemented for affected well water users in the projected 4-mi. drawdown radius around the RBS site. New supply of West Feliciana Parish potable water would reduce impacts on aquifers. (b) New impervious areas would be confined to the designated construction impact area. SWPPP implementation would minimize water quality impacts.	Estimates involving groundwater are based on the impact that construction activities would have on subsurface soil and water sources. Construction activities involving placement of the nuclear island will occur after general site preparation has been completed and after the RBS Unit 3 COL has been received. A SMALL impact will be realized as a result of increased water flow through Alligator and Grants Bayou due to dewatering activities required in excavating the deepest foundations in the power block involving the nuclear island basemat, with erosion of banks and stream beds possibly occurring. Dewatering activities are considered a preconstruction activity, since a permanent dewatering system is not required as a result of the groundwater elevations in the Unit 3 power block area (approximately 60 ft. msl) being well below the DCD Table 2.0-1 maximum design groundwater level requirement of 2 ft. below plant grade (final design grade is approximately 97.5 ft. msl). The preconstruction dewatering will cause surficial aquifer drawdown over an approximate 4-mi. radius area over a 9-month period. Therefore, approximately 95 percent of the groundwater impacts as a result of aquifer drawdown would occur during preconstruction.

Table 4.6-1 (Sheet 15 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

Impact/Impact Description		Preconstruction		Construction		Potential Mitigation Measures	Basis for Estimate[c]
		Significance[a]	Impact Percentage[b]	Significance[a]	Impact Percentage[b]		
4.2.2.4	Aquatic Biota - Modification of the intake structure	S	95	S	5	SWPPP measures would be implemented for erosion control. Modifications would occur in the same location as is already disturbed for the intake structure, and RBS Unit 3 new intake line would be adjacent to the existing line to minimize impacts. The new intake pipeline would be buried and would not alter surface water flow. Compliance with permit requirements would be maintained to minimize impacts to aquatic biota.	Aquatic estimates are based on the modification impact of the intake structure on the east shore of the river that would entail temporary loss of the edge habitat of the Mississippi River in the affected areas. Activities directly affecting the river would center on accessing the intake during preconstruction activities. These activities would be expected to take place during low river levels, so river biota would be exposed to minimal direct impacts.

Table 4.6-1 (Sheet 16 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

Impact/Impact Description	Preconstruction Signifi-cance[(a)]	Preconstruction Impact Percent-age[(b)]	Construction Signifi-cance[(a)]	Construction Impact Percent-age[(b)]	Potential Mitigation Measures	Basis for Estimate[(c)]
4.3 Ecological Impacts						
4.3.1 Terrestrial Ecosystems						
4.3.1.1 Site and Vicinity (a) Clearing of vegetation and forest areas (b) Wildlife disturbance (c) Wetland impacts	S	95	S	5	(a), (b), (c)--Following the site layout would minimize impacts. Disturbed areas would be used to the maximum extent possible. (a), (c)--SWPPP measures would be implemented to minimize erosion and sedimentation. (a), (b), (c)--Compliance with permit requirements and conditions would be maintained to minimize terrestrial ecosystem impacts. (a), (b)--Potential field surveys for birds and small wildlife may be conducted before construction begins. (c) SMALL impacts. USACE mitigation measures for Section 404 and Section 10 permits would be implemented after wetland delineation is complete. (b) SMALL impacts to threatened and endangered species are anticipated. (a), (b)--Areas that need to be cleared were planned to avoid wildlife corridors and to be adjacent to already cleared areas. Temporarily affected areas would be reforested with native species or allowed to revegetate. Enhancement of vegetation and habitat on-site would be accomplished by removing undesirable plant species and planting desirable plant species.	**4.3.1.1 (95/5 split)** As with Land Use described in Subsection 4.1.1 above, 95 percent of all on-site construction activities will occur as part of preconstruction activities. Ecological impacts would occur largely in the same proportion as the clearing of the site, making the impacts to vegetation, wildlife, and waters about the same percentage split as the general land use impact activities, with 95 percent of impacts occurring during preconstruction and 5 percent during construction. Site preparation activities will occur within the boundaries of the existing RBS site. Habitats outside the site will not be disturbed. The RBS site has no critical habitats, and any impacts will be small. Such impacts include a SMALL, permanent adverse impact due to loss of aquatic habitat in a man-made pond (approximately 100 x 50 ft.) located within the 3-ac. area proposed for the construction of offices; a SMALL, temporary adverse impact due to a temporary increase in silt load to the on-site Alligator and Grants Bayou water systems and the Lower Mississippi River; and SMALL, permanent adverse impacts to wildlife habitat from losses due to construction of a 550-ft. natural draft cooling tower. Limited losses of phytoplankton productivity and zooplankton densities in these systems are likely.

Table 4.6-1 (Sheet 17 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

Impact/Impact Description		Preconstruction Significance[(a)]	Preconstruction Impact Percentage[(b)]	Construction Significance[(a)]	Construction Impact Percentage[(b)]	Potential Mitigation Measures	Basis for Estimate[(c)]
4.3.1.2	Transmission Corridors and Off-Site Areas (a) Vegetation clearing, placement of tower bases (b) Wildlife disturbance (c) Wetland impacts	S	100	S	0	(a), (b), (c)--Route selection incorporated avoidance of important habitat, wildlife areas, and wetlands to the extent possible. (b) SMALL impacts to threatened and endangered species are anticipated. (c) Wetlands would be spanned where possible. The minimum possible number of towers would be placed in wetland areas.	Anticipated environmental impacts to off-site environs (off-site transmission corridor) are estimated to be SMALL and include impacts to forest, vegetation, floodplains, and agricultural areas along the proposed 148-mi. long transmission line. **4.3.1.2 (100/0 split)** The impact is listed as occurring 100 percent during the preconstruction phase because any impacts associated with constructing a new 500 kV transmission line to transmit power from RBS Unit 3 to the grid interconnection both on-site and off-site will be completed during the preconstruction phase of the project. Anticipated environmental impacts to off-site environs (off-site transmission corridor) are estimated to be SMALL and include impacts to forest, vegetation, and floodplains along the proposed 148-mi. long transmission line.

Table 4.6-1 (Sheet 18 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

Impact/Impact Description		Preconstruction		Construction		Potential Mitigation Measures	Basis for Estimate[c]
		Significance[a]	Impact Percentage[b]	Significance[a]	Impact Percentage[b]		
4.3.2	*Aquatic Ecosystems*						
4.3.2.1	Impacts to the Lower Mississippi River (a) Dredging and intake pipe construction (b) Turbidity (c) New transmission line construction activities	S	95	S	5	(a), (b)--Compliance with USACE permit conditions would be maintained to minimize impacts. Dredging work would occur in a limited area and would have a temporary duration. (a) Dredge materials would be returned to the Mississippi River in accordance with the USACE permit. (b) Measures from the SWPPP as well as BMPs would be implemented. Floodplain areas would serve as buffers against sediment migration to the river. (c) Minimal impacts - The Mississippi River would be spanned in a corridor adjacent to the existing transmission lines going across the river.	**4.3.2.1, 4.3.2.2 (95/5 split)** As with Land Use described in Subsection 4.1.1 above, 95 percent of all on-site construction activities will occur as part of preconstruction activities. Site preparation activities will occur within the boundaries of the existing RBS site. Habitats outside the site will not be disturbed. The RBS site has no critical habitats, and any impacts will be small. Such impacts include a SMALL, temporary adverse impact due to a temporary increase in silt load to the Lower Mississippi River. Limited losses of phytoplankton productivity and zooplankton densities in these systems are likely. Impacts to on-site water bodies would continue during the construction phase, with continuing potential for erosion and increased water flows from preconstruction dewatering activities in support of the construction effort. Impacts include a SMALL, permanent adverse impact due to loss of aquatic habitat in a man-made pond (approximately 100 x 50 ft.) located within the 3-ac. area proposed for the construction of offices; and a SMALL, temporary adverse impact due to a temporary increase in silt load to the on-site Alligator and Grants Bayou water systems. Limited losses of phytoplankton productivity and zooplankton densities in these systems are likely.

Table 4.6-1 (Sheet 19 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

Impact/Impact Description		Preconstruction Significance[a]	Preconstruction Impact Percentage[b]	Construction Significance[a]	Construction Impact Percentage[b]	Potential Mitigation Measures	Basis for Estimate[c]
4.3.2.2	Impacts to Alligator Bayou, Grants Bayou, and On-Site Ponds (a) Loss of small on-site pond (b) Erosion and siltation (c) Increased water flows (d) Pollutant impacts to aquatic life (e) New transmission line construction activities	S	95	S	5	(a) Minimal impacts - Species and features of the small on-site pond are represented well at other nearby locations; the impact of pond loss would be minimal. (b), (d)--SWPPP measures would be implemented to minimize sediment migration to aquatic ecosystems. (c) These water bodies normally handle periodic flow increases similar to those anticipated from RBS Unit 3 without significant impacts. (d) SPCC Plan measures would be implemented to prevent and mitigate spills before they affect aquatic resources. (e) Transmission lines would span aquatic resources whenever possible to avoid impacts. Measures similar to those implemented by the SWPPP on the RBS site (silt fence, hay/straw bales) would be observed along the transmission corridor. Compliance with the LDEQ/USACE permits/ authorizations would further reduce transmission impacts on aquatic resources. Mitigation measures for the off-site transmission lines and structures would be further detailed in applicable permits when they are obtained.	
4.3.2.3	Aquatic Threatened and Endangered Species	S	100	S	0	None - Pallid sturgeon has not been found in the area, based on nearby aquatic studies.	**4.3.2.3, 4.3.2.4 (100/0 split)** Impacts to threatened and endangered species are listed as 100 percent during the preconstruction phase because any impacts on these species would be addressed very early in the project. Also, the majority of potential turbidity impacts affecting nuisance species would occur during preconstruction, and measures to control nuisance species, as needed, would be established early in the project, during preconstruction.
4.3.2.4	Nuisance Species	S	100	S	0	None - Turbidity may have positive effect of decreasing populations of zebra mussels and Asian clams.	

Table 4.6-1 (Sheet 20 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

Impact/Impact Description		Preconstruction		Construction		Potential Mitigation Measures	Basis for Estimate[c]
		Significance[a]	Impact Percentage[b]	Significance[a]	Impact Percentage[b]		
4.4	**Socioeconomic Impacts**						
4.4.1	*Physical Impacts*						
4.4.1.1	Noise - Construction noise impacts from equipment and workers	S	70	S	30	Compliance with St. Francisville noise ordinances as guidance (55 dBA limit) for construction activities occurring between 7:00 p.m. and 7:00 a.m. would be implemented to minimize noise impacts. Construction activities would be reduced on weekends and during the night, minimizing noise. Neighbors of the RBS would be notified in advance of planned activities that may generate loud noises. Silencers would be used on diesel equipment exhaust. A construction noise monitoring program would be implemented.	**4.4.1.1, 4.4.1.2, 4.4.1.3 (70/30 split)** Noise, air quality, and dust impacts would be closely related to land use impacts. Preconstruction excavation of the site will have the greatest impact on the environment as a result of vehicles creating dust, noise, and air emissions in clearing and preparing the site (70 percent). Construction equipment and noise would be present, but at lower levels during construction, representing a lesser degree of impact. The most intense factor of noise impacts during the construction phase would occur during pile driving operations within the power block area, which raised the environmental impact for construction activities to 30 percent.
4.4.1.2	Air Quality	S	70	S	30	Idling of machinery and equipment would be minimized to reduce air quality impacts as much as possible.	
4.4.1.3	Dust	S	70	S	30	Compliance with LDEQ and Louisiana state regulations for fugitive dust control would be maintained. Water spraying would be used on nonpaved areas to minimize fugitive dust from construction traffic. Revegetation would begin in each area as activities are completed. The concrete batch plant would be equipped with a dust control system.	
4.4.1.4	Burning Controls	S	100	S	0	Minimal impacts. The construction of RBS Unit 3 would be compliant with the applicable Louisiana regulations and requirements where no burning is permitted, and waste would be taken to the nearest suitable landfill for disposal.	**4.4.1.4 (100/0 split)** There is no burning permitted on the site during preconstruction and construction activities. Controls will be established during the preconstruction phase; this impact is listed as 100 percent during preconstruction.

Table 4.6-1 (Sheet 21 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

Impact/Impact Description		Preconstruction Signifi-cance(a)	Preconstruction Impact Percent-age(b)	Construction Signifi-cance(a)	Construction Impact Percent-age(b)	Potential Mitigation Measures	Basis for Estimate(c)
4.4.2	*Social and Economic Impacts*						
4.4.2.1	Demographics and Economics (a) Relocation of workers (b) Economics	M-L (Benefit)	85	S	15	(a) Minimal impacts. The peak RBS Unit 3 workforce of 3150 would be equal to 7.1 percent of the projected 2014 construction workforce within the 50-mi. radius (b) Minimal impacts. The workforce increase has significant benefits to the small inflationary impact due to the construction market.	**4.4.2.1, 4.4.2.2, 4.4.2.3, 4.4.2.4 (85/15 split)** This impact was based on estimating the number of RBS Unit 3 construction workers that would likely relocate from distant areas to within the region, which is a function of the availability of qualified construction workers that could commute to the site from their existing residences. With a peak construction workforce of 3150, this would imply that 788 construction workers would be expected to relocate to the primary impact area, and 2363 construction workers would be non-movers from within the primary impact area. The impact to the area will be greatest during preconstruction activities with the initial influx of workers coming into the area. The impacts associated with these numbers of workers on demographics, economics, local housing, regional taxes, and local public services will occur largely during the preconstruction phase and will continue to a lesser degree during the construction phase as services improve to accommodate the continuing influx of workers. Impacts will therefore occur in an approximate 85/15 percentage split between preconstruction and construction work activities.
4.4.2.2	Local Housing	S-M	85	S-M	15	Minimal impacts. There would be sufficient capacity in vacant housing and rental units to assimilate the projected 788 relocating workers to the regional area. Temporary impacts on the West Feliciana Parish housing market are expected to be SMALL.	
4.4.2.3	Regional Tax	S	85	S	15	No negative impacts. There would be a net positive impact in the vicinity since most local tax revenues for West Feliciana Parish come from the RBS.	

Table 4.6-1 (Sheet 22 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

Impact/Impact Description	Preconstruction Significance[a]	Preconstruction Impact Percentage[b]	Construction Significance[a]	Construction Impact Percentage[b]	Potential Mitigation Measures	Basis for Estimate[c]
4.4.2.4 Local Public Services	S-M	85	S	15		
(a) Education	S-M				(a) Minimal impacts. In-migrating workforce and their families would be expected to settle throughout the region, with a preference for urban and suburban areas. This immigration would represent approximately 0.09 percent of the total population of the region. There would be sufficient capacity in schools in the region.	
(b) Transportation	M-L				(b) Traffic level of service (LOS) analysis would be done in accordance with LDOTD policy. Mitigation measures would be decided and implemented in conjunction with LDOTD to maintain acceptable level of service on roads in the RBS vicinity.	
(c) Public Safety and Social Services	S				(c) Potential traffic safety issues on U.S. Highway 61 near the RBS at times of shift changes would be mitigated by the planned expansion of U.S. Highway 61 to four lanes north of Baton Rouge.	
(d) Public Utilities	S				(d) Minimal impacts. The Applicant has purchased additional water from Water District 13 that would not significantly affect the district's ability to provide service, since its peak operating demand is only 35 percent of its capacity.	
(e) Recreation, Tourism, Aesthetics, and Land Use	S				(e) Minimal impacts. After construction is complete, the aesthetic and visual impacts associated with construction would recede, with only the cooling tower impact remaining visible from off-site.	
(f) Local Employment and Income	M-L (Benefit)				(f) Minimal impacts. Over a 5-year period, the project would produce approximately 8000 job-years of employment and $472 million in direct earnings.	

Table 4.6-1 (Sheet 23 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

		Preconstruction		Construction			
Impact/Impact Description		Signifi-cance[(a)]	Impact Percent-age[(b)]	Signifi-cance[(a)]	Impact Percent-age[(b)]	Potential Mitigation Measures	Basis for Estimate[(c)]
4.4.3	*Environmental Justice Impacts*						
4.4.3.1	Impacts on Low-Income Areas	S	100	S	0	None - No qualifying populations exist near the RBS.	**4.4.3.1 - 4.4.3.3 (100/0 split)** Environmental justice impacts are not expected to occur as a result of construction of RBS Unit 3 because there are no low-income, minority, or isolated populations in the area that meet the criteria given in NRC definitions. Any impacts would be addressed early in the project; therefore, these impacts are shown as 100 percent during preconstruction.
4.4.3.2	Impacts on Minority Populations	S	100	S	0	None - No qualifying populations exist near the RBS.	
4.4.3.3	Isolated Population Impacts	S	100	S	0	None - No qualifying populations exist near the RBS.	
4.5	**Radiation Exposure to Construction Workers**						
4.5.1	*Site Layout*						
	Proposed RBS Unit 3	S	80	S	20	Minimal impacts. The proposed layout of the RBS Unit 3 facility poses no radiological hazard to the construction workers since no radiation sources other than those normally used for construction nondestructive testing would be stored in the facility.	**4.5.1 (80/20 split)** Estimate was based on the proposed RBS Unit 3 being located to the southwest of RBS Unit 1. RBS Unit 1 is expected to be operating normally during the construction period for RBS Unit 3. Construction support areas such as offices, parking, warehouses, and laydown areas are also located to the south and west of the new facility location. The bulk of excavation and work outdoors would be associated with preconstruction activities, since after power block construction, construction activities would move indoors.

Table 4.6-1 (Sheet 24 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

Impact/Impact Description		Preconstruction Significance[a]	Preconstruction Impact Percentage[b]	Construction Significance[a]	Construction Impact Percentage[b]	Potential Mitigation Measures	Basis for Estimate[c]
4.5.2	*Radiation Sources*						
4.5.2.1	Direct Radiation Sources	S	80	S	20	(a) Effluent radiation emitted by RBS Unit 1 is a very small percentage of allowable federal regulatory limits for radioactive materials. (a) Access to areas near radiation sources would be limited to minimize workers' exposure to radiation. (a) Monitoring of radiation doses at various RBS locations would be carried out through the Annual Radiological Environmental Operating Report and the Annual Effluent Release Report. Appropriate mitigation measures would be taken if findings of these annual reports show dose increases approaching regulatory limits.	**4.5.2.1, 4.5.2.2, 4.5.2.3, 4.5.2.4 (80/20 split)** The potential radiological dose impacts to construction workers at the proposed RBS Unit 3 location on the RBS site would result from the operation of RBS Unit 1. The bulk of radiation exposure would be associated with preconstruction activities, since most work would be outdoors. As a result, the impact split would be 80 percent preconstruction activities and 20 percent construction activities.
4.5.2.2	Radiation from Gaseous Effluents	S	80	S	20		
4.5.2.3	Radiation from Liquid Effluents	S	80	S	20		
4.5.2.4	Radiation from Solid Waste Storage and On-Site Spent Fuel Storage	S	80	S	20		
4.5.3	*Measured and Calculated Radiation Dose Rates*						
4.5.3.1	Dose Rate from Direct Radiation Sources	S	80	S	20	Refer to Subsection 4.5.2.1 data above.	Refer to Subsection 4.5.2.1 estimate above.
4.5.3.2	Dose Rate from Gaseous Effluents	S	80	S	20		
4.5.3.3	Dose Rate from Liquid Effluents	S	80	S	20		
4.5.3.4	Dose Rate from On-Site Spent Fuel Storage	S	80	S	20		

Table 4.6-1 (Sheet 25 of 25)
Summary of Measures and Controls to Limit Adverse Impacts During Construction Activities

		Preconstruction		Construction			
Impact/Impact Description		Significance[a]	Impact Percentage[b]	Significance[a]	Impact Percentage[b]	Potential Mitigation Measures	Basis for Estimate[c]
4.5.4	*Construction Worker Dose Estimates*						
4.5.4.1	Dose Rate from Direct Radiation Sources	S	80	S	20	Refer to Subsection 4.5.2.1 data above.	Refer to Subsection 4.5.2.1 estimate above.
4.5.4.2	Dose Rate from Gaseous Effluents	S	80	S	20		
4.5.4.3	Dose Rate from Liquid Effluents	S	80	S	20		
4.5.4.4	Dose Rate from On-Site Spent Fuel Storage	S	80	S	20		

a) Significance - The three significance levels utilized for SMALL, MODERATE, and LARGE are defined in Footnote 3 of Table B-1 of 10 CFR 51 and are based on the impact of preconstruction and construction being conducted separately from each other.

b) Impact Percentage - Identifies the estimates of the percentages of impacts to the environment attributable to "preconstruction" and "construction" activities.

c) Basis for Estimate - A summary of the overall impact being evaluated for the "preconstruction" and "construction" estimates identified in the significance and impact percentage columns. The splits identified in this column represent the portion of impact associated with preconstruction activities to construction activities (Preconstruction/Construction split).

4.7 CUMULATIVE IMPACTS OF CONSTRUCTION

This section discusses the cumulative impacts to the environment that could result from the construction of RBS Unit 3. A cumulative impact is defined in the Council of Environmental Quality (CEQ) regulations (40 CFR 1508.7) as an "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time."

The impacts of the proposed RBS Unit 3, as described in ER Chapters 4 and 5, are combined with other past, present, and reasonably foreseeable future actions that would affect the same resources in the RBS vicinity. Cumulative impacts anticipated during the construction phase are discussed in this section, while those anticipated during operation are discussed in Section 5.11.

To determine whether cumulative impacts to the existing environment in the vicinity of the RBS are likely to occur, the baseline environmental information and proposed, ongoing, and future development projects of similar magnitude in the RBS area (refer to Chapter 2) are considered along with the environmental impacts (refer to Chapter 4) of constructing one new unit at the RBS.

4.7.1 LAND USE

For purposes of this analysis, the geographical area considered for cumulative impacts to land use resulting from construction is West Feliciana Parish. The only other major construction project in West Feliciana Parish during the same general time frame as RBS Unit 3 is the construction of the Audubon Bridge, State Highway 10, and Big Cajun's Unit 4 across the river in Pointe Coupee Parish. All of these are scheduled to be completed by 2010 and would have little or no impact compared to the construction phase. RBS Unit 3 construction is projected to begin in 2011.

Approximately 364 ac. of the existing RBS property would be required for construction of RBS Unit 3. As discussed in Subsection 4.1.1, the land required for construction is part of the existing RBS site and is either vacant or currently used for storage facilities. The construction of RBS Unit 1 did not spur a great amount of industrial growth in West Feliciana Parish, and the impacts from construction of RBS Unit 3 are expected to be similar.

Cumulative impacts for land use include possible additional growth and land conversions to accommodate the RBS Unit 3 facilities, new workers, and associated services. However, the impacts are expected to be minor because the construction workforce and the operations workforce are expected to be drawn from an area much wider than West Feliciana Parish, including the larger metropolitan area of Baton Rouge. Because the workforce would be dispersed over this larger area in the labor supply region, the induced impacts on land use (resulting from either construction or operation of a new unit at the RBS site) could be easily absorbed in that wider region.

An additional transmission corridor would be constructed in an approximately 148-mi. long, 200-ft. wide corridor. Central Louisiana is predominantly rural, and most land is agricultural or forested.

Proposed construction of RBS Unit 3 would have a minor contribution to cumulative impacts of changing land use. Additional on-site and off-site land might be required to dispose of construction-related soil and debris. However, it is anticipated that the potential cumulative impacts from additional off-site disposal required for the RBS Unit 3 facility would be SMALL, and mitigation would not be required.

4.7.2 AIR QUALITY

For purposes of this analysis, the geographical area considered for cumulative impacts to air quality resulting from construction is West Feliciana Parish, and the focus includes other sources of similar emissions. The RBS site is in an area that is in attainment for criteria pollutants. Some increase in air pollution would arise during construction of RBS Unit 3 because of construction activities, including engine exhaust from worker vehicles and machinery, fugitive dust, and commuter traffic. The vehicles and machinery would comply with applicable government standards during construction, dust control methods would be used, and the relatively isolated nature of the construction area from off-site residences and facilities would help prevent a noticeable impact on air quality beyond the site. The concrete batch plant would be subject to the limitations of an LDEQ air emissions permit.

RBS Unit 3 is the only known major construction project planned in West Feliciana Parish after completion of the Audubon Bridge construction and the Big Cajun Unit 4 construction across the river in Pointe Coupee Parish. In addition, the effects of RBS Unit 3 construction are anticipated to be local. The temporary impact of construction activities should not produce noticeable air quality impacts or elevate air pollutant levels to a significant degree. The cumulative impact on air quality in West Feliciana Parish during construction is projected to be SMALL, and additional mitigation would not be warranted.

4.7.3 HYDROLOGY, WATER USE, AND WATER QUALITY

The cumulative impact area for surface water in this analysis is the Mississippi River segment from the RBS south approximately 36 river miles to Baton Rouge and the U.S. Geological Survey (USGS) monitoring station there. The impact area for groundwater is West Feliciana Parish. Other impacts include Audubon Bridge construction and Big Cajun Unit 4 expansion, known projects in the region within the time frame of the RBS Unit 3 construction.

The RBS area is an area of abundant water supplies, and the temporary needs for construction would not impact the availability of water for other water users. In addition, plans to control the construction activities, materials of construction, and construction site would minimize any impacts of construction-related runoff/effluents to surface water and groundwater quality and the usability of the water by others.

Dewatering during the period of RBS Unit 3 construction is estimated to cause potential drawdown in surficial aquifer wells within a 4-mi. radius of the RBS during the construction dewatering period. Because of the abundance of surface and groundwater supplies in the RBS area, the availability of West Feliciana Water District public water, the predominant use of deeper aquifers as the preferred potable water source in the area, and the Applicant's commitment to assist any surficial aquifer water user with legitimate needs associated with the drawdown, the impact of dewatering to local water users is determined to be SMALL.

There would be a permanent change in water seepage patterns into groundwater from the expanded impervious areas. The implementation of a construction SWPPP would limit any loss or potential seepage of construction-related pollutants into groundwater.

4.7.3.1 Surface Water Use

Subsection 2.3.2 (for current operation of RBS Unit 1) and Subsection 5.2.2 (for planned operation of RBS Units 1 and 3) address the lack of impact to other water users or water supply needs associated with operation of RBS Units 1 and 3. Subsection 4.2.1 addresses the limited hydrologic alterations of the RBS site associated with construction.

The cumulative impacts of surface water use for construction needs at RBS Unit 3, combined with all existing uses of Mississippi River water, would be SMALL, and additional mitigation would not be warranted.

4.7.3.2 Surface Water Quality

The following two primary accountabilities will limit the impacts of construction activities to surface water quality:

- The existing LPDES permit for RBS Unit 1 (Reference 4.7-1) includes limitations for stormwater runoff discharge from the RBS with associated monitoring and reporting requirements. These requirements for RBS Unit 1 will continue during the construction phase for RBS Unit 3.

- A construction stormwater permit will be obtained from the LDEQ. Construction impacts for RBS Unit 3 will be reduced and effectively managed by complying with a construction stormwater permit and developing/implementing a site-specific construction SWPPP. The SWPPP will establish the plan to minimize erosion, control sediment, manage construction materials/activities, and reduce the impact of any surface runoff from the construction site to the waterways in the site vicinity.

The continuing limitations on discharges from RBS Unit 1 and other discharges to the Mississippi River by LPDES permits and the continuing regulation of water quality criteria in the Mississippi River by the LDEQ and the EPA provide a regulatory system to manage cumulative impacts to river water quality.

Construction plans and permit limitations would minimize any temporary impacts to surface water quality from construction of RBS Unit 3. The cumulative impacts to Mississippi River water quality resulting from construction of RBS Unit 3, combined with all existing water quality controls and limitations for all other discharges to the Mississippi River, would be SMALL, and additional mitigation would not be warranted.

4.7.3.3 Groundwater Use

The only other major projects planned for development in the vicinity of the RBS during the Unit 3 construction period are the Audubon Bridge project and the Big Cajun expansion across the river. Considering that these projects should not affect groundwater use, there should be no cumulative interaction with Unit 3. Therefore, the following subsections focus on RBS Unit 3 induced impacts on existing local uses.

The Applicant is obtaining drinking water from the West Feliciana Water District, which has adequate supply for future additional needs.

Construction activities are estimated to require approximately 165,000 gpd or 114 gpm of water from all sources (e.g., river, public, transported supplies, and groundwater sources, as applicable), for concrete batch plant operation, dust suppression, and sanitary needs. River water and lower-quality surficial aquifer water may be used for applications with less critical water quality needs.

Dewatering activities will occur during the construction excavation phase of approximately 9-months' duration. The construction dewatering would cause drawdown over an approximate 4-mi. radius area in the surficial aquifer. Since the drawdown is from a surficial aquifer that yields water of varying quality and quantity, the impact to other potential water users in the 4-mi. radius would be limited. The deeper aquifers that yield water of reliable drinking quality and quantity would not be affected by the surficial dewatering.

Construction activities may require some groundwater in addition to the river water and public water used by existing users such as RBS Unit 1. Cumulative impacts to groundwater during the RBS Unit 3 construction period would be SMALL.

4.7.3.4 Groundwater Quality

Because of changes in seepage patterns due to temporary redirection of surface flows for construction and stormwater runoff control, recharge of groundwater would be modified during the construction phase. As building construction and paving progresses, the surface area that allows seepage of precipitation into the groundwater would be effectively reduced, with slightly increased runoff and slightly decreased seepage for a larger developed site.

The impact of this reduction in seepage rate, in combination with other existing conditions and projects, is expected to be minimal to groundwater quality and quantity. Use of the construction SWPPP and the materials housekeeping elements of the SWPPP would limit any potential contamination of groundwater from the loss or potential seepage of construction materials/ supplies into the groundwater.

The RBS is located over an EPA sole source aquifer. (The EPA sole source aquifers in the area include the Southern Hills Regional Aquifer, which includes the Pascagoula Formation, as described in Subsection 2.3.2) In correspondence dated February 2008, the Applicant notified the EPA and LDEQ about potential plans to construct a new RBS Unit 3 over the aquifer. Potential contamination of groundwater from seepage from RBS Unit 3 construction is limited by such activities as preventing spills, leaks, and releases of materials by implementing the construction SWPPP, implementing spill prevention planning, using appropriate chemical storage systems, and performing frequent inspections of material storage systems, as discussed in Subsection 4.2.2. Ongoing cumulative impact monitoring includes semiannual sampling of radioactivity in groundwater upgradient and downgradient from the RBS.

No additional impacts to the sole source aquifer are anticipated as a result of RBS Unit 3 construction. Combined with all existing activities at the RBS site and in West Feliciana Parish, the cumulative impacts to groundwater quality are expected to be SMALL, and additional mitigation would not be warranted.

4.7.4 ECOLOGY

The RBS Unit 3 site layout and construction plan have been designed to minimize site-specific construction impacts to the terrestrial ecosystems to the greatest extent possible. In turn, these efforts would limit the project's contribution to cumulative impacts to these sources in the region. Currently developed and previously disturbed grounds would be used to the maximum extent possible. Clearing of forested areas has been planned so that wildlife corridors would be avoided, and most of the clearing would be limited to areas adjacent to existing cleared areas. Temporarily disturbed sites would be replanted with natural vegetation following completion of the project. Permanent impacts to wetlands would be insignificant, and no threatened, endangered, or otherwise protected species would be affected by project activities.

Off-site, the Applicant is proposing a new 148-mi. long, 200-ft. wide, 500 kV transmission line corridor between the RBS and Natchitoches, Louisiana, where a new switchyard (1000 ft. by 1000 ft.) would intersect an existing 500 kV line between Hartburg, Texas, and Mount Olive, Louisiana. Although ground studies have not been conducted for the transmission corridor, route selection has used developed or otherwise open lands to the maximum extent possible. The routing study also considered avoidance of wildlife (including refuges and management areas, protected species, and important habitats) to minimize impacts to terrestrial and aquatic resources.

The Audubon Bridge and the Big Cajun Unit 4 expansion are currently the only major projects in the region under construction. The bridge is located approximately 1/2-mi. south of RBS property, and Big Cajun is across the river from the RBS. No other proposed large-scale projects scheduled for construction during the RBS Unit 3 construction period are known in the region that would increase the cumulative impacts to regional ecological resources. There are no other past, present, or known planned actions in West Feliciana Parish that involve significant effects on terrestrial or aquatic ecological resources similar to those affected by construction of RBS Unit 3, Big Cajun, and the Audubon Bridge.

The existing Big Cajun facility (i.e., Big Cajun components other than Unit 4) was considered as part of the existing environment because its construction impacts have already occurred and it has been operating for several years. (Additionally, the new Big Cajun Unit 4 is scheduled to be completed by 2010, prior to the start of RBS Unit 3 construction.) Therefore, construction impacts from Big Cajun, for the most part, have been reflected in existing environmental characteristics. Terrestrial and aquatic ecology are discussed briefly in the following subsections.

4.7.4.1 Terrestrial Ecology

Existing terrestrial resources are described in Subsection 2.4.1, and the potential impacts to these resources are discussed in Subsection 4.3.1. As noted in Subsection 4.3.1, aside from developed or temporarily impacted areas, RBS Unit 3 would affect 12.2 ac. of undeveloped forestland, 0.2 ac. of which is wetlands. In the region (50-mi. radius), there are 924,478,200 ac. of undeveloped forestland and 7,515,243,000 ac. of wetlands (refer to Subsection 2.2.3.2). As a percentage of the regional acreage, the on-site forestland affected is approximately 1.3E-06 percent of the total and wetlands are even less at 2.2E-10 percent. These are infinitesimal amounts and, when coupled with no impacts to protected species, minor impacts to wildlife, and other subjects covered in Subsection 4.3.1, the cumulative impacts to terrestrial resources from on-site construction of RBS Unit 3 are considered SMALL, even considering the Audubon Bridge and the Big Cajun expansion.

The cumulative impact of off-site activities (i.e., the transmission line construction) must be considered somewhat subjectively, because the route selection is preliminary and no ground studies have been conducted. However, the line routing has utilized as much open and developed lands as possible and avoided protected species, wetlands, and other terrestrial resources wherever possible (refer to Subsection 4.3.1.2). As such, the anticipated cumulative impacts of the off-site activities may be greater than those resulting from on-site activities; however, the cumulative impacts are expected to remain SMALL in comparison to regional resources.

4.7.4.2 Aquatic Ecology

For this analysis, the geographic region encompassing past, present, and foreseeable construction actions (including RBS Unit 3) is the area immediately surrounding the RBS, including adjoining sections of the Mississippi River and the area surrounding the existing RBS Unit 1 and transmission line ROW. Projects similar to RBS Unit 3 in this area include Big Cajun Unit 4 and the Audubon Bridge.

Direct impacts to on-site aquatic resources at the RBS site due to Unit 3 construction activities are expected to be minimal. Permanent losses of aquatic habitats would be limited to a single man-made pond (approximately 100 ft. by 50 ft.) located within the 3-ac. area proposed for the construction of offices and the drainage ditch realignment of West Creek (refer to Subsection 2.3.1.1.2).

Dredging of the barge slip in the LMR during construction activities to allow barge delivery of heavy construction equipment and building materials would result in the loss of benthic biota in this area. Dredging will also take place at the intake embayment to allow for the addition of upgraded technology to the existing intake technology. These dredging activities are expected to be similar to those ongoing O&M dredging activities used to maintain both the barge slip and the intake embayment under an existing USACE permit.

Additional impacts to off-site aquatic resources due to transmission line construction, as detailed in Subsection 4.1.2, are expected to be minimal. The final design of the proposed transmission lines and respective corridors would span any aquatic ecosystems crossed. Additionally, transmission tower construction is expected to be limited to terrestrial locations to the maximum extent possible. Subsection 2.2.2 details the water bodies crossed by the new transmission corridors. ROW clearing can occur in areas adjacent to these aquatic resources; however, indirect impacts to aquatic resources are expected to be minimized through preventive measures developed and implemented through a construction SWPPP.

Indirect impacts to aquatic systems, such as increased sedimentation and increased water flow throughout intermittent water bodies, are also expected. These effects could cause temporary losses to benthic habitat and biota due to siltation, as well as short-term declines in phytoplankton productivity and zooplankton densities in the immediate area affected by construction. While this may temporarily reduce food resources for forage fish species, these effects would be limited in duration and temporary in nature and would cease upon the completion of RBS Unit 3 construction. Affected aquatic systems are expected to revert to preconstruction conditions upon completion of RBS Unit 3 construction, and impacts are anticipated to be SMALL.

Other less likely, but potential, impacts include interruption of fish migration and spawning and fish mortality related to accidental chemical spills. While it is not expected that migratory pathways would be physically barricaded during construction, increased turbidity can act to inhibit migratory cues in some fish species. Contaminants in construction effluents can also act as chemical barriers inhibiting fish migratory behavior. To reduce sediment loading and effluent runoff into on-site water bodies, a construction SWPPP and SPCC plan would be developed and in place prior to the start of construction.

Similar impacts to aquatic resources would be expected from the construction of the Audubon Bridge and Big Cajun Unit 4. As with the RBS Unit 3 development, such impacts would be temporary, limited to a small area, and relatively minor; aquatic communities would recover quickly following completion. As a result, the Audubon Bridge and Big Cajun Unit 4 projects, scheduled to be completed by 2010, would not result in significant cumulative impacts to aquatic resources.

From an historic perspective, the construction of RBS Unit 1 in the 1980s did not change the Mississippi River significantly. For example, in 2007, a comparative analysis of recent (2000 - 2001) and historic (1977 - 1979) fish samples collected near St. Francisville, Louisiana, and the RBS site (RM 240 to RM 273) was performed (refer to Subsection 2.4.2.2.1). Studies examined for this analysis documented 79 species of fish as common to scarce, and no threatened or endangered species were encountered in either set of samples. Final conclusions stated that the fish communities identified in both historic and recent surveys are similar, indicating that the fish community of the Mississippi River near the RBS site is relatively stable, and speciation of common fishes has not changed significantly since historic studies (i.e., the 1970s) were performed prior to RBS Unit 1 construction and earlier expansion of Big Cajun power plant operations.

In summary, the contribution of construction of RBS Unit 3 to the cumulative impacts on aquatic ecological resources in the West Feliciana Parish area would be SMALL, and additional mitigation would not be warranted.

4.7.5 SOCIOECONOMIC, HISTORIC, AND CULTURAL RESOURCES

Much of the analyses of socioeconomic impacts presented in Sections 4.5 and 5.5 of this ER 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 would 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.

During the period of construction of RBS Unit 3, the construction project would create significant direct and indirect socioeconomic benefits while maintaining consistency with the West Feliciana Parish plan. The project would provide substantial benefits for the West Feliciana Parish area, including low income and minority areas, while having a SMALL impact on the area culture and human health. The potential for negative impacts would be controlled through appropriate construction practices. Given the location of the RBS in a Census Block Group that is neither low income nor minority, there is no reason to expect that any low income or minority areas within the parish or region would encounter any significant negative impacts from the construction activities or be disproportionately affected by the project.

Construction impacts to historic properties identified within the footprint of the RBS Unit 3 expansion are considered SMALL, and avoidance or mitigation measures will be applied (refer to Subsection 4.1.3). The Applicant will have procedures to ensure that neither known nor newly discovered historic and cultural sites would be inadvertently affected during on-site activities that involve land disturbances. Construction of the new facility would not affect land outside the bounds of the current RBS property. Therefore, any additional cumulative impacts would be negligible.

4.7.6 NONRADIOLOGICAL HEALTH

This impact analysis includes the RBS site and construction/operations workers during the period of construction. Any nonradiological health impacts are expected to be localized such that projects outside the RBS site are not considered in the cumulative analysis.

The cumulative health impacts of operation of the existing RBS Unit 1 and the construction of the proposed RBS Unit 3 on the ambient temperature of the Mississippi River and cooling tower releases to the river or atmosphere with regard to the potential formation of thermophilic microorganisms were evaluated in Subsection 5.3.4. The RBS currently uses biocides to reduce hazards from microbiological organisms in the cooling towers, and the Applicant has committed to employ appropriate industrial hygiene practices to protect facility and construction workers from the effects of thermophilic microorganisms in the cooling towers of the new unit. Health risks to workers are expected to be dominated by occupational injuries at rates below the average U.S. industrial rates. Health impacts to the public and workers from noise and dust emissions were also evaluated and found to be SMALL.

In summary, the cumulative impacts on nonradiological health would be SMALL, and additional mitigation would not be warranted.

4.7.7 RADIOLOGICAL IMPACTS

Since the only known significant potential source of radiological impacts in the project vicinity would be RBS Unit 1, this impact analysis includes only the RBS site during the period of construction for RBS Unit 3. During that period, construction workers on-site would receive some radiation dose from the continued operation of RBS Unit 1. Doses were calculated based on exposure to direct radiation, gaseous effluents, and liquid effluents. The total collective dose during the construction period from all on-site sources, as summarized in Table 4.5-5 and compared to the public dose criteria in Tables 4.5-6 and 4.5-7, indicates that the workers would not need to be classified as radiation workers.

It is concluded that annual construction worker doses attributable to the operation of RBS Unit 1 for the proposed construction of a new facility would be SMALL because it would be a fraction of 10 CFR 20 and 10 CFR 50 Appendix I limits. Thus, monitoring of individual construction workers would not be required. Construction workers are to be treated as if they were members of the general public in unrestricted areas.

4.7.8 CONCLUSION

This subsection summarizes, in a cumulative sense, the potential impacts to West Feliciana Parish resulting from construction of a new RBS Unit 3 at the RBS site. For the duration of the proposed construction period, the evaluation accounted for existing impacts in West Feliciana Parish, known/planned activities such as the Audubon Bridge construction project, the Big Cajun Unit 4 expansion, and the RBS Unit 3 construction plans.

For nearly all potential impact items addressed, the potential cumulative impacts resulting from construction or resulting from planned mitigations/avoidance are generally SMALL, and additional mitigation would not be warranted.

A similar evaluation of the cumulative impacts of RBS Unit 3 operation is presented in Section 5.11.

4.7.9 REFERENCES

4.7-1 Louisiana Department of Environmental Quality, "Louisiana Water Discharge Permit - River Bend Station, Permit Number LA0042731," June 2006.

CHAPTER 5 ENVIRONMENTAL IMPACTS OF STATION OPERATION

Chapter 5 presents the potential environmental impacts of operation of the proposed RBS Unit 3. Impacts are analyzed in each section within this chapter, and a single significance level of SMALL, MODERATE, or LARGE has been estimated for potential impacts in each environmental resource area as defined in Subsection 1.1.7. Potential mitigation measures that may be taken to reduce adverse impacts are also described in each section, as applicable.

The sections in this chapter cover the following environmental resource areas:

- Land Use Impacts (Section 5.1).
- Water-Related Impacts (Section 5.2).
- Cooling System Impacts (Section 5.3).
- Radiological Impacts of Normal Operation (Section 5.4).
- Environmental Impacts of Waste (Section 5.5).
- Transmission System Impacts (Section 5.6).
- Uranium Fuel Cycle and Transportation Impacts (Section 5.7).
- Socioeconomic Impacts (Section 5.8).
- Decommissioning (Section 5.9).
- Measures and Controls to Limit Adverse Impacts During Operation (Section 5.10).
- Cumulative Impacts of Operation (Section 5.11).

The following definitions are generally used throughout the sections in this chapter, with some variation in the areas of the vicinity and region as necessary for particular issues:

- RBS site - The 3330-ac. existing Unit 1 and proposed Unit 3 site.
- Vicinity - The area within approximately the 8- to 10-mi. radius around the RBS site, specified by resource area.
- Region - The area within approximately the 50-mi. radius around the RBS site.

5.1 LAND USE IMPACTS

Subsection 5.1.1 describes the impacts of RBS Unit 3 operation on land use at the RBS site and within the 8 mi. vicinity. For the land use impacts analysis, the 8-mi. vicinity is defined by a 10-km band around the outside of the RBS property boundary, in compliance with NUREG-1555 guidance. Subsection 5.1.2 describes impacts that could occur along transmission lines and in off-site areas resulting from operations and maintenance (O&M) activities. Subsection 5.1.3 describes potential impacts on historic properties in the site and vicinity, along the on-site transmission corridors, and at off-site areas. The operation of RBS Unit 3 is not expected to have a substantial effect on any current or planned land uses; therefore, its overall operational impact on land use is expected to be SMALL.

5.1.1 THE SITE AND VICINITY

The land around the existing site is used primarily for forestry and pasture, and there are some areas in agricultural use as cropland in the vicinity (Figure 2.2-1). Adverse impacts to the RBS site and vicinity would occur primarily during construction of Unit 3, as documented in Chapter 4. Impacts on land use at the plant site and vicinity from RBS Unit 3 construction are evaluated in Subsections 4.1.1 and 4.1.2. 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 RBS site.

Land use within and adjacent to the existing RBS site is discussed in Subsection 2.2.1. Figures 2.1-3, 2.1-4, and 2.2-1 illustrate land use within the site and within the 8-mi. vicinity. No new areas are expected to be disturbed after the construction phase ends, and no agricultural crop production is expected to occur on the RBS site because it is largely forested outside the areas occupied by the power plant structures. Therefore, operations at the RBS site are expected to have SMALL impacts on the forest, maintained grassland, and developed land located within the site boundary.

The RBS Unit 3 heat dissipation system description is provided in Subsection 3.4.1. Heat dissipation to the atmosphere from operation of the RBS cooling towers and the effects of the cooling tower plumes and drift are discussed in detail in Subsection 5.3.3. The impacts of the cooling tower plumes regarding salts, fogging, icing, plume shadowing, precipitation, noise, and avian collisions on the RBS site are discussed in Subsection 5.3.3.2. Salt deposition is not likely to be a concern for agricultural producers in the vicinity because most cooling tower drift impacts would be confined to the site, with minimal drift reaching beyond the site property boundary. Analyses of the heat dissipation system operation for RBS Unit 3 found that the impacts to the site and vicinity would be SMALL.

Socioeconomic impacts related to land use during RBS Unit 3 operation are described in Section 5.8. The analysis in Section 5.8 indicates MODERATE to LARGE beneficial earnings and employment benefits in the region, SMALL to MODERATE impacts from increased traffic flow, with other socioeconomic impacts (noise, housing, local public services, and education) related to land use during operation anticipated to be SMALL.

5.1.1.1 Land Use Planning and Zoning

The operation of RBS Unit 3 would comply with West Feliciana Parish land use plans and zoning requirements because the site is on land already zoned and planned for industrial development and use. The area south of the RBS site and the State Highway 10 extension has already been zoned for industrial use and would not be affected by operation of RBS Unit 3. Operation of RBS Unit 3 would have no impact on area planning and zoning designations. As discussed in Section 2.2, West Feliciana Parish is compiling a new Comprehensive Plan that is expected to make recommendations consistent with current land use and plans for the RBS site and vicinity.

In keeping with the industrial zoning of the immediate area surrounding the RBS site, the West Feliciana Community Development Foundation is seeking clean industrial tenants for a planned business park within 1 mi. south of the south RBS property line. Some businesses may choose to avoid this location because of its proximity to an operating nuclear plant, while others may see the existing industrial infrastructure and power supply as an advantage of the location. Depending on the viewpoint of each industry seeking to locate in the business park, operation of RBS could either hinder or accelerate the industrial and potential commercial land use of the area.

Land use related to the demand for new housing for the operations and outage work force is described in Subsection 5.8.2.1.

Impacts related to land use planning and zoning during RBS Unit 3 operation are expected to be SMALL.

5.1.1.2 Transportation

Vehicular traffic to the RBS site would increase with the estimated 500 operational workers needed to run Unit 3. Clearly, the number of new workers would represent a substantial increase over current staffing at RBS Unit 1. Figure 2.2-4 shows the transportation resources that serve the region. Currently, there are no bridges on major roadways within the immediate site vicinity; however, the Audubon Bridge under construction just south and east of the RBS property is forecast to be completed in 2010. The closest existing bridges are located on Interstate 10 (Horace Wilkinson Bridge) near Baton Rouge, about 20 mi. south, and on U.S. 65 (Natchez-Vidalia Bridge) at Natchez, Mississippi, about 53 mi. north (Reference 5.1-1).

The vehicular infrastructure in the vicinity of the RBS site has routinely handled a fluctuating workforce during construction and outages at RBS Unit 1, which would constitute a much larger traffic load than would be expected during RBS Unit 3 operation. In addition, the Audubon Bridge, State Highway 10 extension from New Roads to Starhill, and the widening of U.S. Highway 61 (discussed in Sections 2.2 and 2.5) would further alleviate potential traffic problems during commuting hours.

On-site, unpaved roads at RBS release visible quantities of dust when driven over during dry conditions, especially when they are subjected to increased traffic by heavy vehicles. During operation, impacts associated with dust are not expected to go beyond the RBS site because of its relative isolation and the significant forest buffer between the operations area and off-site permanent populations and structures. Measures such as spraying the roads with water or adding more gravel to road surfaces may be taken, if necessary, to reduce fugitive dust emissions.

By the time of projected RBS Unit 3 operation in 2017, the widening of U.S. Highway 61 to four lanes and the construction of the Audubon Bridge and new State Highway 10 extension will have been completed, and these transportation structures will have been in use for several years. These projects would assist with alleviating the congestion along U.S. Highway 61 resulting from plant staff arriving and leaving during rush hour traffic going into and coming out of St. Francisville and Baton Rouge. Barge transportation would no longer be needed during operation, but may be used occasionally when needed for specific equipment deliveries at the plant. There are no plans to restore railroad transportation options at the RBS site during operation or at any time in the future.

Based on the transportation analysis discussed in Section 5.8, land use impacts from the transportation network used to access the RBS site would be SMALL to MODERATE as a result of operational activities for Unit 3. During the operation of the new unit, there could be minor increases in traffic on existing public roads leading to and from the RBS site during normal commuting hours because of an increase in operational personnel.

Land use impacts associated with plant operation that may have social and economic impacts to the region are discussed in Section 5.8.

5.1.1.3 Soil and Agriculture

During operation of RBS Unit 3, there are not likely to be significant erosion issues that would affect the site or the surrounding vicinity. Construction would have been completed by the operation stage, and stabilization measures would already be in place to prevent erosion and sedimentation impacts to the site and vicinity. Erosion at the RBS Unit 3 site would be prevented through the observance of erosion control measures and adherence to permits and the Stormwater Pollution Prevention Plan (SWPPP) as a routine practice during operation. Young vegetation would be in place over most of the areas that had been disturbed during construction, which would help prevent erosion and enhance soil stability. Because there would no longer be a routine need for land clearing, excavation, and similar activities after completion of construction, normal activities carried out during the operation of RBS Unit 3 would not have significant erosion or soil impacts.

Prime farmland and construction impacts to prime farmland are discussed in Sections 2.2 and 4.1, respectively. None of the land on the RBS site is used for agriculture. As described in Section 2.2, prime farmland areas on sites dedicated to urban development are excluded from the definition of prime farmland. Since the RBS site is dedicated to industrial development, which can be considered part of urban development, it is reasonable to conclude that soils formerly designated prime farmland on the site would now be excluded from the definition of prime farmland. Therefore, no new impacts within the site are anticipated as a result of RBS Unit 3 operation.

As evaluated in Section 5.3, impacts from cooling tower drift and salt deposition would be SMALL and confined to the RBS site, with minor amounts of drift that could extend outside the property boundary and into the vicinity. The analysis in Section 5.3 explains that the drift would have minimal potential impacts to agricultural lands in the vicinity of the RBS. These minimal impacts to agricultural land are not anticipated to affect agricultural land use in the vicinity of RBS during operation of the new unit.

Overall soil and agricultural land use impacts from RBS Unit 3 operation are expected to be SMALL.

5.1.1.4 Ecological Impacts

As detailed in the subsections below, ecological resource impacts to land use from RBS Unit 3 operation are anticipated to be SMALL.

5.1.1.4.1 Natural and Forested Areas

Effects on natural and forested areas during operation of RBS Unit 3 would be very limited. The forested and natural areas present on the plant site are on the periphery or farther removed from the main areas of plant operation and activities; therefore, there is very little potential for impacts to these areas during the course of normal operation. The Applicant selectively logs portions of the forested areas on-site on a 12- to 15-year cycle, and this activity is anticipated to continue during operation of RBS Unit 3. Logging operations have not affected the natural and forested area land use on-site during Unit 1 operation and are similarly not expected to impact land use during Unit 3 operation. Accordingly, impacts to land use related to natural and forested areas on the RBS site and in the vicinity are expected to be SMALL.

5.1.1.4.2 Water Courses, Wetlands, and Floodplains

Water-related impacts of RBS operation are discussed in more detail in Section 5.2. Once construction is complete, there is very little potential for impacts to these areas during the course of normal operation. Measures to prevent impacts to water resources, such as those included in the SWPPP and Spill Prevention, Control, and Countermeasure (SPCC) Plan, will be implemented as a matter of course. Therefore, impacts to these resources are expected to be SMALL with regard to land use on the site or in the site vicinity during Unit 3 operation.

5.1.1.4.2.1 Groundwater

During operation of RBS Unit 3, groundwater use would comprise a very small portion of the plant water supply. Since RBS use of this resource would have minimal impact on the water table and groundwater wells used by residents in the vicinity of RBS, there would be SMALL impacts to land use on and in the vicinity of the RBS site as a result.

5.1.1.4.2.2 Streams and Water Bodies

During normal operation, the small bodies of water that cross the RBS site, including Grants Bayou and Alligator Bayou, would not be affected. Measures specified in the site SWPPP and SPCC Plan would prevent adverse impacts to on-site waters. With the implementation of these measures, it is reasonable to predict that effects on streams and water bodies would have SMALL impacts on land use on the site or in the site vicinity.

5.1.1.4.2.3 Discharges to the Mississippi River

A description of waste heat is provided in Section 3.4. The portion of the waste heat that is not discharged to the atmosphere by the cooling towers is discharged to the Mississippi River through the permitted RBS outfall structure. As is the case for Unit 1 operational discharges, all waste heat discharges from RBS Unit 3 operations would be in accordance with federal, state, and local laws and regulations and applicable permit requirements, such as those of the Louisiana Pollutant Discharge Elimination System (LPDES) permit. The Louisiana Department of Environmental Quality (LDEQ) conducts regular inspections and consults with the Applicant about issues that require resolution. The expected increase in volume of cooling tower blowdown discharge water from Unit 3 (6264 gpm) compared to the volume discharged from Unit 1 (2612 gpm) would be a 240 percent increase. However, the change in temperature in the immediate area of the discharge point caused by operation of the new unit would be small and would not affect the current or future uses of the Mississippi River, nor would it have significant effects on aquatic biota, as described in Subsection 5.3.2.2.

In Section 3.6, effluents containing chemicals are described; in Section 5.2, effluents are analyzed for their impacts to the Mississippi River during operation. The Mississippi River is publicly accessible and is used mainly for commodity transport and industrial water supply in the area of the RBS. No residential (vacation or year-round) housing is located along its immediate shores. The river is designated for multiple uses in the area of the RBS, including primary and secondary contact recreation; these uses and the land uses related to them would not be affected by chemical, thermal, or other discharges from RBS Unit 3 operation. Therefore, Mississippi River discharge impacts to land use during operation are expected to be SMALL.

5.1.1.5 Recreation Areas and Viewshed

There are a number of recreational land use areas within the site vicinity, as discussed in Section 2.2. The recreational areas closest to the RBS site may experience increased visitation from the larger operational workforce of Unit 3 combined with that of Unit 1. Some recreation area users at the closest recreation areas, such as Hemingbough, Cat Island National Wildlife Refuge, Audubon State Commemorative Area, and the Mississippi River, could perceive slight negative impacts if portions of the new, 550-ft. natural draft cooling tower are visible from these areas where there was previously only a forested view. However, because of the angle of view and the forest cover around the site and around the nearest recreation areas, it is very unlikely that an observer on the ground would be able to see any portion of the cooling tower or other plant structures from the nearest recreation areas. SMALL land use impacts related to these recreational facilities would be expected as a result of RBS Unit 3 operation.

5.1.1.6 Air Quality

Overall impacts to air quality from operation activities at RBS Unit 3 are expected to be minimal, as described in Subsection 5.3.3. Air emissions would be controlled in accordance with local, state, and federal laws and the requirements and conditions of the RBS Unit 3 air permit documents. Regular maintenance of the unpaved roads on-site would reduce fugitive dust emissions from typical site traffic, and cooling tower salt deposition and drift impacts would not significantly affect surrounding agricultural lands or vegetation. Operational impacts to air quality at the site and in the vicinity would not affect land use on the site or in the vicinity of RBS Unit 3; impacts would be SMALL.

5.1.1.6.1 Dispersion of Heat and Moisture from Unit 3 Cooling Towers

Potential impacts on land use would be related to possible increases in local temperatures, fogging, icing, and salt deposition resulting from heat discharge out of the new natural draft and mechanical helper cooling towers. Subsection 3.4.1.1 contains a detailed description of the operation of the cooling towers. Increases in overall atmospheric temperature would be minimal and localized to the RBS site; atmospheric temperature increases are not anticipated to affect the atmospheric or ground temperatures beyond the RBS site boundary. Therefore, there would be no significant impacts to on-site or off-site land use caused by heat dissipation to the atmosphere from the new cooling towers for RBS Unit 3. Residential and recreational land uses should not be affected by cooling tower emissions, although localized, temporary impacts are possible.

Drift from cooling towers using freshwater usually has low salt concentrations. Drift from natural draft designs can extend to greater distances than that of mechanical draft towers; mechanical tower drift largely remains in the immediate vicinity of the towers. Drift would not be expected to cause damage to vegetation in the vicinity of the RBS site. The potential steam plume would not be likely to affect the highway during normal atmospheric conditions. Therefore, no impact to land use from cooling tower drift is expected on the site. Based on the proposed cooling tower distance from the site boundary and the prevailing wind direction, there may be a SMALL impact beyond the site boundaries. The effects of the cooling tower plumes from RBS Unit 3 operation on fogging and icing on and around the RBS site are evaluated in Subsection 5.3.3.1.2 and Subsection 5.3.3.1.3 for salt deposition and have been determined to be SMALL.

5.1.1.7 Pipelines

Operation of RBS Unit 3 would not affect pipelines on the site or in the vicinity. As shown and described in Section 2.2, the major pipeline routes in the area do not cross the site and would not be near the construction area for Unit 3. A small water pipeline has been constructed on the site to provide a supply of potable water from West Feliciana Parish Water District No. 13. Impacts during operation would be SMALL.

5.1.1.8 Spills

The measures discussed in Section 4.1 to prevent spills on the site during construction would also be implemented during operation. Environmental training is, and would continue to be, provided to existing and future plant staff members to increase their awareness of the potential effects of spills on the environment and to assist their compliance with best spill avoidance practices as outlined in the SPCC Plan. If a spill did occur, the impact on land use during operation would be temporary; the spill area would be avoided as cleanup progressed and would be returned to its normal use upon completion of spill cleanup. Staff training and observance of spill avoidance measures at the RBS Unit 3 site is expected to result in SMALL impacts to land use on the site and in the vicinity from potential spills.

5.1.1.9 Solid Waste

Solid waste produced during operation of RBS Unit 3 would be properly recycled or disposed of in closed containers. Waste would be picked up on a regular basis to avoid overflow of containers and windblown waste on the site and in the surrounding area. In an effort to prevent windblown waste from affecting the river or on-site natural areas, plant staff and contractors would be notified that littering is prohibited. Hazardous chemicals and waste would be stored inside enclosed buildings with secondary containment so that these materials could not migrate to the environment by wind or moisture.

RBS Unit 3 would generate waste requiring disposal at permitted facilities and landfills. Further discussion of radioactive waste disposal and nonradioactive wastes is contained in Sections 3.5 and 3.6. Impacts of radioactive and nonradioactive waste disposal are discussed in Section 5.5.

The RBS solid waste practices outlined above, as well as existing waste minimization practices, provide for responsible waste management and reduce the amount of waste generated to a minimal level; therefore, the impacts to land use caused by disposal of wastes generated at RBS are considered SMALL and do not warrant mitigation.

5.1.1.10 Noise

Noise levels during normal station operation are expected to be similar to ambient noise levels during Unit 1 operation. Operational noise levels for RBS Unit 1 have not affected land use in the plant area; therefore, it is anticipated that RBS Unit 3 noise impacts during operation would be SMALL and would not impact land use in the area. Noise impacts during operation are discussed in more detail in Subsection 5.8.1.1.

5.1.1.11 Factors Contributing to Potential Cumulative Impacts

During operation, RBS Unit 3 would contribute to cumulative impacts in the area much less than it would during construction. Aesthetic impact to the vicinity from the new 550-ft. cooling tower, in addition to the aesthetic impact of other development that may be ongoing, such as in the West Feliciana Business Park south of the RBS, could affect the area during operation.

Low-level and high-level radioactive waste disposal could have a SMALL impact on land use on the site if temporary or long-term storage is not available at other locations. An additional unit at the RBS may necessitate construction of another spent fuel storage concrete pad on the site to store waste until a federal repository is available. Low-level waste may need to be stored on the site if its current destination is no longer available.

Land use impacts that would contribute to cumulative impacts in the area of the RBS are anticipated to be SMALL. Other impacts that may contribute to cumulative impacts from operation would not significantly affect land use on the site or in the area, including water discharge and other areas discussed in Section 5.11.

5.1.1.12 On-Site and Vicinity Land Use Impacts Summary

With consideration given to the topics previously discussed in this subsection and their potential effects on land use, impacts to land use in the site and vicinity resulting from RBS Unit 3 operation are anticipated to be SMALL.

5.1.2 TRANSMISSION CORRIDORS AND OFF-SITE AREAS

A description of the existing and proposed transmission corridors associated with the RBS site is provided in Section 3.7 and Subsection 2.2.2. One on-site transmission line corridor expansion and one entirely new off-site transmission corridor are proposed to serve RBS Unit 3. There are no off-site areas associated with RBS Unit 3 other than the new off-site transmission corridor. Land use within and adjacent to the existing RBS transmission corridors is discussed in Subsection 2.2.2. Figure 2.2-1 depicts land use on the site and in the vicinity. Land use in the area of the proposed new off-site transmission corridor is shown in Figure 2.2-7.

Effects of transmission line corridor construction on land use were evaluated in Subsection 4.1.2. Various aspects of transmission line operation (e.g., ozone production) have the potential to affect land use through their effects on wildlife and humans. These effects are evaluated in Section 5.6. None of these potential impacts is expected to be significant to agricultural or other land uses in the area.

The expanded on-site transmission corridor would have very little effect on land use during operation of RBS Unit 3. There would be occasional vehicular traffic in the expanded corridor for maintenance purposes, which could result in SMALL impacts to vegetation and soils and minor amounts of soil erosion. These minor impacts would not affect land use on the RBS site or in the vicinity.

Land use impacts that would occur within the new off-site transmission line corridor would be confined to the corridor area and would occur mostly during construction, as described in Subsection 4.1.2. During operation of RBS Unit 3, the new transmission lines and towers would have SMALL impacts on the land uses adjacent to the corridor in the form of vegetation management and noise from maintenance and inspection vehicles, workers, and corridor inspection by small aircraft. Very small amounts of erosion and sedimentation may occur as a result of vehicle traffic in the corridor, especially during wet weather. These impacts would be short-term and occasional in nature. Cultivation and grazing can continue beneath the new line(s) as they did before construction of the off-site corridor.

5.1.2.1 Planning and Zoning

During operation, the expanded on-site corridor and the new transmission structures and the new off-site transmission corridor would continue to be in compliance with the land use plans and zoning requirements (where applicable, as discussed in Subsection 4.1.2) of West Feliciana, Pointe Coupee, Avoyelles, Grant, Rapides, and Natchitoches Parishes, which are crossed by the new off-site transmission corridor. The area crossed by the new off-site transmission corridor is removed from residences and development as much as possible along most of the route and primarily traverses agricultural land. This agricultural land comprises a very small portion of the available agricultural land in the region, and agriculture can still be practiced in the transmission corridor under the new line. It is reasonable to assume, therefore, that operation of a small new corridor would have SMALL impacts on the surrounding land use.

5.1.2.2 Transportation and Rights-of-Way (ROW)

During operation of the RBS Unit 3 transmission system, all tower structures and new lines would already be in place, including any portions of the system that had been constructed across roads, pipelines, or other utilities. No new transportation infrastructure crossings or ROW would be needed to support the transmission system during RBS Unit 3 operation, and maintenance activities would be carried out so as not to interfere with traffic, pipeline, or utility operations in the area.

The 10-ac. on-site expansion of the Fancy Point switchyard would not affect transportation or ROW during operation because the parish road named West Feliciana Parish 7 would have been relocated during construction to accommodate the expanded switchyard.

Transmission line operation as it relates to transportation and ROW is anticipated to have SMALL impacts on land use on-site and in the vicinity.

5.1.2.3 Agricultural and Soil Issues

Agricultural land use is prevalent along the new off-site transmission corridor route. Agricultural land usually has minimal occupancy; no significant number of residences would be in proximity to the transmission lines. Some agricultural uses may be slightly curtailed in the areas directly adjacent to or under the new off-site corridor because of landowner preference, although landowners would be permitted to farm under the lines during operation. No agricultural use occurs in the expanded on-site corridor areas or anywhere on the RBS site.

Maintenance activities undertaken during operation of the transmission corridors would occur within the 200 ft. width of the corridor and would not affect land use in adjacent areas. Maintenance may cause some temporary erosion and compaction along certain portions of the transmission corridor and on any access roads that have gravel or other unpaved surfaces. Erosion impacts would be unlikely to affect adjacent properties outside the transmission corridor. During operation of the transmission lines, vegetative cover will have been established and will prevent erosion onto adjacent land, and no excavation, grading, earthwork, or similar activities would occur as they did during construction.

The implementation of best management practices (BMPs), use of minimal maintenance vehicles and access roads to the extent possible, and limiting transmission line maintenance work during wet weather conditions would result in SMALL impacts to agricultural land and soils both along the new off-site transmission corridor and to soils in and around the expanded on-site transmission corridor.

5.1.2.4 Ecological Impacts

Subsection 2.4.1 describes the vegetative cover within the existing transmission corridors associated with the RBS site, which has been identified as upland and bottomland forest. Although the transmission corridors already exist, impacts are anticipated from expansion of the on-site corridor into forested areas and the new off-site corridor into agricultural and forested areas. There will also be impacts from routine maintenance of the transmission corridors, including vegetation control, such as mowing and access road maintenance, and from operation (e.g., transmission system noise, electrical and signal interference, electromagnetic frequency effects, small aircraft visually checking lines, and access road traffic and worker occasional presence). Such activities are not expected to result in land use restrictions or changes beyond the boundary of the transmission corridors.

The transmission lines would produce small amounts of ozone and nitrogen oxides, electromagnetic fields, and corona noise and may cause some bird mortality as a result of collisions with structures and conductors. In addition, periodic cutting of vegetation for ROW maintenance would affect terrestrial wildlife through replacement of forested edge habitat with short meadow type habitat.

Occasional bird mortality may result from bird collisions with the transmission tower structures and the conductors. Bird collisions with lines are most evident where the lines pass through areas of bird concentration, such as river crossings and wetland areas frequented by large numbers of waterfowl. Bird concentrations of concern have not been noted on the RBS site in the bottomland areas, the bayous, or near the Mississippi River near the RBS transmission lines, and the lines should have no greater impact on birds than other transmission lines in adjacent corridors and elsewhere in the region. The Applicant’s transmission group has an Avian Interaction Policy that ensures compliance with laws, regulations, permits, and its Avian Interaction Program guidelines. One measure from this program includes the avoidance of areas of high bird densities during initial routing of transmission lines. When the route is finalized at a time closer to operation of the lines, bird concentrations along the new off-site transmission corridors would be investigated for this and measures taken to mitigate anticipated effects in areas where impacts might occur.

Overall, ecological impacts on land use associated with O&M of the on-site and off-site transmission corridors are considered SMALL.

5.1.2.5 Recreation and Aesthetics

Recreation areas crossed by the transmission lines would be primarily affected during construction of the expanded transmission corridor, as described in Subsection 4.1.2. There are no recreation areas within the on-site transmission corridor expansion; however, the off-site corridor may cross recreation areas or other aesthetically sensitive lands. New off-site transmission line route crossings of these areas cannot be determined until the route is finalized. If the off-site route does cross recreation areas, some recreation area users may view their recreation experience as potentially degraded by the visual intrusion of the new transmission line structures. Even though some recreationists may perceive this adverse aesthetic impact, they are not likely to discontinue their use of the affected recreation areas.

The on-site expanded transmission corridor would have some aesthetic effect, but it would be mostly confined to the site and areas within RBS employee view. The aesthetic impact would be dependent on the perception of the viewer with regard to conversion of forest to grass and low vegetation typical of a utility corridor use. The expanded on-site transmission corridor may be noticeable to observers across the Mississippi River in Pointe Coupee Parish, as explained in Subsection 4.1.2.

The new off-site transmission corridor would have a definite visual impact, which would have occurred mostly during construction. During operation, observers in the area around the new off-site corridor, whether they are residents or travelers driving past the area, would likely notice the presence of the operating transmission line. The line would have been visible during most of the construction process, so it would become an aspect of the landscape that viewers would likely be accustomed to seeing during operation.

Impacts to recreation areas and aesthetic impacts as they relate to land use would be SMALL.

5.1.2.6 Spills

Spill prevention and response will be addressed in the same manner along transmission corridors as it is on the RBS site (Subsection 4.1.1.11), primarily through observance of preventive measures. Extra care would be taken during operation to avoid spills of transformer oils and fluids and to avoid using maintenance vehicles with oil or other fluid leaks when work is performed on the transmission lines. With these precautionary measures in place during operation, impacts to land use from spills are expected to be SMALL.

5.1.2.7 Noise

Noise, electrical and signal interference, and production of ozone and nitrogen oxides result from corona phenomena (electrical discharges in the air around the conductors) associated with the operation of power lines. Corona increases with voltage, adverse weather conditions (e.g., high humidity or fog), and the number of surface irregularities (e.g., scratches, dirt particles) on the conductors. The Applicant prevents corona effects to the degree possible through sizing of the conductors on its transmission lines. After it is strung on the towers, the new on-site 500 kV line would add an indiscernible level of additional noise to the noise from the existing lines. The new off-site 500 kV line would emit a low level of noise, and there may be residents at points along the off-site corridor that perceive the low humming sound of the new transmission line over the background noise of the mostly rural route; however, it is not likely to be loud enough to cause annoyance because of the height of the wires and the deliberate avoidance of most residential areas when the route was selected. Most portions of both the on-site and off-site transmission lines are removed enough from residences that corona noise would not likely be audible.

Maintenance activities would result in a minor amount of noise, both in the on-site corridor and along the portion of the off-site corridor that workers are servicing. This noise would be from worker activity and communication, vehicles, and vegetation maintenance equipment such as mowers and chainsaws. These noise-producing maintenance activities are of short duration and would not occur on a regular basis at most areas along the lines. Many maintenance activities are likely to take place in areas away from residential land uses.

Overall noise impacts during operation as they relate to land use would be SMALL, as the minor noise impacts during operation would not cause changes in land use in or adjacent to the transmission corridors.

5.1.2.8 Corridor Maintenance Actions

New impacts would be created as a result of the operation of RBS Unit 3 with regard to maintenance of transmission corridors. RBS Unit 3 would use an expanded on-site transmission corridor as well as a new off-site transmission corridor as discussed in Sections 2.2 and 3.7. Therefore, the impacts caused by operation of these new transmission lines would be expected to be greater than those associated with the operation of RBS Unit 1 because of the greater area occupied by the lines serving both units compared to only one unit.

The impacts usually associated with transmission line ROW maintenance consist of erosion/siltation, disturbance of wildlife and wildlife habitat, and similar impacts where ROWs cross floodplains and wetlands. ROW maintenance would be conducted similar to current operations but over a wider area.

The power line ROW would be managed by periodic removal of tall trees within the ROW and removal or trimming of such trees at the edge of the ROW. This maintenance practice is in widespread use among utilities and has not been known to have significant impacts. Population numbers of most of the wildlife species occurring on the ROW may fluctuate in accordance with the cutting cycle, with the lowest number occurring shortly after the periodic cutting. To minimize the potential for significant impact to wildlife and aquatic resources, pesticides and herbicides would not be used. Access roads would be used for ROW maintenance as needed.

During heavy vehicle access to the transmission corridor, especially during wet weather conditions, erosion may occur on unpaved transmission line access roads. Access roads would be constructed to follow the contours of the land and would use water diversion measures to direct water off the sides of the access roads and prevent erosion. During operation of the transmission corridor, there would be vegetative cover in place to stabilize the soil and prevent erosion.

Because of their periodic nature and typically small areas being maintained at any one time, the effects of ROW maintenance on land use are expected to be SMALL during operation of RBS Unit 3, even with the increased width of the expanded on-site corridor and the new off-site corridor.

5.1.2.9 Electrical Impacts

The transmission lines would produce small amounts of ozone and nitrogen oxides, electromagnetic fields, and corona noise. These impacts to the public from transmission line operation, as well as mitigation measures to prevent impacts, are expected to be SMALL and are detailed in Subsection 5.6.3.

5.1.2.10 Factors Contributing to Potential Cumulative Impacts

The main transmission line operation impact that could contribute to cumulative impacts in the area is the potential for avian collisions with the transmission lines. Subsection 5.6.1.2 addresses this potential impact, which is projected to be SMALL. Mitigation for avian collisions, if required, would be done in consultation with the U.S. Fish & Wildlife Service (USFWS).

Continuing aesthetic impacts from the presence of the new off-site transmission corridor in the agricultural landscape where there were previously no structures of this type could contribute to cumulative aesthetic impacts in the area if other projects of this type are ongoing in the same area across the same land uses.

5.1.3 HISTORIC PROPERTIES

Subsection 5.1.3 focuses on the effects that RBS operations may have on existing historic properties (e.g., archaeological sites, isolated finds, standing structures, cemeteries, and traditional cultural properties) on the RBS site and within a 10-mi. (16.1-km) radius of the center point. This examination of historic properties is mandated by Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and the National Environmental Policy Act (NEPA) of 1969, which dictate that federal agencies must make assessments of eligibility for inclusion on the National Register of Historic Places (NRHP) for each cultural resource affected by the undertaking (refer to Subsection 4.1.3). To determine the areas of potential effect (APE), a cultural resources inventory was compiled of all nondisturbed areas of the construction footprint and a review was made of all previously recorded archaeological sites, historic standing structures, and NRHP properties situated within 10 mi. (16.1 km) of the proposed project area (refer to Subsections 2.5.3 and 4.1.3). The APE cultural resources investigation was determined in consultation with the Louisiana Division of Archaeology, State Historic Preservation Office (SHPO) and in consideration of those portions of the RBS property that were previously disturbed during Unit 1 construction (refer to Subsection 2.5.3). Additional consultation was initiated with potentially interested Native American tribes as a part of the fieldwork portion of this project. To date, no commentary from the interested tribes has been received. Copies of all correspondence with the Louisiana SHPO and all interested tribes are included in Appendices 2A and 2B, respectively.

5.1.3.1 Historic Properties Identified Within the RBS Proposed Project Area

Two archaeological sites (i.e., Sites 16WF36 and 16WF181) within the RBS proposed project footprint that were identified during the 2007 cultural resources investigation were assessed as significant or potentially significant, respectively (refer to Subsection 2.5.3), in accordance with the NRHP Criteria for Evaluation (Reference 5.1-2). These two sites will be avoided by the Applicant prior to the construction of RBS Unit 3; refer to Subsection 4.1.3 and Figure 2.5-16.

In addition to these two properties, 33 archaeological sites have been assessed as eligible or potentially eligible for inclusion on the NRHP and are located within a 10-mi. (16.1-km) radius (refer to Subsections 2.5.3 and 4.1.3; and Table 2.5-49). Furthermore, 50 additional historic properties have been listed on the NRHP. These include 6 archaeological sites and 63 individual structures greater than 50 years in age (Tables 2.5-50 and 2.5-51). This discrepancy in number (i.e., 50 historic properties versus 69) stems from multiple structures being nominated as a single entity. For example, 16 individual structures were included in the NRHP nomination for Cottage Plantation. Since each structure received a separate identification number from the state of Louisiana, the number of individual resources is higher than the number of listed properties.

Regarding the two historic properties identified within the RBS Unit 3 footprint, the Applicant has determined that avoidance measures will be implemented for these two properties prior to construction. Additionally, the Louisiana Division of Archaeology has indicated that it has no viewshed concerns associated with the size of the RBS Unit 3 tower or the visible plume (refer to Subsection 2.5.3) as they relate to historic properties located within 10 mi. (16.1 km) of the RBS Unit 3 project. Therefore, operation of the proposed RBS Unit 3 project would not have an adverse effect on historic properties, and the impact to historic resources is considered SMALL.

5.1.3.2 Historic Cemeteries

A total of 9 of 35 historic cemeteries identified within 10 mi. (16.1 km) of the RBS Unit 3 were recommended as eligible or potentially eligible for inclusion in the NRHP; the NRHP eligibility of the remaining 26 cemeteries was not assessed (refer to Subsection 4.1.3). Operation of the proposed RBS Unit 3 project poses no immediate impacts to these cemeteries, and no viewshed concerns are associated with these cultural resources. Therefore, the impact of operations on these resources is considered SMALL.

5.1.3.3 Traditional Cultural Properties

No traditional cultural properties were identified during the background research completed for the RBS expansion project. As a result, no traditional cultural properties would be affected by operations, and the impact of operations is considered SMALL.

5.1.3.4 Historic Properties Identified Within the Transmission Corridor

No historic properties were identified during the 2007 archaeological inventory of the proposed on-site transmission corridor. Therefore, operational impacts to historic properties within this area are considered SMALL.

5.1.3.5 Inadvertent Discovery of Cultural Resources During Plant Operations

The Applicant implements fleet-wide procedures for activities such as trenching, excavation and ground penetration, environmental reviews and evaluations, and cultural resources protection. These procedures detail immediate Stop Work orders and notification of appropriate personnel should inadvertent discovery of cultural resources take place during operation activities. An unanticipated discoveries plan is presented in Subsection 4.1.3.6. Therefore, operational impacts are anticipated to be SMALL.

5.1.4 CONCLUSION

Operation of RBS Unit 3 would take place within the existing site property, where power generating and transmission facilities are already in operation for RBS Unit 1. During operation, there would be no new clearing of land or changes in land use for on-site facilities or transmission lines because these activities would have taken place during construction. A small aesthetic impact to some vantage points in the surrounding area may occur with the operation of the natural draft cooling tower and visibility of the steam plume rising from the new cooling tower location for Unit 3. After RBS Unit 3 is operating, it is unlikely that aesthetic impact would affect land use in the surrounding area because the cooling tower structure would have been visible in the area for part of the construction period as building of Unit 3 progressed and would be an expected part of the viewshed during operation.

Impacts of operation for both the Unit 3 facilities on-site and the transmission corridors would be minimized because the new and existing units and expanded and existing transmission lines would be in adjacent locations to areas already used for power generation and utility purposes. The new off-site transmission lines would operate in a new corridor, but most impacts from the new corridor would have been experienced during construction; maintenance would involve the 200-ft. corridor and would have minimal impacts on land use outside the corridor.

Operational maintenance activities for Unit 3 and its transmission system would continue in a fashion similar to the ongoing maintenance for Unit 1 and the existing transmission lines, but maintenance would be slightly expanded to cover Unit 3 and the expanded on-site and new off-site transmission corridors.

Archaeological Sites 16WF36, the Magnolia Plantation Sugar Mill, and 16WF181, which were assessed as significant and potentially significant, respectively, applying the NRHP Criteria for Evaluation, will be avoided by the Applicant and will not be affected by RBS Unit 3 operation. Potential impacts to historic properties in the area and within 10 mi. of the site, impacts to historic cemeteries, and impacts to traditional cultural properties during operation are expected to be SMALL.

Overall, as discussed in this section, impacts to land use on-site and in the vicinity from operation of RBS Unit 3 and on-site and off-site transmission corridors are expected to be SMALL.

5.1.5 REFERENCES

5.1-1 Weeks, J. A. III, Website, http://www.visi.com/~jweeks/index.html, The Bridges and Structures of the Lower Mississippi River page, http://www.visi.com/~jweeks/lower_mississippi/index.html, Ohio River Confluence to the Head of Passes Outlet, Second Edition, March 2007, accessed January 30, 2008.

5.1-2 36 CFR 60.4 (a-d), "Criteria for Evaluation," National Register of Historic Places, 2004.

5.2 WATER-RELATED IMPACTS

The hydrological alterations, plant water supply, and water use impacts of station operation are described in Subsections 5.2.1 and 5.2.2.

5.2.1 HYDROLOGIC ALTERATIONS AND PLANT WATER SUPPLY

The hydrologic alterations and plant water supply impacts of station operation are described in this subsection. Subsection 2.3.1 provides greater detail on surface water bodies and the groundwater aquifers, including their physical characteristics. The surface water bodies described in Subsection 2.3.1 include the Mississippi River; local streams including Grants Bayou, Alligator Bayou, and West Creek; and local farm ponds.

Discussions regarding the low flow characteristics of the Mississippi River at the intake structure location are provided in Subsection 2.3.1 and in FSAR Subsection 2.4.11. Present and known future surface water uses are discussed in Subsections 2.3.2 and 5.2.2. Groundwater withdrawal information is provided in Table 2.3-14.

5.2.1.1 Cooling Water System

Makeup water (cooling water and other raw water needs) for a new facility would be primarily supplied by the Mississippi River via the existing embayment and intake structure through the Station Water System (SWS), which would be modified for the combined Units 1 and 3 operations. The intake structure is located on the east bank of the river at approximately River Mile (RM) 262.5 (Reference 5.2-1).

The SWS would supply raw water for the circulating water system (normal power heat sink and the auxiliary heat sink), the demineralized water systems, and the fire protection system. The plant water use diagram is provided in Figure 3.3-1.

The maximum withdrawal rate for Unit 3 is 25,524 gpm (56.9 cfs). The combined maximum withdrawal rate demand for Units 1 and 3 is 40,927 gpm (91.2 cfs) of water. This is a small amount of water relative to the normal river flow. Using the minimum flow value of 100,000 cfs (Subsection 2.3.1.1.1), the maximum withdrawal rate for Unit 3 is 0.057 percent of the minimum flow value in the river, and the maximum withdrawal rate for Units 1 and 3 combined is 0.091 percent of the minimum flow value in the river.

Because of the low percentage of river flow that would be required for plant use, the maximum plant withdrawal would not have any adverse effect on the river hydraulic characteristics. In addition, operation of the intake pumping station does not affect the flow of water across the floodplain.

Periodic dredging of the embayment is required because of sediment transport in the river. Dredging activities typically occur no more than once per year and are performed in accordance with a general permit from the USACE. The volume of material removed is usually not tracked because it is placed back into the river; however, the volume of material removed is estimated to be less than 20,000 cu. yd. per removal. The most recent maintenance dredging of the embayment was performed on January 9-11, 2008. The estimated volume of material removed was 14,585 cu. yd. Dredging activities temporarily increase turbidity in the Mississippi River.

The U.S. Army Corps of Engineers (USACE) and the state of Louisiana do not currently restrict the quantity of water that can be withdrawn from the Mississippi River. Therefore, no permit for river water withdrawal is required for the RBS. In addition, Louisiana does not directly regulate or limit the consumptive water withdrawals from either groundwater wells or water bodies.

In summary, operational activities at the RBS are considered to be of SMALL impact and mitigation is not warranted, based upon minimal impact from dredging discharge design and no need for dewatering during operation.

5.2.1.2 Potable Water System and Dewatering

The Applicant is connected to the West Feliciana Parish Water System as the source of potable water for the RBS; this source would also supply potable water during the construction and operation of Unit 3. The daily drinking water consumed during construction is anticipated to be 9450 gpd. The maximum expected peak usage rate of potable water for the operation of Unit 1 and Unit 3 is 315 gpm.

Since minimal groundwater is used for the operation of the RBS, and the average surface water withdrawals are minimal compared to the total flow past the site, water use impacts would be SMALL and mitigation is not warranted. The present and future uses of groundwater are further discussed in Subsection 5.2.2.

Dewatering is not needed during Unit 3 operation because there will be no ongoing construction activities in deep excavations, which sometimes require dewatering. Therefore, no associated impacts to groundwater would be expected.

5.2.1.3 Water Returns/Discharges

Effluent from a new facility would be combined with that from the existing Unit 1 discharge. A new cooling tower blowdown pipeline will be installed along the existing pipeline route for the combined flows. The maximum Units 1 and 3 combined discharge rate is 9034 gpm. The discharge velocity at the pipe exit is 3 fps. The effluent is discharged downstream of the intake structure to preclude recirculation to the intake pipes. Discussion and analysis of the thermal discharge impact are provided in Subsections 5.3.2 and 5.3.2.2.1. The volume of effluent is extremely small compared to the minimum flow rate in the river. The discharge rate, thermal plume, and bottom scour (refer to Subsection 2.4.2 for a description of bottom scouring) in the river associated with the effluent discharge would have a very SMALL impact and mitigation is not warranted.

5.2.1.4 Alterations to Local Streams and Lakes

Plant area runoff flows to West Creek, which drains about 1.0 sq. mi. before joining the main stem of Grants Bayou. During Unit 1 construction, a Fabriform ditch was constructed in the plant area to contain West Creek flow and to minimize the potential of plant flooding during extreme rainfall events. Prior to Unit 3 construction, the Fabriform lined portion of the ditch would be shifted to a location just west of its current alignment. The ditch alignment is shown in Figure 2.3-15. Combined Units 1 and 3 stormwater discharge to West Creek would be larger than current discharges because of the additional impervious area and total contributing area.

Discharges would be controlled in accordance with the LPDES permit and associated stormwater management program requirements.

One of the existing small ponds, with a surface area of 0.5 ac., would be removed during Unit 3 construction, as described in Subsection 4.2.1.1. Additional impacts to ponds in the site vicinity are not anticipated as a result of the operation of RBS Unit 3.

Based on an evaluation of present and future water use, water withdrawal and discharge at the RBS site are considered to be of SMALL direct, indirect, or cumulative impact, and mitigation is not warranted.

5.2.2 WATER USE IMPACTS

This subsection describes the water use impacts of a new RBS Unit 3 during the facility operation phase, includes information about the operation of RBS Unit 1, and highlights information from other sections of this report.

Key issues presented in this discussion include the following:

- The water to be used by the new RBS Unit 3 for cooling water and other needs is a very small portion of the Mississippi River flow.

- The effect of the water discharged to the Mississippi River from the existing RBS Unit 1 has been minimal, based on the results of ongoing monitoring programs.

- The impact of the discharge of water from a new RBS Unit 3 is projected to be minimal.

- Future use options of the Mississippi River and quantities of Mississippi River water available to future users are not projected to change or be limited as a result of RBS Unit 3 operations.

- Future use of groundwater by RBS Units 1 and 3 is anticipated to be small, and effects on groundwater are likewise expected to be negligible.

Additional details and cross-references are provided in this subsection. This subsection builds upon the discussion of hydrology impacts, including descriptions of hydrological alterations and their related operational activities and physical effects of hydrological alterations, in Subsection 5.2.1.

5.2.2.1 Water Use - Quantity-Related Impacts

This subsection notes that the future availability of Mississippi River water is not changed by the plans for RBS Unit 3. As noted in Subsection 2.3.2, the primary supply of water for RBS Unit 3 would be from the Mississippi River, with comparatively very small usage of groundwater. Therefore, this subsection focuses on impacts to the usage and quality of the Mississippi River. Subsection 2.3.2 includes information on water bodies, groundwater, and surface water withdrawal rates and uses, including recreational, navigational, and other uses. Sections 3.3 and 3.4 address plant water use and cooling systems.

As noted in Subsection 2.3.2, the predominant use of Mississippi River water in Louisiana is for power generation, with extensive use of river water for cooling. The Mississippi River would be the primary source of water for the new RBS Unit 3, including an estimated combined makeup flow withdrawal to Units 1 and 3 of approximately 40,927 gpm (based upon the addition of individual withdrawal rates shown in Figure 3.3-1, which summarizes proposed water use for Units 1 and 3). The Mississippi River has a large flow rate at RBS, as discussed in Subsection 2.3.1, and the planned maximum daily intake of river water by RBS Unit 1 and a new Unit 3 is only approximately 0.1 percent of the estimated minimum Mississippi River flow volume. Facility water usage does not vary significantly seasonally, so daily usage can be used to indicate monthly usage estimates.

Water consumption at the RBS is dominated by evaporative losses from the cooling tower system. With a normal loss of approximately 18,848 gpm in the water balance for Unit 3 attributed to evaporation and cooling tower drift (from Figure 3.3-1), this leaves a projected flow of approximately 9034 gpm for discharge or approximately 13 Mgd for the proposed maximum combined discharge for Units 1 and 3. Both the evaporative loss and the discharge flow are a small portion of the Mississippi River flow.

As noted in Subsection 2.3.2, the state of Louisiana does not currently restrict the quantity of water that can be withdrawn from the Mississippi River. Water rights or allocations do not apply to withdrawals of Mississippi River water. The existing LPDES permit (Reference 5.2-2) includes requirements to monitor and report discharge flow rates. No other federal, regional, or local water use limitations are known to be applicable.

In addition, there are no known diversions or returns of water between the plant discharge and the region of complete dilution.

Additionally, planned groundwater or public water usage for Units 1 and 3 is estimated at a maximum of only 315 gpm, a small flow from the public system or on-site aquifer systems described in Subsection 2.3.2, and a very small portion of the total water needs, as shown in Figure 3.3-1. Most of the on-site groundwater usage could be displaced by water supplied by the West Feliciana Water District, as noted in Subsection 2.3.2, because the water district has additional water available for the RBS if needed. This usage is not expected to compete with other future needs for the public water. Groundwater usage at the RBS is discussed further in Subsection 2.3.2.

Regarding evaporative losses from a new Unit 3 cooling tower, the Applicant will limit losses to the extent practicable to provide adequate operational conditions and compliance with all applicable permits and licenses.

In summary, the quantity of water withdrawals and usage of Mississippi River water by RBS Units 1 and 3 is small enough in relation to Mississippi River flow to have no anticipated effect on recreation, navigation, public water supply, or other anticipated usage of the river and its water by others. Therefore, impacts are anticipated to be SMALL.

5.2.2.2 Water Use - Quality-Related Impacts

This subsection describes how the future use of Mississippi River water is not limited by water quality changes associated with the plans for RBS Unit 3.

Under its current LPDES permit (issued in 2006 - Reference 5.2-2), the existing RBS Unit 1 discharges a projected maximum 4.655 Mgd of combined cooling tower effluent to the Mississippi River. The terms of the current discharge permit are summarized in Table 5.2-1 for all outfalls, including stormwater runoff outfalls. Limits included in the permit are those determined by the LDEQ to be protective of the Mississippi River water quality and the streams receiving stormwater, based upon a detailed evaluation of facility operations, facility wastewater discharges, waterway conditions, and Louisiana and federal water quality regulations and guidance, as discussed in Subsection 2.3.3.

Table 5.2-2 summarizes plant discharge composition based upon operating data from RBS Unit 1. The composition of combined discharges from Units 1 and 3 is expected to be similar, based upon design conditions.

As noted in Table 5.2-2, the composition of RBS Unit 1 discharges has been shown to be less than Louisiana water criteria, with the exception of sulfate, which is shown as high as 475 mg/l in the cooling water discharge versus the state criteria of 120 mg/l (Reference 5.2-3). The following information applies to sulfate concentrations:

- Assuming that the RBS discharge flow is a maximum of 0.1 percent of Mississippi River flow (as mentioned in Subsection 5.2.2.1), the maximum contribution to total Mississippi River sulfate concentration is approximately a 0.5 mg/l increase, based upon the 475 mg/l sulfate value and a dilution factor of 1000 from the 0.1 percent flow value. The highest Mississippi River sulfate value highlighted in recent data near RBS (in Subsection 2.3.2 and Table 2.3-17 [52.1 mg/l]) added to the increase of 0.5 mg/l still results in a value (52.6 mg/l) that is significantly below the Louisiana water quality criteria of 120 mg/l for that river segment (Reference 5.2-3).

- Average sulfate concentration in the Mississippi River, as shown in Table 2.3-17, for a sampling station near the RBS is approximately 39 mg/l; in Table 2.3-18, south of the RBS near Baton Rouge, the average sulfate concentration is approximately 40 mg/l. This would include the effects of all contributing stream flows and industrial, domestic, agricultural, and other source runoff/discharge to the Mississippi River between the two sampling locations and indicates that the 36-mi. river segment between the monitoring stations north and south of the RBS has been significantly below the maximum sulfate state criteria value of 120 mg/l.

- The LDEQ reviews the discharge data from the RBS and receiving water quality every 5 years as part of the scheduled renewal of the discharge permit. The LDEQ has not specified a sulfate limit for the RBS in the current permit (Reference 5.2-2). If conditions would indicate a concern for the water quality of the Mississippi River, the LDEQ could specify a sulfate discharge permit limit for the RBS.

5.2.2.2.1 Impacts from Stormwater Discharges

The LPDES permit (Reference 5.2-2) includes limitations for stormwater runoff discharge from the RBS, with associated monitoring and reporting requirements. The planned changes to the station layout for the addition of a new Unit 3 will increase the impermeable surface area and maximum surface runoff by approximately 70 percent. Thus, the total of the individual maximum stormwater flow rates shown on Table 5.2-1 would increase from approximately 12.9 Mgd for Unit 1 to a value of approximately 22 Mgd for the combined Unit 1 and Unit 3 maximum stormwater runoff flow. This change in the potential stormwater runoff plan rate does not appear to have a significant potential effect on flows or quality to the receiving waters from an extreme rain event.

Stormwater runoff from RBS Unit 1 is managed under the LPDES permit (Reference 5.2-2), with the limits shown in Table 5.2-1, and under a permit-required SWPPP that defines the BMPs used to minimize any contamination of runoff from the site. Runoff contamination from Unit 1 during the regular operations period is minimal because of limited exposure or handling of materials outdoors at the site, use of the procedures outlined in the SWPPP to minimize any contamination of runoff from precipitation, and feedback from the monitoring and inspections of the facility (i.e., if concerns are identified, corrective actions are taken).

Key aspects of an SWPPP typically include the following:

- Site Evaluation, Assessment, and Planning - This part of the plan identifies the potential sources of stormwater runoff contamination and reviews prevention methodology.

- Best Management Plans - The SWPPP identifies the best methods to manage operations and materials on-site to minimize contact of contaminants with stormwater runoff and to minimize erosion.

- Good Housekeeping Plans - Materials, supplies, chemicals, and fuels are managed and used in a way to minimize any potential losses to stormwater runoff. Techniques are specified in the plan for these materials.

- Inspections and Maintenance - A key element of the SWPPP is an active inspection program to ensure the proper use of the methods defined in the plan and to provide feedback for changes and improvements that are suggested based on observations. The SWPPP is a living document with active feedback from the inspection process. Responsible parties are assigned in the SWPPP for conducting inspections, taking timely corrective action as necessary, confirming adequate maintenance of controls, and modifying the SWPPP to deal effectively with changes and observations.

- Training and Recordkeeping - Effective use of the SWPPP requires initial training and refresher training for key operating staff. The SWPPP specifies training needs and the means for effective communication of identified issues and revised procedures. Records are maintained of inspections, training, and activity logs that are available during regulatory inspections.

Because of the proximity of Units 1 and 3 and similarity of operations, the stormwater outfalls would be combined with existing area drainage outfalls. Therefore, stormwater runoff from an operating Unit 1 and Unit 3 is projected to have similar minimal effects, with expected coverage under a combined unit LPDES permit, an expanded SWPPP that addresses both units, and continuation of monitoring and inspections. (Runoff control during the construction phase of Unit 3 was described in Section 4.2, including the transition from a construction SWPPP to an operational phase SWPPP.) Compliance with the LPDES permit and the SWPPP would provide protection to the waterways first receiving the runoff (presented in Table 5.2-1 for permit conditions and in Figure 5.2-1) and ultimately for the Mississippi River, which receives all site discharges directly or indirectly. Therefore, impacts are anticipated to be SMALL.

5.2.2.2.2 Impacts from Cooling and Process Water Discharge

The RBS Unit 1 facility has operated substantially in compliance with its LPDES permit limits since operation started in 1986. This demonstrates that maximum discharges have not exceeded the values shown in Table 5.2-1 and, thus, have been protective of the Mississippi River for other designated uses. The following discusses the key potential impacts to water use and water quality as a result of the operation of Unit 3. Measures for reducing such impacts are also addressed where applicable.

Effluent Toxicity Testing: An additional safeguard required by the LPDES permit is annual whole effluent toxicity testing of the RBS cooling water discharge to test for any cumulative toxic effect of the discharge water to U.S. Environmental Protection Agency (EPA)/LDEQ-specified test organisms. This testing is designed to detect any residual toxic effects caused by the total effluent, including the impact of any biocides or other chemical additives used in the water system at the RBS to control macro- and microbiological fouling and/or to inhibit corrosion in the cooling water systems. The LPDES permit requires that the samples collected for this test "are representative of any periodic episodes of chlorination, biocide usage, or other potentially toxic substances used on an intermittent basis" (Reference 5.2-2). The RBS has "passed" the whole effluent toxicity test each year since the first test was run under a new permit in 2000.

Whole effluent toxicity testing is anticipated to continue in a similar way for the testing of a combined discharge from Units 1 and 3 under a combined facility LPDES permit. This testing process would continue to analyze the toxic impact of Units 1 and 3 discharges to the Mississippi River. As noted in Subsections 2.3.3 and 3.6.1, biocides and other additive chemicals are used under the terms of the LPDES permit (Reference 5.2-2). The continuation of whole effluent toxicity testing will be a key measure to limit adverse water-use effects.

River Water Quality Trends: Concerning river water quality near RBS and the effects of discharges from the RBS, a comparison of water quality data collected by the U.S. Geological Survey (USGS) from the Mississippi River upstream and downstream of the RBS site (as described in Subsection 2.3.3 and in Tables 2.3-17 and 2.3-18) shows that Mississippi River water quality is substantially similar throughout the 36-mi. segment from St. Francisville, past the RBS, to Baton Rouge. The data trends demonstrate the ability of the Mississippi River to assimilate discharges and drainage to the river over that segment.

Radioactivity Sampling: Also reflecting actual upstream and downstream monitoring of the Mississippi River around the RBS, results of radioactivity sampling are mentioned in Subsections

2.3.3, 5.4, and 5.5. Potential radioactivity release is monitored at RBS Unit 1 in compliance with the U.S. Nuclear Regulatory Commission (NRC) license and NRC regulations and is reported annually to the NRC. This monitoring includes the following:

- Quarterly sampling of radioactivity in upstream and downstream Mississippi River surface water.
- Annual sampling of radioactivity in Mississippi River sediment.
- Semiannual sampling of radioactivity in groundwater upgradient and downgradient from the RBS plant.

Through 2006, the results of the monitoring program have indicated discharges/impacts below the limits of 10 CFR 20 and no river or sediment samples above levels that are already present from either naturally occurring background or weapons testing. Levels of radionuclides monitored in 2006 continued to remain similar to results obtained in previous operational and preoperational years (Reference 5.2-4). NRC radiation safety teams evaluate the monitoring program procedures in detail every 2 years (such as on November 1-4, 2005 in Reference 5.2-5). The continuation of this monitoring program is a key measure to limit adverse water-use effects. In addition, the RBS monitoring wells sampled as part of the NEI Groundwater Protection Initiative have not shown any detectable radioactivity levels of plant-related materials in the subsurface soils and water tables.

Impacts to Potential Users: The results above demonstrate the minimal effect of the existing RBS Unit 1 on the Mississippi River and its potential use by other users. Similarly, the increased flow from Unit 3 is projected to provide minimal effect on the river. Some of the key issues are as follows:

- Unit 3 operations would not include additional or different potential impact issues beyond those evaluated and regulated for Unit 1. Both operations would be similar in the technologies used, chemicals used, etc.
- Monitoring programs and requirements for both facilities are expected to be similar. For example, monitoring requirements for LDEQ wastewater discharges and NRC radioactivity monitoring are anticipated to be similar for the new unit, with the same types of controls and safeguards in place. (Monitoring programs are described further in Chapter 6 of this ER.)
- The assimilation ability of the Mississippi River is expected to remain the same as demonstrated by the temperature plume modeling results for Unit 3 (discussed further below).
- The Applicant is committed to limiting any adverse water-use impacts associated with the operation of RBS Units 1 and 3.
- Quantities of water to be used by Unit 3 are not expected to limit the quantities of water available in the future for other river water users, including recreational, navigational, and other non-consumptive known future water users.

Thermal Plume Size: Concerning the effect of thermal plumes on the river, all modeling studies to date of the RBS site have concluded that hot water discharge plumes from cooling water discharges to the Mississippi River have minimal effect because of the large size and assimilation capacity of the Mississippi River (Reference 5.2-6 and Subsection 5.3.2.1). Past thermal modeling studies have indicated that plumes do not restrict fish passage or significantly raise the river temperature.

A review in 2007 using the CORMIX (Cornell Mixing Zone Expert System) mixing zone model (a model supported by the EPA) showed that the combined cooling water discharge plume from the existing RBS Unit 1 and the proposed RBS Unit 3 would have minimal impact on the Mississippi River (refer to Subsection 5.3.2.1). The maximum mixing zone length determined by the CORMIX model for a temperature rise up to 2.8°C above river ambient temperature (in accordance with Louisiana water quality regulations - Reference 5.2-3) is approximately 63 feet, and the maximum mixing zone width is approximately 8.2 feet. This plume is located in a section of the Mississippi River that is 1700 to 4000 ft. wide (refer to Subsection 2.3.1), with a mean river velocity of approximately 4.3 fps. A discussion of this topic is provided in Subsection 5.3.2.1.

Dissolved Solids from Cooling: Another traditional water quality issue associated with power plant withdrawal of surface water for cooling and subsequent discharge of the cooling water is the increased concentration of dissolved solids in the cooling water discharge as a result of evaporative losses from cooling. The total dissolved solids (TDS) concentration from the combined RBS Units 1 and 3 discharge is projected by design engineers to be approximately 1500 to 2700 mg/l. Recent Mississippi River residue (TDS) data (in Subsection 2.3.3) are shown in the 169 to 282 mg/l range.

Assuming that the RBS discharge flow is a maximum of 0.1 percent of Mississippi River flow (as mentioned in Subsection 5.2.2.1), the maximum contribution to total Mississippi River TDS concentration is approximately a 2.7 mg/l increase, based upon the 2700 mg/l maximum TDS value and a dilution factor of 1000 from the 0.1 percent flow value. The highest Mississippi River TDS value (highlighted in recent data in Subsection 2.3.2 [282 mg/l]) added to the increase of 2.7 mg/l still results in a value (285 mg/l) that is significantly below the Louisiana water quality criteria of 400 mg/l for that river segment (Reference 5.2-3). This increase does not challenge the continuing compliance of the Mississippi River with the TDS criteria.

River Dredging: Concerning the Mississippi River water intake area for the RBS, the embayment was designed to minimize the amount and rate of sediment deposition carried into the embayment. Its location should pose no impediment to normal river traffic. Dredging of the embayment for maintenance of the embayment depth and configuration has been necessary no more than once per year during operations to date. Materials dredged from the embayment would continue to be placed back into the river as specified by the USACE in the applicable permit (Reference 5.2-7). Any effects from this activity are expected to be small and very temporary, based upon recent operations of RBS Unit 1. Materials remain in the river with a limited period of increased turbidity. (Dredging is also discussed in Subsection 4.2.1.)

Water Intake: The planned water intake system to be used for the combined RBS Units 1 and 3 water intake from the Mississippi River is discussed in Subsections 2.4.2 and 5.3.1. The modified intake screen system is designed to meet intake velocity guidelines to minimize the effects on aquatic life.

In accordance with the information given in this subsection, impacts from cooling and process water discharges are expected to be SMALL.

5.2.2.2.3 Impacts to Groundwater Quality

The existing operations of RBS Unit 1 have not resulted in significant, adverse impacts to groundwater quality. Semiannual upgradient and downgradient groundwater sampling for radioactivity as described above has not indicated any changes from previous sampling efforts (Reference 5.2-4). Groundwater sampling conducted in 2007 for a variety of physical and chemical parameters (summarized in Table 2.3-20) did not indicate apparent effects from more than 20 years of RBS Unit 1 operations. Also, most on-site groundwater usage could be displaced by water supplied by the West Feliciana Water District, as noted in Subsection 2.3.2.

Considering thus, the RBS Unit 1 has had no significant effect on groundwater quality, and no effects are expected from operations of RBS Unit 3. The following safeguards and factors discussed previously in this subsection demonstrate the minimal opportunities for impact:

- Storage and use of chemicals and other potential pollutants are very limited at the RBS.
- Process operations and materials storage are in sealed buildings with monitored containment and discharge points.
- Spills, leaks, and releases of materials are prevented and managed under such active programs at the site as stormwater pollution prevention planning, spill prevention planning, use of appropriate chemical storage systems, and frequent inspections of material storage systems.
- Discharges from the site are controlled via the LPDES permit (Reference 5.2-2).
- Semiannual groundwater monitoring for radioactivity would continue under the terms of the existing NRC license for Unit 1 and the expected license for Unit 3.
- Sampling would continue under the NEI Groundwater Protection Plan.

Groundwater quality impacts from RBS Unit 3 operation are expected to be SMALL.

5.2.2.3 Summary of Operational Impact to Water Users

As described in this subsection, the effects on water users of the operation of a new RBS Unit 3 are expected to be minimal (SMALL), as demonstrated by the operation of RBS Unit 1 and the flow and quality monitoring results discussed in this subsection; therefore, no mitigation measures are required. The combination of the new usage of Mississippi River water and the insignificant impacts to Mississippi River water quality would affect neither the current Mississippi River usage patterns (as described in Subsections 2.3.2 and 2.3.3) nor the availability of Mississippi River water for future users. The information described above contributes to the conclusion that RBS 3 operations would not affect the EPA's designation that the RBS section of the Mississippi River fully supports drinking water supply, fish and wildlife propagation, and primary and secondary contact recreation (as noted in Subsection 2.3.3.1.7). Compliance and control under the NRC facility license, NRC regulations, LDEQ permits, and LDEQ regulations, in combination with the protective measures described in Subsection 5.2.2.2.3, would continue to protect the river and area groundwater as demonstrated for Unit 1. (Federal, state, and local environmental authorizations are listed in Table 1.2-1.)

Unavoidable consequences of the operation of Unit 3 are the loss of water from evaporative cooling that is not returned to the river and the increased concentration of any dissolved solids contained in the return river water associated with the evaporative loss of water. Such issues would also be associated with many other types of power generation facilities, such as those facilities combusting natural gas or coal. The siting of a power facility using Mississippi River water is appropriate in mitigating the effects of evaporative water loss because of the large quantity of water available and the small proportion of river flow that would be lost to evaporation from this project.

5.2.3 REFERENCES

5.2-1 Gulf States Utilities Company, "River Bend Station Environmental Report, Operating License Stage," Volumes 1-4, Supplements 1-9, November 1984.

5.2-2 Louisiana Department of Environmental Quality, "Louisiana Water Discharge Permit - River Bend Station, Permit Number LA0042731," June 2006.

5.2-3 State of Louisiana Administrative Code, Title 33, Part IX, § 1123, Table 3, May 2007.

5.2-4 Entergy Operations, Inc., *River Bend Station - Annual Radiological Environmental Operating Report for 2006*, April 26, 2007.

5.2-5 U.S. Nuclear Regulatory Commission, "River Bend Station - NRC Radiation Safety Team Inspection Report 05000458/2005015," December 16, 2005.

5.2-6 Gulf States Utilities Company, "River Bend Station Unit 1, Final Environmental Report," as amended through Amendment No. 9.

5.2-7 U.S. Army Corps of Engineers, "General Permit - Silt Removal in the Mississippi River, EM-20-020-2486, SE (General Permit) NOD-23," issued to Entergy on June 3, 2002.

5.2-8 Entergy, Renewal Application for Permit LA0042731, prepared for Louisiana Department of Environmental Quality, April 29, 2004.

5.2-9 Entergy, *River Bend Station Support Manual*, Procedure No. ESP-8-008, February 5, 2007

Table 5.2-1 (Sheet 1 of 3)
Summary of Wastewater Discharges and Permit Limits - RBS Unit 1

Outfall ID No.	Source of Waste Stream	Volume (Mgd)	Pretreatment	Discharge	Parameters	Limit (Monthly Average)
101	Low-level radioactive, low volume wastewater	<0.016 (Intermittent)	Miscellaneous filtration	Combine with final cooling water to Mississippi River	Oil and grease Total suspended solids (TSS)	15 mg/l 30 mg/l
201	Sanitary wastewater, floor drains, low volume sources	0.130	Physical, activated sludge, aerated lagoons, ultraviolet (UV) disinfection	Combine with final cooling water to Mississippi River	Biochemical oxygen demand (BOD)	45 mg/l[(a)]
					Oil and grease	15 mg/l
					TSS	30 mg/l[(a)(b)]
					Fecal coliform	400/100 ml[(a)]
301	Metal cleaning wastewater	0.1 (Intermittent)	Miscellaneous physical	Combine with final cooling water to Mississippi River	TSS Oil and grease Copper Iron	30 mg/l 15 mg/l 1 mg/l 1 mg/l
401	Backwash, blowdown, and other low volume sources	<0.016 (Intermittent)	Miscellaneous physical	Combine with final cooling water to Mississippi River	Oil and grease TSS	15 mg/l 30 mg/l
501	Low volume mobile standby filtration and cooling water waste	<0.016 (Intermittent)	Screening, reverse osmosis (RO)	Combine with final cooling water to Mississippi River	Oil and grease TSS	15 mg/l 30 mg/l
601	Low volume filter backwash wastewater	<0.016 (Intermittent)	RO	Combine with final cooling water to Mississippi River	Oil and grease TSS	15 mg/l 30 mg/l

Table 5.2-1 (Sheet 2 of 3)
Summary of Wastewater Discharges and Permit Limits - RBS Unit 1

Outfall ID No.	Source of Waste Stream	Volume (Mgd)	Pretreatment	Discharge	Parameters	Limit (Monthly Average)
001	Cooling tower blowdown and internal outfall effluents 101, 201, 301, 401, 501, and 601	4.66	Dechlorination, neutralization	Discharge to Mississippi River	Temperature Free available chlorine Total chromium Total zinc pH range	105° F 0.2 mg/l 0.2 mg/l 1.0 mg/l 6 - 9 S.U.[c]
002	Stormwater from materials storage area and other areas	0.73 (Intermittent)	None	Ditch to Grants Bayou to Alligator Bayou to Thompson Creek to Mississippi River	Total organic carbon (TOC) Oil and grease pH range	50 mg/l[d] 15 mg/l[d] 6 - 9 S.U.[c]
003	Stormwater from several building areas; low volume wastewaters and condensates	5.4 (Intermittent)	Partial flow screening and oil/water separation	Ditch to Grants Bayou to Alligator Bayou to Thompson Creek to Mississippi River	TOC Oil and grease TSS pH Range	50 mg/l[d] 15 mg/l[d] 100 mg/l[d][e] 6 - 9 S.U.[c]
004	Stormwater from several building areas; maintenance wastewaters and condensates; effluent from 104	5.8 (Intermittent)	Partial flow screening	Ditch to Grants Bayou to Alligator Bayou to Thompson Creek to Mississippi River	TOC Oil and grease pH range	50 mg/l[d] 15 mg/l[d] 6 - 9 S.U.[c]

Table 5.2-1 (Sheet 3 of 3)
Summary of Wastewater Discharges and Permit Limits - RBS Unit 1

Outfall ID No.	Source of Waste Stream	Volume (Mgd)	Pretreatment	Discharge	Parameters	Limit (Monthly Average)
104	Exterior vehicle wash water	0.0004 (Intermittent)	None	Ditch to Grants Bayou to Alligator Bayou to Thompson Creek to Mississippi River	Chemical oxygen demand (COD) TSS Oil and grease pH range	300 mg/l[(d)] 45 mg/l[(d)] 15 mg/l[(d)] 6 - 9 S.U.[(c)]
005	Stormwater from cooling tower area	0.99 (Intermittent)	None	Ditch to Grants Bayou to Alligator Bayou to Thompson Creek to Mississippi River	TOC Oil and grease pH range	50 mg/l[(d)] 15 mg/l[(d)] 6 - 9 S.U.[(c)]
006	Clarifier underflow	0.86	None	Discharge to Mississippi River	Records of coagulants	N/A

a) Weekly average.
b) Limit applicable to maintenance wastewater discharges only.
c) Monthly average and daily maximum.
d) Daily maximum.
e) Limit applicable to low volume wastewater discharges only.

Source: Reference 5.2-2.

Table 5.2-2
Composition of RBS Unit 1 Discharges
(Result by Outfall[a] in mg/l [or other unit as noted])

Compound/ Parameter	001	002	003	004	005	101	201	Louisiana Water Criteria (acute)
Biochemical Oxygen Demand	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	0	
Chemical Oxygen Demand	42.9	11.2	42	18	35	5.4	15	
Total Organic Carbon	19.5	6.1	3.6	7.4	6.6	3.6	8	
Total Suspended Solids	14.0	11.0	5.3	5.0	153	2	5	
Ammonia (as N)	0.4	<0.1	0.4	<0.1	<0.1	<0.1	<0.1	
pH	6.69-8.29	6.98-8.38	6.87-8.84	7.19-7.98	6.86-8.56	NA	6.99-7.57	6.0-9.0
Color (in color units)	11.2	12	21	30	62	10	18	75
Nitrate-Nitrite (as N)	11.7	0.1	1.8	0.015	NA	0.84	4.69	
Phosphorus	1.66	<0.2	0.39	<0.2	0.589	1.2	2.8	
Sulfate	475	15	147	16	189	148	18	120
Sulfide	0.044	0.024	0.06	0.032	0.081	<0.02	<0.02	
Barium	0.24	0.074	0.074	0.044	0.078	0.24	0.011	
Iron	0.33	0.28	0.24	0.31	1.07	3.15	<0.1	
Magnesium	61.1	10.2	14.7	3.42	21	0.39	2.34	
Manganese	0.050	0.028	0.029	0.033	0.057	0.93	<0.02	
Copper	0.21	<0.01	0.04	<0.01	0.045	0.017	<0.01	26
Zinc	0.374	<0.02	0.11	<0.02	0.054	0.17	<0.02	157

a) Outfall numbers described in Table 5.2-1.

Source: Reference 5.2-8.

NA = Not available.

ER 5.2 Figures

Due to the large file sizes of the figures for ER Chapter 5, they are collected in a single .pdf file, which you can navigate via the figure numbers in the Bookmark pane. When cited in the text, the links for these figures will launch the .pdf file.

5.3 COOLING SYSTEM IMPACTS

This section describes the potential impacts to environmental resources at the RBS site due to the operation of the proposed RBS Unit 3 system, including the impacts associated with the operation of the new cooling system and associated natural draft and mechanical draft cooling towers. The proposed station water system (SWS) would provide makeup water to RBS Units 1 and 3 from the Mississippi River. The proposed SWS is a closed cycle cooling water system consisting of four river water intake screens, three pumps, four clarifiers, piping, and valves.

Unit 3 operation is anticipated to have SMALL effects on aquatic resources at the RBS. In the Generic Environmental Impact Statement (GEIS), the NRC stated that closed cycle cooling systems, such as the proposed SWS, have minimal water requirements compared with the water usage for open cycle cooling water systems (Reference 5.3-1). The SWS proposed for RBS would be designed, operated, and maintained in accordance with 40 CFR 125, "Requirements Applicable to Cooling Water Intake Structures for New Facilities under Section 316 (b) of the Act" (the FWPCA), including the intake velocities. Other wastewater discharges to aquatic resources at the RBS site are, and will continue to be, controlled in accordance with current and future Louisiana Pollutant Discharge Elimination System (LPDES) permits (Reference 5.3-2).

This section consists of the following four subsections:

- Subsection 5.3.1 presents the physical impacts caused by the flow field induced by the intake system during station operation, as well as impacts on aquatic ecosystems.
- Subsection 5.3.2 presents potential physical impacts (i.e., increased turbidity, scouring, erosion, and sedimentation) on receiving water bodies resulting from the plant's thermal discharge system, as well as impacts on aquatic ecosystems.
- Subsection 5.3.3 presents the aesthetic and physical environmental impacts on the atmosphere and terrestrial ecosystems in the vicinity of the heat discharge system at the site during station operation.
- Subsection 5.3.4 presents the human health impacts associated with the plant's cooling system.

5.3.1 INTAKE SYSTEM

Abbreviated descriptions of the existing RBS SWS (Unit 1) and the proposed combined RBS SWS (Units 1 and 3) are included. Additional details describing Units 1 and 3 station layout, intake flow rates, and intake velocity calculations can be found in Section 3.4. More specific descriptions of Lower Mississippi River (LMR) bathymetry, substrate characterizations, and ambient LMR current patterns exhibited in the vicinity of the intake structure, including illustrations, are included in Section 2.3. The intake structure location relative to the RBS site is presented in Figure 2.4-7.

Existing RBS Unit 1 SWS

The existing RBS Unit 1 SWS consists of two 100 percent river water intake screens (i.e., screens that are individually capable of supplying 100 percent of RBS Unit 1 water demand; two 100 percent pumps, piping, and valves; and two 100 percent clarifiers that withdraw makeup water from the main channel of the Mississippi River (Figure 5.3-1). The system was originally designed to provide makeup water supply to Units 1 and 2. Some components for Unit 2 were installed[a]; however, construction of Unit 2 was never realized.

The intake screens and associated housing are located in a man-made embayment (Figure 5.3-1) on the east bank of the Mississippi River. Each intake screen is 11 ft. wide diagonally and 4 ft. high. Back-flushing of the intake screens is provided by diverting flow from the operating makeup water pump to the intake screen, which is not in use (Figure 5.3-2). A 36-in. line crossties the pump suction piping to the screens, so that either screen may be placed into service with either pump.

Each pump is a vertical, centrifugal, two-stage pump with a design flow of approximately 15,300 gallons per minute (gpm) at 190-ft. discharge head. The net positive suction head required (NPSHR) is 20 ft., and the pumps operate at 705 revolutions per minute (rpm). Each pump motor is 1500 horsepower (hp) 4160 vacuum-assisted closure (VAC) and is powered from Switchgear NNS-SWG3A/B. The pumps were originally manufactured with three stages. The third stage was removed from each pump to reduce the discharge head. The pumping horsepower required was reduced when the third-stage impeller was removed, but neither the power supply nor the motor was modified.

The two 24-in. pump discharge lines are combined into one buried 36-in. header connected to a flow splitter box at the two clarifiers. Each clarifier is sized for 100 percent of the Unit 1 flow.

The makeup water pump house was built for three pumps, each capable of providing 50 percent of the total station flow for Units 1 and 2 (refer to Figure 5.3-3). The middle pump (P4B) was not installed following cancellation of the originally planned second unit. Suction (36-in.) and discharge (24-in.) piping for the middle pump were installed with blind flanges. The electrical system has the capability to power the third pump and to operate two pumps at the same time. The configuration for the existing SWS is illustrated in Figures 5.3-3, 5.3-4, and 5.3-5.

Proposed Combined RBS Units 1 and 3 SWS

The proposed RBS combined SWS would consist of four river water intake screens, three pumps, four clarifiers, piping, and valves. The proposed SWS would provide makeup water to RBS Units 1 and 3 through separate discharge lines and clarifiers (refer to Figure 5.3-6). Based on preliminary design values, the total flow rate for Unit 3 would be approximately 25,524 gpm. The total combined flow for both Units 1 and 3 would then be 40,927 gpm. The existing pump

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a. The makeup water pump house was built for three pumps, each capable of providing 50 percent of the total station flow (at the time, Units 1 and 2). The middle pump (P4B) was not installed following cancellation of the originally planned second unit (Unit 2). Suction and discharge piping for P4B were installed with blind flanges. The electrical system has the capability to power the third pump and operate two pumps at the same time. Refer to Figure 5.3-3 for illustrative clarification.

house and support systems would be used. The additional pump for Unit 3 would be placed where Pump P4B was planned to be installed during Unit 1 construction (refer to Figure 5.3-3).

The current configuration for Unit 1 makes use of one intake header and screen at a time. The design for combined unit flow (Units 1 and 3) requires both intake headers and intake screens with additional flow capacity to maintain the low through-screen velocity ($\leq$0.5 ft/sec) required by the CWA 316(b) regulation. Two new pairs of wedgewire intake screens would replace the screens that are currently connected to the existing intake lines (refer to Figures 5.3-5 and 5.3-6). Each new pair of wedgewire screens would be sized for at least the maximum single-unit flow for Unit 3 (25,524 gpm). The intake lines would be crosstied into a single pump suction header in the lower level of the pump house.

5.3.1.1 Hydrodynamic Descriptions and Physical Impacts

Since the cooling water would be withdrawn solely from the main channel of the Mississippi River, operational impacts associated with the proposed RBS combined SWS (Units 1 and 3) intake system operation would be limited to impacts on aquatic resources within the Mississippi River (refer to Subsection 2.4.2). Impacts could include alteration of site hydrology and increased riverbed scouring in the vicinity of the intake structure.

The original design for the Unit 1 SWS implemented intake design features that limited adverse operational impacts to aquatic resources of the LMR because of the physical location of the intake system. The existing intake system (Unit 1 SWS) is located in an embayment, with intake pipes that withdraw cooling water from the LMR (refer to Figure 5.3-2). The current intake velocity is minimal when compared with ambient river flow in the main channel of the LMR. Additionally, the location of the main portion of the intake technology in an embayment prevents the intake system from impeding barge traffic. Since the existing pump house and support systems for the Unit 1 SWS would be utilized to accommodate the additional equipment proposed for the Unit 3 SWS, the physical location of the combined SWS would be unchanged. Therefore, there would be no additional physical impact to the aquatic ecosystems associated with location of the system.

Additionally, operational measures that allowed for minimal impacts to aquatic resources during daily station operation were considered in the design of the Unit 1 SWS. These operational measures were also considered in the proposed design of the RBS combined SWS (Units 1 and 3). The measures include maintaining a low intake velocity (0.5 foot per second [fps] or less), which allows most aquatic organisms to avoid the intake altogether (further described in Subsection 5.3.1.2). An intake velocity of 0.5 fps or less also reduces the effects of bed scouring in the vicinity of the intake structure, although, as discussed in Subsection 2.4.2, the riverbed of the LMR is highly disturbed in its natural condition. Because of the low intake velocity design controls and the current state of the LMR riverbed, the additional scouring impacts that could be attributed to RBS intake operation would be SMALL.

Historically, extensive hydraulic modeling was performed to analyze the operational effects of the Unit 1 intake on the LMR. The results of the modeling concluded that the measured intake velocity for Unit 1 would not affect natural currents of the LMR (References 5.3-3 and 5.3-4). The intake flow rate for the proposed RBS combined SWS (Units 1 and 3) is 40,927 gpm (91.19 cubic feet per second [cfs]), approximately 0.08 percent of the extreme low flow conditions of the LMR in the vicinity of the RBS site (historically recorded at 110,000 cfs). The anticipated intake flow for both units (Unit 1 and Unit 3) would be negligible (approximately 0.02 percent) when compared to the average flow of the Mississippi River (447,000 cfs); the ambient flow of the river would not be altered by Unit 3 operation. Therefore, impacts to hydrology would be SMALL.

5.3.1.1.1 Maintenance of Intake Structure and Components

The intake embayment is configured to minimize the amount and rate of sediment deposition and littoral debris load to the LMR in the vicinity of the SWS intake technology. The base of each intake screen would be at an elevation that provides sufficient separation between the screens and the dredged bottom of the embayment, such that dredging due to sedimentation would not be required frequently (e.g., frequency of no more than once per year; Figure 5.3-2).

Periodic dredging of the intake embayment may be necessary.[b] Disposal of dredge spoils from embayment construction and spoils from periodic dredging, if required, would be performed in a manner acceptable to the USACE and the LDEQ. Dredged material would be returned to the Mississippi River, as allowed by the existing Section 404 permit (Reference 5.3-5). A temporary increase in turbidity would occur in the Mississippi River near the RBS site during dredging activities. However, due to the short-term duration of the dredging operations, the dredging activities would not affect water quality outside an acceptable mixing zone. The base of each intake screen would be configured to allow enough space between the screen and the river bottom to allow maintenance dredging due to sedimentation, which would not be required more than once annually.

Zebra mussels are a nuisance species that act as a biofouling agent in cooling and makeup water systems. In some cases, fouling has been severe enough to clog intake and discharge lines. The potential clogging due to mussel infestation represents an operational hazard that can require cooling/makeup water system shutdown for cleaning and maintenance of the intake/discharge lines and associated equipment. Therefore, it is pertinent that their population numbers be monitored as a preventive measure for safe and efficient plant operation. A zebra mussel monitoring and control program (ZMMCP) is currently in place at the RBS to monitor the occurrence and relative densities of zebra mussels in the LMR, the clarifier influent and effluent, and the clarifier internals. Periodic inspection and/or sampling of the adult populations in the LMR near the intake piping are performed, and the intake screens and adjacent piping are cleaned when deemed necessary. This monitoring program is associated with the current RBS LPDES permit and is expected to be included in future LPDES permits for the RBS site. Therefore, intake maintenance impacts would be SMALL.

5.3.1.2 Aquatic Ecosystems

Environmental impacts from cooling water intakes are regulated through the LPDES permit system. The LPDES program requires that the location, design, construction, and capacity of the cooling water intake structure (CWIS) reflect the best technology available (BTA) for minimizing

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b. Maintenance dredging for the Unit 1 intake technology has been performed on an annual basis and was last performed in January 2008. Approximately 14,565 cu. yd. of material was removed from the intake embayment during these activities (permit allows for removal of up to 110,000 cu.yd. of material [Reference 5.3-5]).

adverse environmental impacts. For many facilities, this entails construction of closed cycle cooling systems to limit adverse impacts related to impingement[c] and entrainment.[d] CWIS intake screens can also be modified to help reduce impingement and entrainment mortality.

In 1996, the NRC published an extensive study detailing operational impacts of nuclear plants on various environmental resources. In consideration of the effects of closed cycle cooling system intake structures on aquatic ecology, the NRC studied and evaluated the impingement of juvenile and adult fish and shellfish and the entrainment of planktonic organisms, including ichthyoplankton, phytoplankton, and zooplankton. These studies concluded that the effects of closed cycle cooling systems and their impacts to the environment are SMALL (Reference 5.3-1).

Cooling water for RBS Unit 3 would be drawn into and discharged from the RBS via the existing cooling water intake and discharge pipelines associated with Unit 1. The existing intake screens would be retrofitted with wedgewire screens with smaller slot openings [0.11 in. (3 mm)]. However, the through-screen velocity would continue to be maintained at 0.5 ft/sec or less as required by the CWA 316(b) regulation. Therefore, impacts to the aquatic ecosystem will be SMALL.

5.3.1.2.1 Impingement and Entrainment

Cooling towers and wedgewire intake screens (0.11 in. [3 mm] with appropriate area to allow for decreased intake velocity) have historically been viewed by the EPA as mitigation measures to reduce entrainment and impingement losses of fish and as BTA for the cooling water process. Cooling towers require a relatively small volume of makeup water needed to account for the evaporative loss of water from the cooling towers when compared with once-through cooling systems (Reference 5.3-1). The 0.11 in. (3 mm) intake screens exclude a wider array of organisms from entrainment, and increasing the screen area aids in decreasing intake velocity, in this case, to 0.5 fps or less.

Based on review of the current literature associated with the intake screen design for the RBS facility and the low design approach velocity, it was concluded that the relatively small volume of water withdrawn from the LMR for the operation of the proposed Unit 3 at the RBS site would have minimal impact on the resident populations of fish, and the impacts to all aquatic resources would be SMALL.

The existing intake structure for Unit 1 will be modified to provide cooling water to RBS Unit 3 without the addition of new intake piping in the LMR. The design intake velocity for Unit 3 cooling water will be maintained at 0.5 fps or less.

Historically, no threatened or endangered species were identified as having the potential to be affected by operation of Unit 1, primarily due to the lack of appropriate habitat available for these organisms in the intake area (Reference 5.3-4). Recent correspondence received from state wildlife agencies regarding construction and operational activities at the RBS identified the pallid sturgeon[e] as an inhabitant of the LMR near the RBS site; however, habitat preferences for this

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c. Impingement - Pinning or trapping of fish and shellfish against the intake structure screens.
d. Entrainment - Pulling or drawing into the cooling water stream of planktonic organisms such as ichthyoplankton, zooplankton, and phytoplankton.

species limit the likelihood for impacts based on the location of the RBS intake system (man-made embayment; refer to Subsection 5.3.1 for more details) (References 5.3-6 and 5.3-7).

In the Final Environmental Statement (FES) generated for the RBS site in 1974, it was concluded that impingement of organisms due to intake system operation would cause little effect to fish populations because of the low intake velocity ($\leq$0.5 fps) for the combined Units 1 and 2 SWS. The FES also concluded that the location of the intake structure in the embayment does not impede fish movement past the site and is not located in an important biological area (Reference 5.3-3). The proposed SWS (cooling system) for Unit 3 at the RBS site would be incorporated into the existing SWS for Unit 1 and designed after the existing cooling system for Unit 1 (Unit 2 was never constructed). The combined intake velocity for Units 1 and 3 would remain at or below 0.5 fps.

Based on the above information, it can be concluded that impacts to aquatic resources at the RBS due to the operation of the intake system would be SMALL.

5.3.1.2.2 Lower Mississippi River

Plankton

Planktonic organisms, including ichthyoplankton, have limited swimming abilities. As such, these types of organisms are unable to avoid CWIS intake velocities and could be entrained in (drawn into) the intake system. Historic (1976 - 1979) plankton distribution studies performed at the RBS site indicated that plankton densities were much higher along the western bank of the LMR (approximately 46 percent of the documented plankton occurred along the western bank). This phenomenon can most likely be attributed to the prevailing semi-slack water conditions along the inner bend of the river, allowing plankton to more readily drift into and congregate in this area. The placement of the intake structure on the eastern bank of the LMR aids in reducing potential impacts to plankton populations solely by location.

The existing intake screens for Unit 1 will be retrofitted with new wedgewire screens with 0.11 in. (3 mm) slot size openings and will be modified to accommodate the addition of Unit 3 (Subsection 5.3.1.2). This type of technology has been historically recognized by the EPA as a mitigation measure to reduce entrainment losses. Additionally, the intake screen size will be increased proportionally to allow for a low intake velocity, 0.5 fps or less in this case. It can be concluded that the retrofit of the new screens onto the CWIS would help to reduce entrainment losses even further than the reduction realized by solely utilizing closed cycle cooling systems.

Additionally, in the 1974 RBS FES, the NRC concluded that impacts on river plankton populations would be SMALL because of the relatively low percentage of the total plankton affected by the intake and the rapid generation time exhibited by most planktonic organisms. This conclusion was based on the operation of Units 1 and 2 (Reference 5.3-3). Based on intake velocity, intake structure location, and intake design, impacts to planktonic organisms due to Unit 3 intake operation are expected to be SMALL.

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e. The pallid sturgeon (*Scaphirhynchus albus*) typically dwells in deepwater channel-like habitats.

Benthic Invertebrates

Low water velocities generated by the intake pumps (Subsection 5.3.1.1) would not be sufficient to draw benthic organisms into the intake system. While benthic invertebrates could become established within the intake embayment, the low intake velocities (0.5 fps or less) and the elevation of the intake above the bottom (Subsection 5.3.1.1) ensure that velocities directly beneath the intake would be too low to sweep organisms from the substrate. Periodic maintenance dredging to remove silt accumulation would remove most benthic inhabitants that might become established within the embayment; however, the benthic community would quickly revert back to its predisturbed state, as evidenced by the organisms documented as occurring at the RBS site (Subsection 2.4.2) and their ability to recover from perturbation.[f] The FES generated for the RBS site in 1974 concluded that benthic organisms in the river would not be affected by the operation of the intake (Reference 5.3-3). Based on the low flow design proposed, impacts to benthic resources associated with the intake structure in the vicinity of the RBS site would be SMALL.

Fish

The intake embayment may act as a temporary haven for fish because some relief from strong river currents may be found in this area. However, periodic maintenance dredging, as described in Subsection 5.3.1.1, would disrupt this fish community. Recruitment, however, is expected to occur fairly rapidly.[g] The retrofit of the intake screens with new 0.11 in. (3 mm) wedgewire screens would prevent most adult fish from entering the intake system. The low design intake velocity ($\leq$0.5 fps; Subsection 5.3.1.1) would prevent healthy fish from being drawn toward or becoming impinged onto the intake screens. The location of the intake structures in the embayment ensures that the intake and related structures would not block fish movements past the site.

Impingement studies conducted at other Entergy-owned facilities downstream from the RBS site (RM 129 AHP) indicate that the most frequently impinged organisms are species common to the LMR. These species include Ohio river shrimp (*Macrobrachium ohione*), grass shrimp (*Palaemonetes kadiakensis*), blue catfish (*Ictalurus furcatus*), channel catfish (*Ictalurus punctatus*), threadfin shad (*Dorosoma petenense*), bay anchovy (*Anchoa mitchilli*), and freshwater drum (*Aplodinotus grunniens*). It is important to note that these studies were conducted at once-through cooling facilities with intake velocities much higher (up to seven times higher) than 0.5 fps. Given that the intake velocity at the RBS site will be maintained at or below 0.5 fps, impingement impacts would be much lower than those documented in these studies, as further detailed below. Additionally, several species documented, such as the catfishes and

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f. *Oligochaetes* were recorded as comprising more than 58 percent of the benthic organisms documented in the Mississippi River at the RBS site. It has been noted that most benthic organisms (*oligochaetes* included) quickly recruit to open areas, allowing for rapid recovery of the benthic community after a disturbance. Organisms capable of initially establishing communities in a disturbed/open area are considered pioneer species and are noted for their ability to recover quickly from perturbation and allow for community growth and succession of organisms.

g. Most fish species documented as occurring near the RBS site are species commonly found throughout the LMR. It is expected that nearby populations would enhance recruitment to the embayment post-dredging disturbances, allowing for rapid fish population recovery.

freshwater drum, are heavier-bodied fishes capable of outswimming an intake velocity of 0.5 fps (refer to Table 5.3-1 for swimming speeds), and would not be expected to be impacted by the RBS water uptake.

The Electric Power Research Institute (EPRI) has documented initial and extended survival rates for fishes commonly impinged at once-through cooling facilities. Many of the fishes common to the LMR have documented initial survival rates greater than 50 percent (i.e., greater than 50 percent of the number impinged survived initial contact with intake screens). Several of these species were also documented to have a greater than 50 percent extended (24 to 120 hours post-impingement) impingement survival rate. This indicates that fish species commonly found in the LMR near the RBS site are hardy organisms capable of surviving trauma associated with intake structures. It is important to note that the facilities reviewed in the EPRI studies were once-through cooling facilities with intake velocities greater than 0.5 fps (most facilities document intake velocities at least 3 times greater than 0.5 fps). As previously discussed, the RBS intake velocity would be maintained at or below 0.5 fps, lessening impacts to fishes near the intake structure. Table 5.3-1 illustrates initial and extended survival rates of fish species common to the LMR near the RBS site (Reference 5.3-8).

Many of the fish species inhabiting the LMR near the RBS site are heavy-bodied fishes capable of out-swimming an intake velocity $\leq$0.5 fps (Subsection 2.4.2). Table 5.3-1 illustrates documented swimming speeds for some of these species. It should be noted that even smaller-bodied, excitable fishes, such as the threadfin and gizzard shad, are capable of sustaining swimming speeds greater than 0.5 fps. It can be assumed that larger fishes whose swimming speeds are not documented in this table, such as gar, crappie, and sauger, would be capable of out-swimming the intake velocity as well (References 5.3-8, 5.3-9, and 5.3-10).

Historic studies conducted at the RBS site and previous conclusions of the NRC corroborated with current studies conducted downstream on the LMR, and the proposed design of the intake structures, indicate that aquatic resources of the river at RBS would not be adversely affected from operation of Unit 3.

In the FES generated for the RBS site in 1974, it was concluded that impingement of organisms on the intake screens is not likely to be a problem because of low intake velocities, and that the location of the intake structure in the embayment is not likely to impede fish movement past the site (Reference 5.3-3). The design improvements of the intake screens and the commitment to maintaining a low intake velocity ($\leq$0.5 fps) substantiates the conclusions that impacts to fish resources at the RBS site due to operation of Units 1 and 3 would be SMALL.

Alligator Bayou, Grants Bayou, and On-Site Ponds

Alligator and Grants Bayou and other on-site ponded areas would not be affected by the intake operation of Unit 3. The new Unit 3 footprint would not be in the vicinity of these areas. In addition, the runoff patterns that currently exist would not be modified by the new Unit 3 footprint, and makeup water for Unit 3 would be drawn from and discharged to the LMR.

5.3.1.2.3 Commercial and Sport Fisheries

Commercial harvest in the Upper Mississippi River (UMR) is dominated by four groups of fishes including the common carp, buffalo fishes (bigmouth and smallmouth), catfish (channel and flathead), and freshwater drum that together represent greater than 90 percent of the total commercial catch in the UMR (Reference 5.3-11). The common carp has ranked first among species in commercial catch for decades.

The same species harvested in the UMR also dominate the commercial fisheries for the freshwater portions of the LMR. Commercial harvest of fishes in the LMR is difficult to assess because of inconsistencies in methods of gathering and reporting data; however, limited information indicates that commercial harvest is increasing. Neither the commercial nor recreational fisheries appear to be overharvested. It is also noted that future fisheries production may be threatened by loss of aquatic habitat, altered spatial and temporal aspects of floodplain inundation, and nuisance invasions. In addition, navigation traffic affects fish survival and recruitment, via direct impacts and habitat alteration, and is expected to increase in the future (Reference 5.3-11).

In the LMR, National Marine Fisheries Service (NMFS) statistics for 1954 - 1977[h] show a fish harvest of 6 to 12 million kg, increasing over time (Reference 5.3-11). Self-reported commercial harvests have been collected by the Tennessee Wildlife Resources Agency since 1990 and by the Kentucky Department of Fish and Wildlife Resources since 1999. The annual catch for the Mississippi River bordering Tennessee during 1999 - 2000 varied from 36 to 125 tons. Landings of blue catfish and flathead catfish have increased substantially, while harvests of common carp, buffalo fishes, channel catfish, and freshwater drum have been highly variable. In Kentucky waters, the catch ranged from 18 to 56 tons between 1999 and 2001. Buffalo and catfish dominated the catch during this period as well. It has been noted that other states on the LMR either do not measure the commercial catch or do so sporadically. In Louisiana, the commercial catch is measured, but is not designated as being from specific waters (Reference 5.3-11).

In 1985, the total commercial and recreational harvest of finfish, turtles, crayfish, river shrimp, and frogs from the LMR, below the RBS site, was conservatively estimated to be 2,160,000 lb/yr (985,000 kg/yr). However, a recent discussion with Louisiana Department of Wildlife & Fisheries (LDWF) officials indicated that there is no current commercial or recreational fishing information available for water bodies in the vicinity of the RBS site.

The 1985 RBS FES indicated that the design of the intake structure at the RBS site would not have a significant effect on fish populations at the site. Given the similar low flow design, unchanged location (relative to Unit 1), and updated screen technology associated with the new Unit 3, it can be concluded that impacts to commercially and recreationally important species would be SMALL.

5.3.1.2.4 Threatened and Endangered Species

There are four threatened and endangered species that have the potential to occur at or near the RBS site; however, none have been documented in historic larval and adult fisheries studies

h. The NMFS ceased maintaining landings data for the Mississippi River in 1977 (Reference 5.3-11).

conducted at the site. These species include: the pallid sturgeon (*Scaphirhynchus albus*, federally listed as endangered); the rainbow darter (*Etheostoma caeruleum*, federally listed as threatened); the bluntface shiner (*Cyprinella camura*, state listed as imperiled); and the central stoneroller (*Campostoma anomalum*, state listed as imperiled). More in-depth discussions of life history and habitat utilization of each of these species can be found in Subsection 2.4.2.

No threatened or endangered species were documented in historic fisheries studies conducted at the RBS site. Additionally, no threatened or endangered species were documented in a 2006 - 2007 impingement study conducted at another Entergy-owned generating facility downstream (RM 129.9) of the RBS site.

Agency Communications

Both state and federal wildlife agencies were contacted regarding threatened and endangered species with the potential to inhabit the RBS site. A letter from the LDWF stated that, via a search through the Louisiana National Heritage Program (LNHP) threatened and endangered species searchable database, the only aquatic species of concern is the pallid sturgeon. Concerns were expressed regarding the spawning season of this species (typically July through August). Based on these concerns, it was concluded that impacts to this species would be minimal, provided that construction activities were scheduled around the sturgeon's breeding season (i.e., no activities affecting the Mississippi River from July through August) and water quality was minimally affected. Additionally, a letter received from the USFWS deemed that aquatic species at the RBS site would be minimally affected through activities associated with RBS Unit 3 (References 5.3-6 and 5.3-7).

Because stipulations provided by the LDWF will be addressed (no construction activities will occur in the Mississippi River during sturgeon breeding season, July through August) and water quality would not be degraded[i] during the operation of Units 1 and 3, it can be concluded that impacts to threatened and endangered species associated with the intake structure at the RBS site would be SMALL.

5.3.2 DISCHARGE SYSTEM

This subsection describes the impacts of the cooling water discharge on water quality and aquatic biota in the LMR, the receiving stream for the RBS. Supporting on-site meteorological data is located in Subsections 5.3.3.1 and 5.3.3.1.2.

Additional information regarding surface water bathymetry, locations of facility dishcarge outfalls, water body temperature profiles, and water body flow characteristics are included in Section 2.3.

5.3.2.1 Thermal Description and Physical Impacts

The effluent from the additional unit (Unit 3) would be combined with the effluent from the existing Unit 1 and discharged directly into the LMR using the existing wastewater outfall. As part of the

i. Water quality at the site would be monitored by RBS staff to ensure that water quality limits set in the RBS LPDES permit are maintained. Other measures for protecting water quality are addressed in Subsection 5.2.2, 5.3.2, and Chapter 6.

impact assessment process for the project, the combined discharge was modeled to determine the physical characteristics and associated impacts of the thermal component of the discharge.

CORMIX (Reference 5.3-12) is a mathematical modeling tool developed for the analysis, prediction, and design of aqueous toxic or conventional pollutant discharges into diverse water bodies. It was developed by the EPA for use as an analysis tool for the permitting of industrial, municipal, thermal, and other point source discharges to receiving waters. The CORMIX Version 5, Module 1, which is used for the prediction of single-port discharges, was used exclusively for this analysis. The methods, data, assumptions, and results of the modeling are described below.

5.3.2.1.1 Modeling Assumptions

Based on the facility drawings (Figures 5.3-1 and 5.3-7), the effluent outfall was assumed to be located approximately 600 ft. (183 m) downstream of the river water intake screens, and at approximately 10 ft. (3.1 m) below the mean low water reference plane of 7 ft. above mean sea level (msl) (approximately 7.6 ft. National Geodetic Vertical Datum [NGVD]). A previous study done for the RBS river intake design shows that the discharge is out of the influence zone of the vortex formed in the embayment (Reference 5.3-4). These assumptions are considered adequate as the bounding conditions in determining the impact from the expected maximum thermal discharge from the combined existing and additional units.

5.3.2.1.2 Methods

To evaluate the extent of the thermal mixing zone resulting from the proposed additional RBS discharge, an analysis of thermal plumes resulting from plant effluent discharges was done for eight scenarios that characterize the range temperature and flow conditions for both the ambient river and the effluent streams (Table 5.3-2). For Scenarios 1 through 4, the maximum summertime effluent temperature was employed, while for Scenarios 5 through 8, the maximum winter temperature was assumed. These scenarios are expected to represent the range of potential worst-case conditions, including the summer, when ambient water temperature is highest, and the winter, when the difference between the discharge temperature and the ambient water temperature (ΔT) is likely to be greatest. These two conditions address both aspects of the relevant Louisiana Water Quality Standards, absolute temperature and change from ambient temperature. Evaluation of these eight scenarios provides the maximum predicted thermal mixing zone that is likely to be observed over the range of ambient conditions expected.

Dilution and distribution of the discharge heat, as well as other effluent constituents, are affected by the design of the discharge structure, flow, and temperature characteristics of the effluent and the characteristics of the receiving water such as temperature, depth, and velocity. CORMIX input parameters consist of cross-sectional channel geometry, ambient conditions, discharge geometry, and effluent properties. A summary of the model input parameters is presented in the following subsection.

5.3.2.1.3 Ambient Water Data

Data were collected to characterize ambient flow and temperature conditions in the Mississippi River in the vicinity of St. Francisville, Louisiana (Figure 5.3-8). To perform the CORMIX thermal modeling, it was necessary to characterize typical seasonal ambient conditions by analyzing long-term time-series records. Table 5.3-3 provides a summary of the time-series data available in the project vicinity to provide a characterization of ambient conditions. The locations of these three gages are shown in Figure 5.3-8.

Ambient River Flow

The time-series of Mississippi River discharge at Tarbert Landing is shown in Figure 5.3-9. For the thermal modeling analysis, two ambient flow scenarios were evaluated: mean daily flow and minimum daily flow (Table 5.3-2), based on the period of record. These flow values were used to determine the associated river velocities. To determine velocities, a stage-discharge correlation was developed for the stage data from Red River Landing (Figure 5.3-10) and the discharge data from Tarbert Landing (Figure 5.3-9). The river stages correlated to the mean and minimum flows were then identified and used to estimate the river velocity, based on data developed by the USACE (Table 5.3-4). Given that the RBS thermal discharge is a submerged discharge, the mean velocity at 60 percent depth was selected as representative of typical flow conditions. The resulting mean and minimum flow and velocity values are shown in Table 5.3-5.

Velocities corresponding to the mean and minimum river flow were retrieved from stage-discharge and stage-velocity correlations as 3.88 ft/s (1.18 m/s) for the mean flow and 2.64 ft/s (0.80 m/s) for the minimum flow (Table 5.3-5). The depth during average flow conditions was calculated from stage data as 44.6 ft. (13.6 m), while the depth for minimum flow conditions was 23.6 ft. (7.2 m). The river was assumed to be rectangular in cross section, and its width was estimated to change with discharge. Width was calculated for both the mean flow and minimum flow conditions using flow divided by the product of velocity and depth. This calculation results in mean width equal to 2894 ft. (882 m) and minimum width equal to 1790 ft.[j] (545 m).

Ambient River Temperature

The ambient river temperature data at St. Francisville, shown in Figure 5.3-11, are summarized as water temperature versus day of the year for the 27-year period of record. The seasonal water temperature pattern is clearly illustrated and consistent over the 27 years. For the thermal modeling analysis, winter and summer conditions were characterized, where winter included January, February, and March and summer included July, August, and September. Four ambient temperature scenarios were evaluated (Table 5.3-6): summer mean, summer extreme (95th percentile), winter mean, and winter extreme (5th percentile). Ambient winter river water temperatures examined were 46.4°F (8.0°C) as the mean temperature and 39.2°F (4.0°C) as the extreme (minimum) (Table 5.3-6). Mean and extreme (maximum) ambient summer river water temperatures were 82.9°F (28.3°C) and 86°F (30.0°C), respectively (Table 5.3-6).

5.3.2.1.4 Discharge Configuration

Module 1 of CORMIX Version 5 for a submerged single-port discharge was used for modeling of the mixing zone. This analysis assumes that the discharge outfall enters the Mississippi River on

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j. The minimum river width presented here is a calculated value based on known river parameters (i.e., velocity and depth). The minimum river width presented throughout the document (1700 ft.) is an estimated value based on scaled topographic maps of the channel width at the station site.

the east bank of the river. Discharge flow is perpendicular to the ambient river flow direction and horizontal in relation to the stream bed. According to outfall design specifications, the discharge port is 36 in. (0.91 m) in diameter. It is located 9.00 ft. (2.74 m) above the local riverbed. This value was used for the port height for mean river flow velocity scenarios; however, the value was adjusted to 7.87 ft. (2.40 m) during minimum river flow velocity scenarios to satisfy a CORMIX constraint that local water depth be at least three times the discharge port height. This modification did not affect the model predictions.

5.3.2.1.5 Effluent Data

Consistent with project plans, it was assumed that effluent from the existing RBS Unit 1 discharge would be combined with that of the additional Unit 3 into a common discharge. Table 5.3-7 shows the projected discharge parameters and rates for the current and proposed operation.

The current Unit 1 discharge flow rate is 2612 gpm (0.165 m^3/s), and the proposed Unit 3 discharge flow rate of 6422 gpm results in a flow rate combined Unit 1 and Unit 3 flow rate of 9034 gpm (0.5700 m^3/s). These effluent flow rates were used for all eight modeling scenarios.

The combined calculated maximum effluent temperature is 101°F (38.3°C) for the summer and 88°F (31.1°C) for the winter. Both of these values are the seasonal extremes, allowing evaluation of maximum temperature impacts. The proposed Unit 3 effluent temperatures were projected to be identical to the current values. The CORMIX model defines the initial effluent temperature as ΔT, the difference between the effluent temperature and the ambient water temperature. This value varies with the season because of seasonal changes in both ambient river water (Table 5.3-6) and effluent (Table 5.3-7) temperature.

A complete summary of the CORMIX input parameters is presented in Table 5.3-8.

5.3.2.1.6 Results

Summaries of the predicted thermal plume dimensions are presented in Table 5.3-9 for the eight different scenarios for both the current discharge (Unit 1 only) and the proposed discharge (combined Unit 1 and Unit 3). As directed by the Louisiana Water Quality Standards, plume width and length are defined in the analysis as the predicted location of the 5°F (2.8°C) ΔT isotherm (above ambient water temperature), which indicates where the discharge plume exceeds the Water Quality Standard for temperature increase above ambient. The winter minimum flow scenario with the minimum ambient river water temperature (Scenario 8 in Table 5.3-2) produces the largest plume in both cases. The maximum mixing zone of the proposed operation is calculated to be 62.99 ft. long and 8.20 ft. wide (19.2 m long and 2.5 m wide), an increase of 28.87 ft. (8.8 m) and 3.93 ft. (1.2 m), respectively, over the plume produced by the current operation in the same conditions. The size of the largest plume (plan view) is 525.27 ft^2 (48.8 m^2).

Uncertainties in the selected model scenarios are addressed by artificially adjusting the ambient river velocities used to characterize the worst-case conditions. These bounding conditions are not known to occur on the river but were selected to explore the mathematical impact of such hypothetical conditions. One-half of the minimum flow velocity (1.31 ft/s [0.40 m/s]) and double the mean flow velocity (7.74 ft/s [2.36 m/s]) were used as bounding values for a sensitivity analysis of plume size variation according to river flow for Scenario 8, which produces the largest plume with respect to the temperature increase standard. Summaries of the predicted thermal plume dimensions are presented in Table 5.3-10 and Figure 5.3-12. Results from the analysis show that the minimum and mean river flow velocity values (2.62 ft/s [0.80 m/s] and 3.87 ft/s [1.18 m/s], respectively) derived from the 46-year period of record are sufficient in characterizing both the maximum plume length and maximum plume area.

River depth at the location of the discharge outfall was based on flow stage (Table 5.3-5) and the elevation of the outfall, as depicted in Figure 5.3-7. More recent elevation data exist on bathymetry maps generated by the USACE (Reference 5.3-14); however, they were not used for this analysis. The steep slope in the area of the outfall requires precise location of the structure; the recent maps do not include identification of the structure, and existing survey data are not at the level of precision required to adequately georeference spatial points with the 2004 bathymetry (Reference 5.3-14). Approximate referencing confirms that the selected elevation is within the ranges seen on the riverbank despite the inability to precisely locate the outfall within contour lines. Additionally, review of recent dredging reports suggests that the elevation range in the region of the outfall aligns with the value defined in Figure 5.3-7.

Uncertainties related to river depth were addressed by determining the plume size for additional bounding depth values. These depths were not derived from plant drawings, but their use allows an evaluation of the differences in plume dimensions that could result from not using the 2004 bathymetry data. One-half the depth at minimum flow (16.40 ft. [5.00 m]) and twice the depth at mean flow (75.79 ft. [23.10 m]) were used as bounding values for a sensitivity analysis of plume size variation according to ambient depth for Scenario 8, which produces the largest plume with respect to the temperature increase standard. Summaries of the predicted thermal plume dimensions are presented in Table 5.3-11 and Figure 5.3-13. Significant changes in depth do not significantly change plume dimensions; the upper bound of depth results in less than 1 percent of decreased plume length over the lower bound depth value. Results from the analysis show that the depth values derived from Figure 5.3-7 (23.62 and 44.60 ft. [7.20 m and 13.60 m]) are sufficient in characterizing both the maximum plume length and maximum plume area.

The additional absolute temperature standard requires that water temperature outside of the mixing zone not exceed 90°F (32.2°C). This standard was assessed by evaluating the plume temperature in excess of the ambient river flow temperature. Figures 5.3-14 and 5.3-15 present the isolines of ΔT (above ambient temperature) of the proposed discharge plume during summertime minimum flow and maximum temperature conditions (Scenario 4). Because of the high river water temperature and reduced river flow rate of this scenario, the conditions are expected to represent a worst-case situation in which the temperature of ambient river water would be most affected by the heated discharge.

The modeled discharge temperature (101°F [38.3°C]) represents the maximum expected summertime temperature. The maximum ambient river temperature during this time was assumed to be 30°C, the 95th percentile of observed summertime temperatures for the 37-year period of record. To adhere to the state water quality standard of 90°F (32.2°C), ΔT must be less than or equal to 36°F (2.2°C) after mixing. Figures 5.3-14 and 5.3-15 show that the maximum allowable temperature (the 36°F/2.2°C line) occurs approximately 13.12 ft. (4 m) downstream of the discharge location and within the mixing zone. The lateral width of this high-temperature plume is approximately 5.00 ft. (< 2 m), representing less than 0.4 percent of the total width of the river during minimum flow (1789.47 ft. [545.43 m]).

As anticipated, this scenario (Scenario 4) produced the highest absolute river water temperatures and is considered the worst of the eight evaluated cases. It is notable that the scenario that produces the largest plume for the temperature rise criterion is not the same scenario that poses the largest risk of exceeding the maximum absolute temperature standard. While the plume size is largest for winter conditions with low river temperature and low flow (Scenario 8), the absolute river temperature is greatest during summer conditions with high river temperature and low flow (Scenario 4).

Consideration of a small mixing zone to reach the relevant thermal water quality standard is very common in the United States and in Louisiana. In fact, the LPDES permit for the existing RBS site includes application of a mixing zone. The addition of Unit 3 would expand the mixing zone from the existing one by a small amount, but would continue to affect a very small area of the river. It should also be noted that use of evaporative cooling towers (i.e., closed cycle cooling) would greatly reduce the thermal loading to the river relative to open cycle cooling (or once-through cooling). Most of the waste heat would be dissipated to the atmosphere rather than the aquatic environment. Use of closed cycle cooling is generally considered to be the most effective technology for reducing thermal impacts.

Louisiana Water Quality Standards do not specify maximum allowable mixing zone lengths or widths. Mixing zone impacts are assessed solely on the effects of the induced change in ambient water temperature. However, according to the standards, a mixing zone may not be so large as to "overlap another mixing zone in such a manner, or be so large, as to impair any designated water use in the receiving water body when the water body is considered as a whole."

The Big Cajun facility discharges thermal effluent across the river from the RBS discharge location, raising concerns that the RBS discharge plume might commingle with the plume generated by Big Cajun. Thermal plume analysis of the preferred location of the Big Cajun outfall predicts a worst-case plume during August extreme low flow conditions (Reference 5.3-14). The horizontal width of the Big Cajun discharge plume extends from 367.45 to 1125.33 ft. (112 to 343 m) into the channel from the west bank. Considering the total width of the channel during low flow conditions (estimated to be 1789.45 ft. [545.43 m] in this analysis), along with the plume width predicted during summer minimum flows (~5.00 ft.) and location (between 98.4 and 187.0 ft. [30.0 and 57.0 m] from the east bank, depending on flow conditions) of the RBS plume, model predictions indicate that the two plumes are not expected to commingle.

Downstream from the RBS site is the Mississippi River Bridge Project (Bridge Project) site. The Bridge Project, sponsored by the Louisiana Department of Transportation and Development (LDOTD), includes construction of a new highway and bridge across the Mississippi River approximately 1 mi. (1600 m) south of the RBS. Under worst-case conditions, the thermal plume resulting from the proposed RBS discharged effluent would be only 65.6 ft. (20 m) long. Therefore, it is not anticipated that the thermal plume would be influenced by the new bridge because of the sizable distance between the sites.

These results are consistent with other similar thermal mixing analyses performed for the RBS (Reference 5.3-4) and other stations in this stretch of the Mississippi River (References 5.3-13, 5.3-14, and 5.3-15), based on effluent flow rate and degree of mixing associated with the configuration of the discharge structure. In particular, the inputs used in the analyses are consistent and the predicted dimensions of the temperature plumes are generally proportional to the total heat load (i.e., increase in effluent temperature multiplied by effluent flow rate).

In summary, CORMIX Version 5, Module 1 was used to define the area of the Mississippi River in which the temperature would be likely to be elevated above ambient as a result of the additional blowdown discharge by the proposed changes at the RBS site. The predicted mixing zone was conservatively estimated using accepted techniques. Based on the results, the predicted mixing zone affects a very small section of the river and is not predicted to interfere with other discharges in the area. Therefore, impacts would be SMALL.

5.3.2.2 Aquatic Ecosystems

Impacts associated with Unit 3 discharges into the LMR could include changes in the benthic ecosystems in the immediate area of the discharge and cold shock to aquatic organisms associated with the immediate area surrounding the discharge during periods of unit shutdown. The NRC previously found that there would be "no impacts" to aquatic organisms associated with Unit 1 discharge (Reference 5.3-4). As demonstrated in Subsection 5.3.2.1, the thermal plume resulting from the combined operation of Units 1 and 3 would be minimal when compared with the breadth of the LMR, and impacts to organisms resulting from additional thermal discharges associated with RBS Unit 3 are expected to be SMALL.

Additionally, NRC studies have "evaluated the potential impacts of the discharge of heated water to an aquatic system including: (1) thermal discharge effects; (2) cold shock; (3) effects on movement and distribution of aquatic biota; (4) premature emergence of aquatic insects; (5) stimulation of nuisance organisms; (6) losses from predation; (7) parasitism and disease; (8) gas supersaturation of low dissolved oxygen in the discharge; and (9) accumulation of contaminants in sediments or biota. In general, for plants employing cooling tower systems, the impacts were found to be minor." (Reference 5.3-1) Future operational plans for RBS Unit 3 include use of a cooling tower system, thereby substantiating the conclusion that impacts to aquatic resources related to thermal discharges would be SMALL.

5.3.2.2.1 Thermal Impacts

The discharge rate for the combined discharge for Units 1 and 3 would be 0.57 m^3/s (20.1 cfs). Even when compared to the extreme low flow values of the LMR (111,000 cfs), this rate would comprise less than 0.02 percent of the flow of the LMR. Small discharges such as this would be expected to rapidly mix with ambient river water, resulting in a small thermal plume, as demonstrated in Subsection 5.3.2.1. The thermal plume is unlikely to hinder fish migration or spawning efforts, although some species may avoid the area altogether in the summer when maximum river temperatures are reached. Alternatively, the thermal plume may act as an aggregation point for species that prefer warmer water temperatures during the winter months, because the heated effluent would warm water temperatures to a more desirable range. Discharge ΔT (water temperature change) would be highest during wintertime when ambient river water temperatures decline. The maximum absolute river water temperature, however, would occur in the summer months during minimum flow conditions. Water temperatures at this time of year have been documented to reach 86°F (30°C). Even under these conditions, the 5° F (2.2 °C) isotherm is extremely small, and impacts to aquatic organisms would still be SMALL in this scenario.

Table 5.3-12 illustrates the lethal upper and lower temperature limits for important aquatic species in the LMR at the RBS site. All but one of these species have been classified by the USFWS as warmwater species, indicating that a majority of the important aquatic species in the vicinity of the RBS site are capable of tolerating elevated water temperatures (References 5.3-16 through 5.3-21). As mentioned, only one species, the sauger (*Sander canadensis*), has not been classified as a warmwater species. However, this species is a deepwater dwelling fish that would not be expected to be found at the water's surface near the discharge port. This sauger's habitat preferences, combined with the understanding that fish tend to avoid areas with temperatures above their normal temperature range, indicate that this species would not be significantly affected by the slight increase in thermal discharges. Therefore, thermal impacts to local fish species are expected to be SMALL.

No thermal impacts to wetlands or the bottomland floodplain are expected. All thermal discharges are released directly into the Mississippi River, and the discharge structure is entirely below the river level throughout the flood season. Under all circumstances, the plume of elevated temperature is predicted to dissipate before approaching the river's edge. The additional volume and velocity of the ambient river conditions during a flood that would spread the river into wetlands adjacent to the river would minimize any potential impacts by minimizing the time for mixing of the effluent with the river water. Therefore, impacts are anticipated to be SMALL.

5.3.2.2.2 Chemical Impacts

Impacts to aquatic ecosystems at the RBS associated with the chemical components of the combined discharge effluents for Unit 1 and 3 would be limited to those constituents listed in existing and future LPDES permits, as described in Section 2.3 and Subsection 3.6.1. Monitoring of these chemicals (specifically, free available chlorine, chromium, and zinc, as listed in the current LPDES permit) is required by the LPDES permit (Reference 5.3-2). Any chemicals that exceed permitted concentrations in the effluent would be documented immediately, and corrective measures would be taken to limit adverse environmental impacts. Additionally, acute 48-hr. ambient monitoring toxicity testing reports utilizing designated aquatic indicator species (fathead minnow *Pimephales promelas* and freshwater invertebrate *Daphnia pulex*, as listed in the current LPDES permit) would be performed and submitted annually. Effluent samples utilized for such testing would be composite samples collected over a 24-hr. period such that the water sample is representative of any periodic or episodic chemical releases into the LMR. Testing performed at the RBS site to date has not indicated any toxicity to designated indicator organisms, thus substantiating the conclusion that the effects of effluent chemical components would be limited and impacts to aquatic biota and other aquatic resources at and near the RBS site would be SMALL.

It is important to note that the LDEQ has defined the current effluent limits after repeated characterization of the quality of the effluent from Unit 1. This has included evaluation of the full suite of Priority Pollutants. During this process, the LDEQ determined that none of the priority pollutants (beyond chromium and zinc) had a reasonable potential to cause an exceedence of

Louisiana Water Quality Standards in the Mississippi River. For this reason, none of the priority pollutants were the subject of an effluent limitation.

Effluent limits outlined in the LPDES permit are developed in accordance with EPA ambient water quality criteria documents. These criteria documents have assessed numerous toxicity studies to aid in determining appropriate limit levels to prevent facility effluents from harming natural resources, including aquatic biota. The levels outlined in the LPDES permit are set well below documented lethal levels for indicator organisms, thus ensuring the health and continuity of the natural processes of any organisms in the receiving water body. By monitoring discharges in accordance with current and future LPDES permits, the RBS will ensure that any chemical components contained in the combined Unit 1 and Unit 3 discharge would not adversely affect aquatic resources within the LMR. Therefore, impacts are anticipated to be SMALL.

5.3.2.2.3 Physical Impacts

Physical impacts associated with heated effluents from the RBS site would be limited to potential benthic scouring in the direct vicinity of the discharge outfall. Potential scouring damage at this location is minimized by the presence of riprap around the submerged discharge port as well as the low induced velocity relative to ambient river velocities. As described in Subsection 2.4.2, benthic productivity in the LMR is limited; the minor loss of substrate in the small area associated with the discharge outfall would only minimally affect those aquatic organisms residing in the direct vicinity of the discharge structure. It is noteworthy that use of the existing outfall eliminates the temporary impacts associated with construction as well as the habitat loss, however minimal, associated with the placement of a new subaqueous structure. Physical impacts to aquatic resources and important aquatic species associated with thermal discharges from the RBS site are expected to be SMALL.

The closed cycle cooling system employed at the RBS would minimize the potential effects of heated water discharge, because the majority of the waste heat would be dissipated to the atmosphere during the cooling process. The analysis provided in this subsection indicates that impacts to aquatic resources within the LMR at the RBS site would be limited to those in a small area in the direct vicinity of the discharge pipeline. Therefore, it is concluded that impacts to these resources would be SMALL and no mitigation for impacts would be warranted.

5.3.3 HEAT DISCHARGE SYSTEM

Operation of a new facility at the RBS site would influence the local climatology and terrestrial ecosystems through its heat discharge system of cooling towers by introducing increased moisture and chemical content into the atmosphere. Therefore, the discussion in this subsection consists of an evaluation of the cooling tower plume effects. To that end, this subsection considers the potential atmospheric phenomena resulting from operation of the heat discharge system and the significance of its potential environmental effects on terrestrial ecosystems and activities.

5.3.3.1 Heat Dissipation to the Atmosphere

RBS Unit 3 Cooling Systems

Cooling systems that depend on water evaporation for a major portion of the heat dissipation can be expected to create visible vapor plumes. These vapor plumes cause shadowing of nearby lands and the deposition of salt and can increase the potential for fogging or icing. Each of these phenomena, including the potential for vapor plume interaction and increases to ground-level humidity, is addressed in the remainder of Subsection 5.3.3.1.

As discussed in detail in Section 3.4, the circulating water system (CWS) provides cooling water during startup, normal plant operations, and shutdown for the removal of the power cycle heat from the main condensers and rejects this heat to the normal power heat sink (NPHS). The NPHS consists of both a hyperbolic natural draft cooling tower (NDCT) and an octagonal mechanical draft cooling tower (MDCT). Cooling towers take the heat that was transferred to the cooling water via a condenser and dissipate it to the atmosphere by evaporation. This evaporation can create vapor plumes that have the potential to affect the existing environment.

Water pumped from the Mississippi River intake structure described in Section 3.3 would be used to replace water lost by evaporation, drift, and blowdown from the cooling towers. Blowdown water is returned to the Mississippi River via an outfall on the river shoreline (Subsection 5.3.2). A portion of the waste heat is thus dissipated to the Mississippi River through the blowdown process. A discussion of the thermal plume predictions upon this water body is contained in Subsection 5.3.2.1.

The Unit 3 ESBWR design has no separate emergency water cooling system. The ultimate heat sink (UHS) function is provided by safety systems that are integral and interior to the reactor plant. These systems have no cooling towers, basins, or cooling water intake/discharge structures external to the reactor plant. Thus, no environmental effect is expected from the operation of the UHS. In addition to the UHS and NPHS, the new facility is to contain an SWS that would utilize a small linear MDCT to dissipate heat during plant shutdown/cooldown. However, the heat dissipated by the significantly smaller SWS cooling tower during plant shutdown/cooldown would be orders of magnitude less than the heat dissipated by the NPHS cooling towers. Additionally, the heat dissipated by the NPHS cooling towers would decrease to zero as the plant shuts down. Therefore, the environmental effect associated with the SWS cooling tower either operating in conjunction with the NPHS cooling towers or alone is bounded by the NPHS cooling tower analysis presented in the remainder of this subsection.

Plume Prediction Code

The NRC has identified several plume-related codes as acceptable methodologies. A model endorsed by NUREG-1555, Subsection 5.3.3.1, Heat Dissipation to the Atmosphere, is that of Carhart and Policastro (Reference 5.3-21). In NUREG-1555, the NRC accepted Carhart and Policastro's conclusion that their code predicts the plume rise within a factor of 2 about 75 percent of the time and visible plume length within a factor of 2.5 about 70 percent of the time. This model was embedded into the EPRI Seasonal/Annual Cooling Tower Impact Prediction Code (SACTI) in 1991, and was later modified in accordance with References 5.3-22 and 5.3-23. The current version of the SACTI plume modeling code (Reference 5.3-24) was used to develop the model for the evaluation of potential plumes at the RBS site from the addition of a new power production facility with cooling towers.

To determine the potential impacts of the cooling tower vapor plumes, the SACTI cooling tower model requires as input certain site-specific, tower-specific, and circulating water-specific data. Input data used in the SACTI cooling tower model are discussed below and are presented in Table 5.3-13.

Site-Specific Data

Site-specific data include the site's latitude and longitude, time zone, surface roughness height, monthly clearness indices, daily solar insolation values, representative hourly recorded surface meteorological data, and average morning and afternoon mixing heights. The site's location is a given data point and, as such, was entered directly into the model. The surface roughness (100 cm) was selected on the basis of a general obstruction profile typical of industrial facilities. The monthly clearness indices and solar insolation values were obtained from Appendix B of the User's Manual for the SACTI computer code (Reference 5.3-24) for Lake Charles, Louisiana, the most representative location provided in the manual.

On-site meteorological data from the RBS tower were used for the available 24-month data period of December 2004 through November 2006 (as discussed in Section 2.7). The on-site data contains wind direction, wind speed, and dry-bulb temperature measurements at 30-ft. and 150-ft. heights. Since the natural draft tower is expected by design to operate continuously during normal operations (and thus more frequently) and is a significantly larger cooling tower (in terms of height, water flow, heat dissipation, airflow, etc.), the 150-ft. meteorological measurements were utilized in the SACTI modeling analysis.

Since the on-site tower does not record atmospheric moisture variables, dew point temperature data commensurate with the on-site data were taken from Ryan Airport, located in Baton Rouge, Louisiana, only 19 mi. from the RBS site. Using the dry-bulb temperature from RBS, as well as both the dew point temperature and air pressure from Ryan Airport, the required wet-bulb temperature and relative humidity values were calculated. If the dew point reported at Ryan Airport was higher than the dry-bulb temperature measured on-site for a given hour, the dew point was set equal to the measured on-site dry-bulb temperature. These data elements (from on-site and Ryan Airport values) were then combined into the appropriate CD-144 format required by the SACTI cooling tower model.

The mixing height data for the SACTI cooling tower model were taken from Table 2.7-8 (data in table from Reference 5.3-25). This table contains average mixing heights for the morning and afternoon by month as calculated by the National Climatic Data Center (NCDC), using Baton Rouge (Ryan Airport) surface data and Lake Charles upper air balloon data. These are the closest, most representative reporting stations for this type of data. A discussion of these data and the resulting tablulated values are presented in Subsection 2.7.3.4.

Tower-Specific Data

Tower-specific data include information pertaining to the type of cooling tower, dimensions of the tower housing, cell exhaust diameter, heat load, drift rate, design airflow, and orientation of the cooling tower cells with respect to the 16 available representative wind directions. Tower-specific data included in the SACTI cooling tower model are included in Table 5.3-13.

Water-Specific Data

Water-specific data include the circulating water total dissolved solids (TDS) concentration, salt density, and size distribution of the water droplets in the cooling tower drift. The cooling water is expected to go through four cycles of concentration before requiring blowdown. Multiplying the average TDS (supplied by the existing Unit 1 cooling tower vendor) of 265 parts per million (ppm) by four cycles of concentration yields a cycled TDS concentration of 1060 ppm or 0.00106 gram (g) salt/g solution.

5.3.3.1.1 Length and Frequency of Elevated Plumes

Cooling tower plume lengths are calculated by the SACTI cooling tower model as the frequency of occurrence of a given plume length from the cooling tower for each of 16 wind directions.

Table 5.3-14 presents the expected plume lengths by wind direction for the NDCT on both an annual and seasonal basis. The longest average plume lengths are predicted to occur during the winter months, and the shortest are predicted to occur during the summer months. Considering all wind directions, the model predicts an average length of approximately 1.57 mi. in the winter and 0.68 mi. in the summer.

Table 5.3-15 presents the expected plume lengths by wind direction for the MDCT on both an annual and seasonal basis. Considering all wind directions, the model predicts an average length of approximately 1.70 mi. in the winter and 0.81 mi. in the summer.

On an annual frequency basis (as presented in Table 5.3-16 and 5.3-17), the SACTI cooling tower model predicts the plume lengths from the NDCT to be less than about 1640 ft. (500 m) roughly 50 percent of the year (considering all wind directions of plume travel) and from the MDCT to be less than about 984 ft. (300 m) roughly 50 percent of the year (considering all wind directions of plume travel). These lengths are also known as the median plume lengths (i.e., the length that the plume is predicted to be longer or shorter than for 50 percent of the year). Additionally, the highest probability of a visible plume over a particular location is approximately 11 percent of the year in an area 328 to 656 ft. (100 to 200 m) north of the NDCT and 11 percent of the year in an area 328 ft. (100 m) north of the MDCT.

Neither the median plume lengths nor the highest probability plumes for either the NDCT or the MDCT would reach off-site because the nearest property boundary to the new towers is approximately 3590 ft. (1094 m). In fact, at a distance equal to the closest point of the property boundary to the proposed towers (i.e., 3590 ft. [1094 m]), the highest probability of a visible plume is only 5.41 percent from the NDCT and 3.30 percent from the MDCT in any particular direction. The above model output indicates that the percent frequency of occurrence of long cooling tower plumes in any particular direction is very SMALL and, as such, does not warrant mitigation.

5.3.3.1.2 Frequency and Extent of Ground-Level Fogging and Icing in the Site Vicinity

Cooling Tower Plume-Induced Fogging

Ground-level fogging occurs when the visible plume from a cooling tower contacts the ground. Studies conducted by Broehl (Reference 5.3-26), Zeller (Reference 5.3-27), and Hosler (Reference 5.3-28) indicate that surface fogging from natural draft towers does not present a significant problem. Broehl and Zeller found no cases of cooling tower plumes reaching the ground, while Hosler noted only one in a 2-year study at the Keystone Power Plant, near Shelcota, in western Pennsylvania. As such, the SACTI cooling tower model assumes that the occurrence of fogging from natural draft towers is an insignificant event and, therefore, does not predict estimates of plume-induced, ground-level fogging from the NDCT (Reference 5.3-24).

The discharge of an MDCT is closer to the ground than that of an NDCT (approximately 60 ft. above grade for an MDCT versus approximately 550 ft. for an NDCT) and more susceptible to causing fogging, and, therefore, icing. Meteorological conditions favorable for ground-level fogging from an MDCT are generally associated with strong winds (generally greater than 20 mph) and high relative humidity for easy plume saturation (Reference 5.3-24). The cooling tower modeling results are calculated by the SACTI cooling tower model as the maximum number of hours that plume-induced fogging from a cooling tower could occur for each wind direction. The SACTI model predicted no hours of fogging from the MDCT. Therefore, the effects are anticipated to be SMALL and would not require additional mitigation.

While the SACTI model predicted no occurrences of fogging hours from the MDCT, sometimes the meteorological conditions that are favorable for the occurrence of natural fog events can be conducive to cooling tower plume-induced fogging as well. As such, should the MDCT produce an induced fog, it may likely occur simultaneously with a natural fog event and thereby mitigate the relative effects potentially caused by cooling tower plume-induced events (of which the model predicted none). Climatologically, natural fog (that which restricts visibility to less than 1/4 mi.) occurs an average of 33.1 days per year in the RBS region, based on meteorological data from Baton Rouge (Ryan Airport) as discussed in Subsection 2.7.4.1.4 (Reference 5.3-29). This means that, at a minimum, there are 33.1 hours of naturally occurring fog in the vicinity of RBS (conservatively assuming that reported fogging events last for only 1 hour per day). As such, any cooling tower plume-induced fogging event that may occur would be a fraction of the fog events that occur naturally.

Therefore, it is predicted that the operation of the MDCT would result in no increased fogging at the site. Any event that may occur is likely to be coincident with a natural fog event and transient in nature, similar to the existing MDCTs, which currently do not disrupt on-site operations. Any effect (again, the model predicted none) should only be aesthetic in nature.

Cooling Tower Plume-Induced Icing

Ground-level plume icing is a coating of small granules of ice formed when small water droplets in the cooling tower plume-induced fogging (discussed above) freeze rapidly on the ground during periods of below freezing temperatures. Temperature measurements at nearby Ryan Airport (refer to Subsection 2.7.2) indicate that, on average, the area only experiences 21.1 days per year where the minimum ambient temperature drops below freezing (Reference 5.3-29).

Since the occurrence of icing conditions in the vicinity of the RBS is expected to be rare, it is also expected that cooling tower plume-induced icing would be minimal.

As discussed previously, the SACTI cooling tower model assumes that natural draft towers do not produce ground-level plume-induced fogging. Thus, ground-level icing from NDCTs is not predicted by SACTI.

The SACTI cooling tower model does, however, predict cooling tower plume-induced fogging events (and thus icing events) from the MDCT. However, as stated above, the SACTI model predicted no hours of fogging from the MDCT. With no hours of fogging predicted, the SACTI model then predicted no hours of icing events from the MDCT.

Cooling tower plume-induced fogging and icing events are not predicted by SACTI to occur as a result of MDCT operation at the RBS. Therefore, the effects are anticipated to be SMALL and would not require additional mitigation.

5.3.3.1.3 Solids Deposition (i.e., Drift Deposition) in the Site Vicinity

The towers use drift eliminators to minimize the amount of water lost from the towers via drift. Some droplets are, nevertheless, swept out of the tops of the cooling towers in the moving air stream. Initially, these droplets rise in the plume's updraft, but because of their high settling velocity, they eventually break away from the plume, and then evaporate, settle downward, and are dispersed by atmospheric turbulence. This drift essentially has the same concentrations of dissolved and suspended solids as the water in the cooling tower basin. The maximum expected TDS (four cycles of concentration) in the CWS were discussed in Subsection 5.3.3.1.

NUREG-1555, discussed in Subsection 5.3.3.2, provides the following guidance on analyzing operational effects from salt drift:

- Deposition of salt drift (NaCl) at rates of 1 to 2 kg/ha/mo (100 to 200 $kg/km^2/mo$) is generally not damaging to plants.
- Deposition rates approaching or exceeding 10 kg/ha/mo (1000 $kg/km^2/mo$) in any month during the growing season could cause leaf damage in many species.
- Deposition rates of hundreds or thousands of kg/ha/yr could cause damage sufficient to suggest the need for changes of tower-basin salinities or a re-evaluation of the tower design, depending on the amount of land affected and the uniqueness of the terrestrial ecosystems expected to be exposed to drift deposition.

The solids deposition analysis conservatively assumed that all of the TDS was salt. Additionally, because the SACTI cooling tower plume model does not allow different types of cooling towers to be modeled simultaneously (e.g., an NDCT modeled with an MDCT), the solids deposition analysis conservatively assumed that the maximum predicted deposition rates for each cooling tower modeled were additive. The results are discussed below separately for each cooling tower and then cumulatively, as just mentioned.

Table 5.3-18 through 5.3-22 present the annual and seasonal SACTI cooling tower model predicted average monthly salt deposition rates for the NDCT. The maximum predicted annual salt deposition rate is 0.0012 kg/ha/mo (0.12 kg/km^2/mo) and occurs between 12,467 and 13,123 ft. (3800 and 4000 m) west-northwest of the NDCT (13,123 ft. is just under 2 mi. past the nearest property boundary in that direction). Because of the high initial plume of the NDCT, no solids are deposited within 3609 ft. (1100 m) of the NDCT. The average salt deposition within the radius containing the maximum value (i.e., 13,123 ft. [4000 m]) is predicted to be 0.0006 kg/ha/mo (0.06 kg/km^2/mo). These values are well within the NUREG-1555 acceptable levels of generally not damaging to plants. Average annual salt deposition isopleths from the NDCT are shown in Figure 5.3-16.

The MDCT is lower to the ground than the NDCT; therefore, solid deposition occurs closer to the tower. Table 5.3-23 through 5.3-27 present the annual and seasonal SACTI cooling tower model predicted average monthly salt deposition rates for the MDCT. The maximum predicted annual salt deposition rate is 0.0196 kg/ha/mo (1.96 kg/km^2/mo) and occurs approximately 1312 ft. (400 m) north of the MDCT (1312 ft. is approximately 1 mi. inside the property boundary in that direction). The average salt deposition within the radius containing the maximum value (i.e., 1312 ft. [400 m]) is predicted to be 1.11 kg/km^2/mo. These values are well within the NUREG-1555 acceptable levels of generally not damaging to plants. Additionally, the annual average salt deposition at the existing switchyard is predicted to be a minimal 0.0078 kg/ha/mo (0.78 kg/km^2/mo). Average annual salt deposition isopleths from the MDCT are shown in Figure 5.3-17.

As discussed previously, the SACTI cooling tower plume model does not allow different types of cooling towers to be modeled within the same model run. Therefore, this analysis conservatively assumed that the maximum predicted deposition rates for each cooling tower modeled were additive (even disregarding downwind distance and direction of impacts). The maximum predicted additive annual salt deposition rate is 0.0208 kg/ha/mo (2.08 kg/km^2/mo). This conservative additive value is also well within the NUREG-1555 acceptable levels of generally not damaging to plants.

As presented above, effects from salt deposition are anticipated to be SMALL and would not require additional mitigation beyond the proposed drift eliminators.

5.3.3.1.4 Cloud Formation, Plume Shadowing, and Additional Precipitation

Cloud Formation and Plume Shadowing

The potential for cloud development and plume shadowing due to the operation of cooling towers exists. NDCT plumes at several power plant sites have been observed to cause broken cloud decks to become overcast, make thin clouds thicker, and create separate cloud formations several thousand feet above the ground (Reference 5.3-30). Although the plumes from NDCTs at several power plants have been observed to increase cloud cover several thousand feet above the ground, MDCTs are not known to produce such cloud development effects (Reference 5.3-31).

Regardless of whether it is from cloud development or from the cooling tower plume itself, plume shadowing is an important phenomena, especially for agricultural areas. However, as illustrated in Figure 2.2-1, there are no major agricultural areas within approximately 1 mi. of the RBS facility. Nonetheless, an analysis of plume shadowing is presented herein. Cooling tower plume shadowing is determined by the SACTI cooling tower plume model by calculating the average number of hours that the cooling tower visible plume causes shadowing of the sun on the ground.

Table 5.3-28 presents the 2-year total hours of predicted shadowing caused by the visible plume associated with the NDCT. The SACTI model predicted that maximum shadowing would occur 656 ft. (200 m) northeast of the NDCT for an average of 284 hours per year. Beyond a radius of 1312 ft. (400 m) from the NDCT, the SACTI model predicted that the average annual hours of shadowing (considering all directions of plume travel) would be less than 100 hours, or approximately less than 2.3 percent of the daylight hours per year. Additionally, the average hours per year of plume shadowing beyond 3590 ft. (1094 m) (nearest property boundary distance) were predicted to be 43 hours per year (0.98 percent of the daylight hours per year) from the NDCT (considering all plume directions in the table).

Table 5.3-29 presents the 2-year total hours of predicted shadowing caused by the visible plume associated with the MDCT. The SACTI model predicted that maximum shadowing would occur 656 ft. (200 m) west of the MDCT for an average of 480 hours per year. Beyond a radius of 656 ft. (200 m) from the MDCT, the SACTI model predicted that the average annual hours of shadowing (considering all directions of plume travel) would be less than 100 hours, or approximately less than 2.3 percent of the daylight hours per year. Additionally, the average hours per year of plume shadowing beyond 3590 ft. (1094 m) (nearest property boundary distance) were predicted to be 27 hours per year (0.62 percent of the daylight hours per year) from the MDCT (considering all plume directions in the table). Even if the predicted hours of plume shadowing from the NDCT and MDCT were conservatively combined (70 hours) at the distance equivalent to the nearest property boundary, the hours would remain an insignificant fraction of the total daylight hours in a year (1.60 percent).

The resulting hours per year of shadowing (especially at the nearest property boundary) are predicted to be an insignificant fraction of the total daylight hours for agricultural purposes. Additionally, shadowing events are not expected to occur at significantly far downwind locations reaching agricultural areas. Thus, the plume shadowing effects are expected to be SMALL and would not warrant additional mitigation.

Additional Precipitation

As presented by Huff, light drizzle and snow occasionally have been noted within a few hundred meters downwind from cooling towers, but these phenomena are very localized and should have no effect outside the site boundary. Huff compared the flux of water vapor and air from NDCTs with those occurring in natural convective showers. His results indicate that some enhancement of small rain showers might be expected, because tower fluxes are within an order of magnitude of the shower fluxes (Reference 5.3-32). This implies that large thunderstorms, with their much greater flux values, should not be significantly affected.

In addition to triggering additional precipitation events, another potential environmental effect resulting from the discharge of cooling tower moisture is the regional augmentation of natural precipitation. In estimates made by Huff, the total contribution to surface precipitation from cooling towers, based on a 2200 MWe station, was found to be only 0.4 in. annually (Reference 5.3-33). Precipitation augmentation from a cooling tower is assessed in SACTI as water deposition. Water deposition from a cooling tower occurs when the airborne water droplets coalesce and precipitate out downwind of a cooling tower. The pattern of water deposition and the distance of maximum water deposition from the cooling tower are a function of the physical size of the water droplets in the drift, prevailing wind direction, orientation of the cells, and the airflow rate through the cooling tower.

As shown in Table 5.3-30, the SACTI cooling tower plume model predicted that the maximum cooling tower water deposition from the NDCT would occur approximately 12,467 to 13,451 ft. (3800 to 4100 m) south of the NDCT at a rate of 49 $kg/km^2/mo$ (13,451 ft. is approximately 1 mi. past the nearest property boundary in that direction). The average water deposition within the largest radius containing the maximum impact (13,451 ft. [4100 m]) is predicted to be 22 $kg/km^2/mo$ (considering all wind directions or plume travel). The results in Table 5.3-31 show that the model predicted that the maximum cooling tower water deposition from the MDCT would occur approximately 1312 ft. (400 m) north of the MDCT at a rate of 1100 $kg/km^2/mo$ (1312 ft. is approximately 1 mi. inside the property boundary in that direction). The average water deposition within the radius containing the maximum impact (1312 ft. [400 m]) is predicted to be 650 $kg/km^2/mo$ (considering all wind directions or plume travel). Conservatively adding the model-predicted maximum water deposition rates (without regard to direction or distance) yields a total deposition rate of 1149 $kg/km^2/mo$ from both towers.

A potential effect of water deposition on vegetation species is the increased threat of plant fungal diseases associated with the increased precipitation. Based on historical meteorological data for Baton Rouge (Ryan Airport) (refer to Subsection 2.7.2.1.4), the average monthly rainfalls for the driest month (October) and the wettest month (January) are 97 and 157 mm, respectively. Conservatively assuming no evaporation of the falling cooling tower drift droplets, the precipitation rate equivalent to the combined maximum SACTI model-predicted water deposition rate (1149 $kg/km^2/mo$) is approximately 0.001 mm per month. By comparison, this precipitation rate is less than 0.001 percent of the average monthly rainfall of even the driest month. Thus, effects due to water deposition (additional precipitation) are expected to be SMALL and would not warrant mitigation.

Induced snowfall due to operating cooling towers has been observed. However, the accumulation was found to be less than 1 in. of very light, fluffy snow. Other documented induced-snowfall occurrences generally preceded actual snowfall occurrences. An investigation into the climatic conditions conducive to induced snowfall indicated that a very cold, stable atmosphere with light winds optimized this situation (Reference 5.3-34). This type of meteorological condition occurs infrequently at the RBS site; therefore, there is no reason to expect that a new facility's cooling towers would significantly alter local meteorology. Thus, effects due to induced snowfall are expected to be SMALL and would not warrant mitigation.

5.3.3.1.5 Interaction of Vapor Plume with Existing Pollutant Sources Located within 1.25 Mi. (2 Km) of the Site

The existing MDCTs for RBS Unit 1 are located approximately 0.5 mi. (800 m) to the northeast of the planned location for the cooling towers for the new facility, on opposite sides of the central power block. The interaction between the plumes from the existing MDCTs and that for a new facility's cooling tower is expected to be insignificant, because the plumes would usually travel in parallel, non-intersecting directions. Given this distance and the fact that the cooling towers would not be situated in line so as to additively affect plant operations (i.e., the towers are situated such that only one set of towers [new or existing] could affect the facility operations on the main power block during a given wind direction), there is expected to be little concern for cumulative effects with existing operations.

There is also the potential for vapor plume interaction with existing and proposed combustion sources such as diesel generators, auxiliary boilers, diesel fire pumps, etc. However, these sources are typically low-level stack point source releases that operate infrequently (i.e., not typically during normal plant operation). Additionally, they do not typically contain the same pollutants within their exhaust streams (nitrogen oxide, sulfur dioxide, carbon monoxide [NO_x, SO_2, CO]) as the cooling tower vapor plumes (particulates). There are no other pollutant sources of significance located within 1.25 mi. (2 km) of the site. Therefore, interaction effects are expected to be SMALL and would not require mitigation.

5.3.3.1.6 Data and Information on Similar Heat Dissipation Systems

The NRC described effects from MDCTs and NDCTs in its GEIS for License Renewal of Nuclear Plants (Reference 5.3-1). The analyses in the GEIS encompass all operating light-water power reactors. For each type of environmental effect, the GEIS attempts to establish a generic finding covering as many plants as possible. This document generally concludes that the continued operation of similar heat dissipations systems at various facilities is of little concern for effects upon plants and birds (refer to Subsection 5.3.3.2).

5.3.3.1.7 Ground-Level Humidity Increase in the Site Vicinity

In the vicinity of the vapor plumes, both the absolute and relative humidity aloft is increased, as evidenced by model-predicted frequency of visible plume occurrence. As discussed in Subsection 5.3.3.1.1, the effects from the occurrence of visible plumes are expected to be SMALL. Thus, absolute humidity at the surface would be increased only slightly. However, relative humidity near the towers may be increased more during colder months because of the relatively low moisture-bearing capacities of cold air. However, any increases in humidity during cold periods would likely be localized and short-lived. An overwhelming majority of the time, contributions of water vapor from the cooling towers would be insignificant when compared with the high humidity values that are naturally experienced in the region (Subsection 2.7.4.1.2). Therefore, increases in ground-level humidity are expected to be SMALL and would not require mitigation.

5.3.3.2 Terrestrial Ecosystems

NUREG-1555, Table 2.4.1.1, defines important species and habitats. No important terrestrial species or "critical habitats" as defined are currently known to occur on the RBS site or in the vicinity (presented in more detail in Subsection 2.4.1).

Although no important terrestrial species or critical habitat exists at the site or in the vicinity, an analysis of the cooling towers potential effects upon terrestrial ecosystems is presented here to ensure minimal effects on any existing species. Cooling towers can potentially affect terrestrial ecosystems through salt drift, vapor plumes, icing, shadowing, precipitation augmentation, noise, and bird collisions with the cooling towers themselves.

5.3.3.2.1 Salt Drift

Vegetation in the vicinity of the cooling towers may experience salt deposition due to drift from the proposed cooling towers. As salinity levels increase, growth of intolerant plants declines, and yields are reduced. Some plant families tend to show either high or low limits of salt survival. Growth suppression is sometimes accompanied by leaf injury.

The towers use drift eliminators to minimize the amount of water lost from the towers via drift. Some droplets are, nevertheless, swept out of the tops of the cooling towers in the moving air stream. Initially, these droplets rise in the plume's updraft, but because of their high settling velocity, they eventually break away from the plume, and then evaporate, settle downward, and are dispersed by atmospheric turbulence. This drift essentially has the same concentrations of dissolved and suspended solids as the water in the cooling tower basin and is, thus, the source of the potential salt deposition onto vegetation. An analysis of potential salt drift from the cooling towers was presented in Subsection 5.3.3.1.3.

NUREG-1555 provides the following guidance on analyzing operational effects from salt drift:

- Deposition of salt drift (NaCl) at rates of 1 to 2 kg/ha/mo (100 to 200 $kg/km^2/mo$) is generally not damaging to plants.
- Deposition rates approaching or exceeding 10 kg/ha/mo (1000 $kg/km^2/mo$) in any month during the growing season could cause leaf damage in many species.
- Deposition rates of hundreds or thousands of kg/ha/yr could cause damage sufficient to suggest the need for changes of tower-basin salinities or a re-evaluation of the tower design, depending on the amount of land affected and the uniqueness of the terrestrial ecosystems expected to be exposed to drift deposition.

The solids deposition analysis conservatively assumed that all of the TDS was salt. Additionally, because the SACTI cooling tower plume model does not allow different types of cooling towers to be modeled simultaneously (e.g., an NDCT modeled with an MDCT), the solids deposition analysis conservatively assumed that the maximum predicted deposition rates for each cooling tower modeled were additive. As presented in Subsection 5.3.3.1.3, the maximum predicted salt deposition rate is 0.0208 kg/ha/mo (2.08 kg/km^2/mo). This value is well within the NUREG-1555 acceptable levels of generally not damaging to plants.

Additionally, monitoring results from a sample of nuclear plants, in conjunction with literature review and information provided by the natural resources agency and agricultural agencies in all states with nuclear power plants, have revealed no instances where cooling tower operation has resulted in measurable degradation of the health of natural plant communities (Reference 5.3-1).

As presented above, effects from salt deposition are anticipated to be SMALL and would not require additional mitigation beyond the proposed drift eliminators.

5.3.3.2.2 Vapor Plumes

As concluded in Subsection 5.3.3.1.1, on a frequency basis, the SACTI cooling tower model predicts the plume lengths from the NDCT to be less than 1640 ft. (500 m) 50 percent of the year (considering all wind directions of plume travel) and from the MDCT to be less than 984 ft. (300 m) 50 percent of the year (considering all wind directions of plume travel). Additionally, the highest probability of a visible plume over a particular location is approximately 11 percent of the year in an area 328 to 656 ft. (100 to 200 m) north of the NDCT and 11 percent of the year in an area 328 ft. (100 m) north of the MDCT.

Neither the median plume lengths nor the highest probability plumes for either the NDCT or the MDCT would reach off-site, because the nearest property boundary to the new towers is approximately 3590 ft. (1094 m). In fact, at a distance equal to the closest point of the property boundary to the proposed towers (3590 ft. [1094 m]), the highest probability of a visible plume is only 5.41 percent from the NDCT and 3.30 percent from the MDCT in any particular direction. The above model output indicates that the percent frequency of occurrence of long cooling tower plumes in any particular direction is very SMALL and, as such, does not warrant mitigation.

5.3.3.2.3 Icing

Ground-level plume icing is discussed in detail in Subsection 5.3.3.1.2. As discussed previously, the SACTI cooling tower model assumes that natural draft towers do not produce ground-level plume-induced fogging. Thus, ground-level icing from NDCTs is not predicted by SACTI.

The SACTI cooling tower model does, however, predict cooling tower plume-induced fogging events (and thus icing events) from the MDCT. As presented in Subsection 5.3.3.1.2, the SACTI model predicted no hours of plume icing from the MDCT.

Cooling tower plume-induced icing events are not predicted by SACTI to occur as a result of MDCT operation at RBS. Therefore, effects are anticipated to be SMALL and would not require mitigation.

5.3.3.2.4 Plume Shadowing

Plume shadowing is an important phenomena, especially for agricultural areas. However, as illustrated in Figure 2.2-1, there are no major agricultural areas within 1 mi. of the NDCT and MDCT. Nonetheless, an analysis of plume shadowing is presented in Subsection 5.3.3.1.4.

As presented in Subsection 5.3.3.1.4, the SACTI model predicted that maximum shadowing would occur 656 ft. (200 m) northeast of the NDCT for an average of 284 hours per year. Beyond a radius of 1312 ft. (400 m) from the NDCT, the SACTI model predicted that the average annual hours of shadowing (considering all directions of plume travel) would be less than 100 hours, or approximately less than 2.3 percent of the daylight hours per year. Additionally, the average hours per year of plume shadowing beyond 3590 ft. (1094 m) (i.e., the nearest property boundary distance) were predicted to be 43 hours per year (0.98 percent of the daylight hours per year) from the NDCT (considering all plume directions in the table).

The SACTI model predicted that maximum shadowing would occur 656 ft. (200 m) west of the MDCT for an average of 480 hours per year. Beyond a radius of 656 ft. (200 m) from the MDCT, the SACTI model predicted that the average annual hours of shadowing (considering all directions of plume travel) would be less than 100 hours, or approximately less than 2.3 percent of the daylight hours per year. Additionally, the average hours per year of plume shadowing beyond 3590 ft. (1094 m) (the nearest property boundary distance) were predicted to be 27 hours per year (0.62 percent of the daylight hours per year) from the MDCT (considering all plume directions in the table). Even if the predicted hours of plume shadowing from the NDCT and MDCT were conservatively combined (70 hours) at the distance equivalent to the nearest property boundary, the hours would remain an insignificant fraction of the total daylight hours in a year (1.60 percent).

The resulting hours per year of shadowing (especially at the nearest property boundary) are predicted to be an insignificant fraction of the total daylight hours for agricultural purposes. Additionally, shadowing events are not expected to occur at substantially far downwind locations reaching agricultural areas. Thus, the plume shadowing effects are expected to be SMALL and would not warrant additional mitigation.

5.3.3.2.5 Precipitation Augmentation

Another potential environmental effect resulting from the discharge of cooling tower moisture is the regional augmentation of natural precipitation. An analysis of this phenomenon is presented in detail in Subsection 5.3.3.1.4.

As presented in Subsection 5.3.3.1.4, the SACTI cooling tower plume model predicted that the maximum cooling tower water deposition from the NDCT would occur approximately 12,467 to 13,451 ft. (3800 to 4100 m) south of the NDCT at a rate of 49 kg/km^2/mo. The average water deposition within the largest radius containing the maximum impact (13,451 ft. [4100 m]) is predicted to be 22 kg/km^2/mo (considering all wind directions or plume travel). The model predicted that the maximum cooling tower water deposition from the MDCT would occur approximately 1312 ft. (400 m) north of the MDCT at a rate of 1100 kg/km^2/mo. The average water deposition within the radius containing the maximum impact (1312 ft. [400 m]) is predicted to be 650 kg/km^2/mo (considering all wind directions or plume travel). Conservatively adding the model-predicted maximum water deposition rates (without regard to direction or distance) yields a total deposition rate of 1149 kg/km^2/mo from both towers.

A potential effect of water deposition on vegetation species is the increased threat of plant fungal diseases associated with the increased precipitation. Based on historical meteorological data for

Baton Rouge (Ryan Airport), discussed in Subsection 2.7.2.1.4, the average monthly rainfalls for the driest month (October) and the wettest month (January) are 97 and 157 mm, respectively. Conservatively assuming no evaporation of the falling cooling tower drift droplets, the precipitation rate equivalent to the combined maximum SACTI model-predicted water deposition rate (1149 kg/km^2/mo) is approximately 0.001 mm per month. By comparison, this precipitation rate is less than 0.001 percent of the average monthly rainfall of even the driest month. Thus, effects due to water deposition (additional precipitation) are expected to be SMALL and would not warrant mitigation.

5.3.3.2.6 Noise

Information related to the estimated noise effects associated with the cooling system components is included in Subsection 5.8.1.1. As presented in Subsection 5.8.1.1, the predicted noise emissions from normal station operation are expected to conform to the NRC and EPA sound level guidelines for minimizing noise effects. Unit 3 in-plant sound levels would conform to OSHA guidelines for occupational noise exposure. The maximum expected increase in ambient sound level of 3 decibels (dB) would be a barely perceptible change in ambient sound level during the quietest nighttime hours, based on the existing conditions detailed in Subsection 2.5.5. The potential noise effects due to the operation of Unit 3 are, thus, expected to be similar to background and current noise levels to which local species are adapted. Therefore, noise effects on terrestrial ecosystems are expected to be SMALL and would not require mitigation.

5.3.3.2.7 Avian Collisions

The potential for avian collisions increases as structure heights and broad dimensions increase. The MDCT is of little concern because of its relatively low height compared to existing and proposed structures on-site. The NDCT, however, would be 550 ft. high. The NRC concluded, in NUREG-1437 (Reference 5.3-1), that the effects of bird collisions with existing cooling towers are minimal. The proposed NDCT is similar to the types of cooling towers that were analyzed in NUREG-1437. Therefore, effects on bird species from collisions with the cooling towers are expected to be SMALL and would not warrant mitigation.

5.3.4 IMPACTS TO MEMBERS OF THE PUBLIC

This subsection describes the potential health impacts associated with the thermal discharges from the proposed RBS Unit 3 plant cooling systems on the environment - specifically, impacts to human health from etiological agents such as microorganisms, parasites, thermo-stable viruses (formerly referred to collectively as thermophilic microorganisms), and from noise resulting from the operation of the cooling system.

5.3.4.1 Etiological Agents

Etiological agents associated with cooling towers and thermal discharges can impair human health. These agents may include microorganisms, thermophilic fungi, parasites, and viruses whose presence or numbers can be affected by the addition of heat. While the growth rate of some etiological agents can be increased by the addition of heat, others can resist moderately high temperatures long enough to be released into a cooler body of water for growth. Thus, cooling towers and thermal discharges can act to harbor or accelerate some etiologic agents that ultimately affect human health once released into the environment.

These etiological agents include, but are not limited to, the enteric pathogens *Salmonella* spp., *Vibrio* spp. and *Shigella* spp, and *Plesiomonas shigelloides*, as well as *Pseudomonas* spp., and toxin-producing algae such as *Karenia brevis*, noroviruses, and thermophilic fungi. Etiological agents also include the bacteria *Legionella* spp., which causes Legionnaires' disease, and free-living amoebae of the genera *Naegleria*, *Acanthamoeba*, and *Cryptosporidium*. Exposure to these microorganisms, or in some cases the endotoxins or exotoxins produced by the organisms, can cause illness or death. Thermo-stable viruses are also considered etiological agents and are subject to review for this impact analysis.

A study of thermophilic and thermotolerant fungi isolated specimens from the thermal effluent of nuclear power generating reactors and examined the dispersal of human opportunistic and veterinary pathogenic fungi (Reference 5.3-35). The following excerpt is taken from the study:

> "Over a period of a year, samples of water, foam, microbial mat, soil and air were obtained from areas associated with the cooling canal of a nuclear power station. The seventeen sample sites included water in the cooling canal that was thermally enriched and soil and water adjacent to, upstream, downstream and at a distance from the generator. Air samples were taken at the plant and at various distances from the plant. Fifty-two species of thermotolerant and thermophilic fungi were isolated. Of these, eleven species are grouped as opportunistic *Mucorales* or opportunistic *Aspergillus* species. One veterinary pathogen was also isolated (*Dactylaria gallopava*). The opportunistic/ pathogenic fungi were found primarily in the intake bay, the discharge bay and the cooling canal. Smaller numbers were obtained at both upstream and downstream locations. Soil samples near the cooling canal reflected an enrichment of thermophilous organisms, the previously mentioned opportunistic *Mucorales* and *Aspergillus* spp. Their numbers were found to be greater than that usually encountered in a mesophilic environment. However, air and soil samples taken at various distances from the power station indicated no greater abundance of these thermophilous fungi than would be expected from a thermal enriched environment. The results indicate that there was no significant dissemination of thermophilous fungi from the thermal enriched effluents to the adjacent environment. These findings are consistent with the results of other investigators."

The operation of an additional cooling tower for RBS Unit 3 is not anticipated to significantly increase thermal discharges into areas surrounding the facility. Discharged blowdown from the cooling towers and the facility's main wastewater are expected to be released directly into the Mississippi River in accordance with the facility's LPDES permit (permitted Outfall 001, Reference 5.3-2).

No streams, ponds, or other small water resources would be influenced by the RBS thermal discharge, thus eliminating the potential for heated effluent retention to lead to increased abundance of thermophilic etiological agents.

The combined heated effluent for both units would result in a limited thermal discharge plume into the Mississippi River within a small mixing zone. This limited size would limit the area of conditions necessary for optimal growth of these etiological agents. Even during worst-case scenario operational conditions (i.e., discharge into the Mississippi River during the summertime with extremely elevated water temperatures and low river flow), the area of the thermal plume with temperatures elevated above 90°F (32.2°C) is only approximately 54 ft. by 5 ft. Additionally, the discharge flow rate would be minor when compared with river flows exhibited by the Mississippi River (refer to Subsection 5.3.2.1.2).

Heated effluent would be expected to rapidly mix with ambient river waters, presenting limited opportunity for rapid growth and population increases of etiological agents. While small-scale increases of thermophilic microorganisms within the cooling towers, and within aquatic and soil environments in the vicinity of the RBS site, could result, impacts to humans associated with an increase in disease outbreaks are expected to be minimal. It is also important to note that diseases caused by etiological agents associated with warm waters are typically contracted via nasal passageway contact with contaminated water (i.e., swimming, diving, and other water sports). The point of discharge of heated effluent from the RBS site is not typically utilized for primary contact recreation, because it is limited by strong, swift currents.[k] It is highly unlikely that a disease caused by an etiological agent would be contracted as a result of human interaction with the thermal plume.

Certain freshwater algal blooms can present issues to human health. Algal species such as *Microcystis* spp., *Anabaena* spp., *Nodularia* spp., *Nostoc* spp., and *Oscillatoria* spp. produce neuro- and hepatotoxins that, when present in high numbers, can damage neurological systems and cause hepatic tumors. However (refer to Subsection 2.4.2), the phytoplankton community of the Mississippi River is limited, due primarily to high levels of suspended solids in the river, which limit the light available for phytoplankton production. While increases in water temperature can be a causative factor in triggering algal blooms, temperature increases in the Mississippi River due to increased thermal discharges would be limited to a small area, as previously detailed. It is not expected that this thermal increase would act as a causative agent in triggering algal blooms in the Mississippi River. It is important to note that the heated effluent discharged by the Big Cajun electric generating facility, located immediately upstream of the RBS site on the opposite bank of the Mississippi River, creates a large thermal plume in the river (343 m long) during extreme low flow, high water temperature conditions. Even with this additional thermal input, no harmful algal blooms have been documented to occur in the Mississippi River at or near the RBS site.

These factors indicate that additional thermal discharges associated with RBS Unit 3 would result in limited increases in etiological agents at the RBS site, and human impacts would be SMALL.

5.3.4.1.1 Health Effects to the Public

Potential adverse health effects to the public resulting from increased thermophilic microbial populations is an issue for nuclear plants utilizing cooling ponds, lakes, or canals and those that discharge to "small rivers." Small rivers, as defined by NUREG-1437, are those with an average flow rate less than 100,000 cfs (Reference 5.3-1). From 1961 through 2001, river flow ranged from a low of approximately 111,000 cfs to 1,500,000 cfs, (refer to Section 2.3), resulting in an average flow over this period of about 500,013 cfs. This illustrates that the LMR would be viewed

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k. This segment of the LMR is designated by the LDEQ for primary contact recreation.

as a "large river," and as such, RBS Units 1 and 3 would be discharging thermal effluents into a "large river."[l] A review of the Centers for Disease Control documents from 1991 through 2004 indicates no outbreaks of waterborne diseases in Louisiana associated with the LMR.

Additionally, the closest potable water intake utilizing water from the LMR is located approximately 90 mi. downstream in the Lafourche district, a distance far enough away from the RBS site to alleviate concern for impacts to potable water supply.

Therefore, the risk to public health from etiological agents resulting from additional thermal discharges to the LMR at the RBS site would be SMALL.

5.3.4.1.2 Health Effects to Workers

Several reported cases[m] of fatal *Naegleria* infections associated with cooling towers have led to the extensive study of free-living amoebae in power plant environments. In response to these cases, many electric utilities require workers to utilize respiratory protection when cleaning cooling towers and condensers. In the case of RBS Unit 1, biocides are utilized to help reduce the levels of harmful microbial populations (Reference 5.3-35). Although no Occupational Safety and Health Administration (OSHA) standard currently exists for the exposure to microorganisms, it is expected that the RBS would utilize similar measures for reducing worker exposure to the adverse impacts associated with microorganisms for Unit 3 as are currently employed for Unit 1. The NRC has stated that it is anticipates that all plants will continue to employ proven industrial hygiene principles so that adverse occupational health effects associated with microorganisms will be of small significance at all sites, and no mitigation measures beyond those implemented during the current term license would be warranted. In this case, the current term license is considered the current operational license for Unit 1.

There have been no reportable cases of Legionnaires' disease, *Naegleria* infections, or any other diseases associated with the operation of cooling towers (including the heated effluent associated with cooling tower discharge) at RBS Unit 1. Potential impacts to workers due to the operation of an additional cooling tower for RBS Unit 3 are expected to be SMALL.

The operation of RBS Unit 3 would comply with all relevant OSHA regulations. Therefore, the risk to site workers, such as maintenance personnel, from etiological agents resulting from additional thermal discharges to the RBS site cooling towers would be SMALL.

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l. Specifically, 10 CFR 51.53(c)(3)(ii)(G) requires that for plants using a cooling pond, lake, or canal or discharge into a river having an annual average flow rate of less than 3.15×10^{12} cu. ft./yr (9×10^{10} m^3/yr), an assessment of the impact of the proposed action on public health from thermophilic organisms in the affected water must be provided in environmental reviews related to facility licensing and license renewal. If the applicant can show that its plant does not use cooling ponds, lakes, canals, or small rivers to receive its thermal discharge, this fact should be noted in the ER and no further information or analysis is needed (Reference 5.3-1). Average annual water flow of the LMR at the RBS site typically exceeds this limit; therefore, in-depth studies of thermophilic organisms with the potential to occur at the RBS site would not be necessary.

m. Cases recorded prior to 1990.

5.3.4.1.3 Agency Communication

The Louisiana Office of Public Health (LOPH) oversees disease and health reporting for the state of Louisiana. The LOPH was notified regarding the potential for increases in etiological agents caused by increased thermal discharges resulting from the RBS expansion project (RBS Unit 3).

5.3.4.2 Noise Impacts

The RBS units produce noise from the operation of pumps, cooling towers, transformers, turbines, generators, switchyard equipment, and loudspeakers. Most of this equipment, except for transformers, loudspeakers, the natural draft and mechanical draft cooling towers, and pumps that supply the cooling water, is located inside structures, thus reducing the noise impacts associated with the equipment on the outdoor ambient noise level. Of these four sources, only the natural draft cooling towers and pumps that supply the cooling water are principal sources of continuous noise.

The cooling tower systems are expected to include a natural draft cooling tower and a mechanical draft cooling tower. The sound level for the natural draft cooling tower is expected to be between 55 and 60 decibels (dBA) at 1000 ft. (Reference 5.3-36).[n] The primary sources of mechanical draft cooling tower noise are the fans (including motors and gearboxes) and water splash. Information related to the estimated noise impacts associated with the cooling system components is included in Subsection 5.8.1.1.

Day-night noise levels that are anticipated from the plant's cooling tower would be less than 65 dBA at the nearest noise-sensitive receptor, which is considered to be of SMALL significance to the public. Thus, no mitigation alternatives are necessary.

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.

Given the minimal increase in the geometry of the discharge plume (Subsection 5.3.2.1.2), continued employment of worker safety measures (Subsection 5.3.4.1.2), and lack of historical record of disease outbreaks (Subsection 5.3.4.1.2), impacts to members of the public resulting from increases in thermal discharges associated with Unit 3 are expected to be SMALL.

5.3.5 REFERENCES

5.3-1 U.S. Nuclear Regulatory Commission, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437, Final Report, Washington, D.C., 1996.

5.3-2 Louisiana Department of Environmental Quality, "Louisiana Water Discharge Permit - River Bend Station, Permit Number LA0042731," June 2006.

n. Normal conversations typically have a decibel measurement of 60 dBA.

5.3-3 U.S. Atomic Energy Commission, "River Bend Nuclear Power Station Units 1 and 2, Final Environmental Statement," 1974.

5.3-4 Gulf States Utilities Company, "River Bend Station Environmental Report, Operating License Stage," Volumes 1-4, Supplements 1-9, November 1984.

5.3-5 U.S. Army Corps of Engineers, "General Permit - Silt Removal in the Mississippi River, EM-20-020-2486, SE (General Permit) NOD-23," issued to Entergy on June 3, 2002.

5.3-6 U.S. Fish & Wildlife Service, Letter to R. Watson from Black & Veatch regarding Protected Species Project Review, February 10, 2007.

5.3-7 Louisiana Department of Wildlife & Fisheries, "Louisiana Department of Wildlife & Fisheries Regarding Threatened and Endangered Species at the River Bend Site," Letter to R. Brooks of Black & Veatch, February 22, 2007.

5.3-8 Electric Power Research Institute, *Evaluating the Effects of Power Plant Operations on Aquatic Communities: Summary of Impingement Survival Studies*, June 2003.

5.3-9 Hocutt, C. H., "Swimming Performance of Three Warmwater Fishes Exposed to a Rapid Temperature Change," *Chesapeake Science*, Vol. 14, No. 1: pp 11-16, March 1973.

5.3-10 Venn Beecham, R., C. D. Minchew, and G. R. Parsons, "Comparative Swimming Performance of Juvenile Pond - Cultured and Wild-Caught Channel Catfish," *North American Journal of Fisheries Management*, 27:729-734, 2007.

5.3-11 Schramm, H. L., "Status and Management of Mississippi River Fisheries," Large River Symposium Proceedings, Vol. 1, 2003.

5.3-12 Jirka, G. H., R. L. Doneker, and S. W. Hinton, *User's Manual for CORMIX: A Hydrodynamic Mixing Zone Model and Decision Support System for Pollutant Discharges into Surface Waters*, Cooperative Agreement No. CX824847-01-0, developed for U.S. EPA Office of Science and Technology, September 1996.

5.3-13 U.S. Army Corps of Engineers, *Mississippi River Hydrographic Survey 2004, Black Hawk, LA to Head of Passes, LA, New Orleans District*, 2006.

5.3-14 Geo-Marine, Inc., "Section 316 Demonstration Report for Big Cajun No. 2 Power Station Unit 3," Reference LA 0054135, Modification No. 1, prepared for Cajun Electric Power Cooperative, Inc., 1978.

5.3-15 System Energy Resources, Inc., "Grand Gulf Site Early Site Permit Application," Section 5, October 2005.

5.3-16 U.S. Fish & Wildlife Service, *Guidance for Evaluating and Recommending Temperature Regimes to Protect Fish*, Biological Report 90 (22), 1991.

5.3-17 Hickman, G. D. and M. R. Dewey, "Notes on the Upper Lethal Temperature of the Duskystripe Shiner, *Notropis pilsbryi*, and the Bluegill *Lepomis macrochirus*," *Transactions of the American Fisheries Society*, Vol. 4, 1973.

5.3-18 Kendall, A. W. and F. J. Schwartz, "Lethal Temperature and Salinity Tolerances of the White Catfish, *Ictalurus catus*, from the Patuxent River, Maryland," *Chesapeake Science*, Vol. 9, pp 103-108, 1968.

5.3-19 Bestill, R. K. and M. J. Van Den Avyle, "Effects of Temperature and Zooplankton Abundance on Growth and Survival of Larval Threadfin Shad," *Transactions of the American Fisheries Society*, 126:999-1011, 1997.

5.3-20 State of Michigan Department of Natural Resources, "The Effects of Temperature on the Growth of the Juvenile Lake Sturgeon, *Acipenser fulvescens*," Fisheries Division Research Report, Report Number 2004, November 15, 1995.

5.3-21 Carhart, R. A., and A. J. Policastro, "A Second-Generation Model for Cooling-Tower Plume Rise and Dispersion - I. Single Sources," *Atmospheric Environment*, V25A, No. 8, pp. 1559-1576, 1991.

5.3-22 Carhart, R. A., A. J. Policastro, and W. E. Dunn, "An Improved Method for Predicting Seasonal and Annual Shadowing from Cooling Tower Plumes," *Atmospheric Environment* 26A(15):2845-2852, 1992.

5.3-23 Policastro, A. J., W. E. Dunn, and R. A. Carhart, "A Model for Seasonal and Annual Cooling Tower Impacts," *Atmospheric Environment* 28(3):379-395, 1994.

5.3-24 Electric Power Research Institute*, User's Manual: Cooling-Tower-Plume Prediction Code*, CS-3403-CCM, April 1984.

5.3-25 National Climatic Data Center, "Mixing Height Data for Lake Charles, Louisiana, January 2002 through December 2006," October 15, 2007.

5.3-26 Broehl, K. J., "Field Investigation of Environmental Effects of Cooling Towers for Large Steam Electric Plants," Portland General Electric Company, 1968.

5.3-27 Zeller, R. W., et al., "Report on Trip to Seven Thermal Power Plants," Pollution Control Council, Pacific Northwestern Area, 1971.

5.3-28 Hosler, C. L., "Wet Cooling Tower Plume Behavior," Pennsylvania State University, University Park, Pennsylvania, 1971.

5.3-29 National Climatic Data Center, "Local Climatological Data Annual Summary with Comparative Data for Baton Rouge, Louisiana," January 2007, pp. 3-7, July 30, 2007.

5.3-30 Kramer, M. L., M. E. Smith, M. J. Butler, D. E. Seymour, and T. T. Frankenberg, "Cooling Towers and the Environment," *Journal of the Air Pollution Control Association*, Vol. 26, No. 6, June 1976.

5.3-31 U.S. Nuclear Regulatory Commission, *Final Environmental Statement Related to the Operation of River Bend Station*, NUREG-1073, Section 5.5.1.1, 1985.

5.3-32 Huff, F. A., et al., "Effects of Cooling Tower Effluents on Atmospheric Conditions in Northeastern Illinois, a Preliminary Report, Illinois Water Survey," 1971.

5.3-33 Huff, F. A., "Potential Augmentation of Precipitation from Cooling Tower Effluents," *Bulletin of the American Meteorological Society*, 53, pp. 639-644, 1972.

5.3-34 Kramer, M. L., D. E. Seymour, M. E. Smith, R. W. Reeves, and T. T. Frankenberg, "Snowfall Observations from Natural-Draft Cooling Tower Plumes," *Science* (1931), pp. 1239-1241, 1976.

5.3-35 Rippon, J. W., R. Gerhold, M. Heath, "Thermophilic and Thermotolerant Fungi Isolated from the Thermal Effluent of Nuclear Power Generating Reactors: Dispersal of Human Opportunistic and Veterinary Pathogenic Fungi," *Mycopathologia*; Vol. 70(3): 169-179, March 31, 1980.

5.3-36 Edison Electric Institute, *Electric Power Plant Environmental Noise Guide*, New York, 1978.

Table 5.3-1

Initial and Extended Impingement Survival and Swimming Speeds of Important Aquatic Species[a]

		Initial Survival[b]		Extended Survival[c]		Swimming Speeds (ft/s)	
Scientific Name	**Common Name**	**Average**	**Median**	**Average**	**Median**	**Median/Mean**	**Critical/ Optimum[d]**
Dorosoma cepedianum	Gizzard Shad	69.30%	88.40%	28.37%	7.00%	0.07 - 0.13	0.328
Dorosoma petenense	Threadfin Shad	32.46%	15.30%	NA	NA	0.07 - 0.13	0.328
Notropis atherinoides	Emerald Shiner	NA	NA	NA	NA	NA	2.25[e]
Notropis volucellus	Mimic Shiner	NA	NA	NA	NA	NA	2.25[e]
Ictalurus punctatus	Channel Catfish	84.34%	80.00%	69.73%	58.80%	NA	1.31[f]
Lepomis macrochirus	Bluegill	90.49%	100.00%	92.63%	97.05%	NA	3.13 - 4.26
Pomoxis spp.	Crappies	49.30%	49.30%	28.95%	28.95%	NA	NA
Pomoxis nigromaculatus	Black Crappie	52.43%	50.65%	11.86%	1.40%	NA	NA
Aplodinotus grunniens	Freshwater Drum	54.46%	52.80%	22.65%	20.35%	2.95	NA

a) Source: References 5.3-8, 5.3-9, and 5.3-10.

b) Survival upon initial contact with intake screen.

c) Extended impingement survival (24 - 120 hours after impingement).

d) Critical swimming speed-speed at which an organism can no longer maintain activity; for fish, activity can entail body orientation with respect to current (i.e., orientation in a way that prevents the organism from being swept into an intake screen).

e) Critical swimming speed recorded for spotfin shiner (*Cyprinella spiloptera*); swimming speed recorded in body lengths per second (BL/s). Mean organism total length (TL) 80 mm. Mean critical swimming speed recorded 8.6 BL/s.

f) Juvenile catfish; maximum sustained swimming speed ($\geq$200 min).

NA - Data not available.

Table 5.3-2
Summary of Thermal Modeling Scenarios

Scenario	Ambient River Water Temperature	Ambient River Flow Velocity	Effluent Temperature
1	Summer mean	Mean	Summer maximum
2	Summer mean	Minimum	
3	Summer maximum	Mean	
4	Summer maximum	Minimum	
5	Winter mean	Mean	Winter maximum
6	Winter mean	Minimum	
7	Winter minimum	Mean	
8	Winter minimum	Minimum	

Table 5.3-3
Summary of Ambient River Data near St. Francisville, Mississippi River

Data	Location	River Mile	Range of Record	Frequency	Count
River Discharge	Tarbert Landing, MS (USACE 01100)	306.3	1/1/1961 – 6/5/2007	Daily	16,957
River Stage	Red River Landing, LA (USACE 01120)	302.4	1/1/1961 – 6/5/2007	Daily	16,957
River Velocity[a]	Tarbert Landing, MS (USACE 01100)	306.3	1973-1989	NA	NA
River Temperature	St. Francisville, LA (USGS 07373420)	266.8[b]	1/31/1968 – 9/7/2005	Monthly	531

a) USACE-developed correlation between river stage and river velocity from Red River Landing stage data and Tarbet Landing discharge data.

b) River mile estimated from GIS map.

Table 5.3-4
Velocity-Stage Relationship at St. Francisville, Louisiana

Gage Height (ft.)	Mean (ft/s)		Maximum (ft/s)	
River National Geodetic Vertical Datum (NGVD) (76 adj)	60 Percent Depth	Surface	60 Percent Depth	Surface
5	2.3	2.6	2.8	3.1
10	2.6	2.9	3.0	3.4
15	2.8	3.2	3.2	3.7
20	3.2	3.6	3.6	4.1
25	3.4	3.9	4.0	4.5
30	3.8	4.2	4.5	5.1
35	4.0	4.5	5.2	5.9
40	4.4	5.0	6.0	6.8
45	4.8	5.4	6.9	7.8
50	5.3	6.0	8.0	9.0
55	5.9	6.7	9.2	10.3
60	6.8	7.6	10.5	11.9

Table 5.3-5
Characteristic Flow, Stage, and Velocity near St. Francisville

Scenario	Flow (cfs)	Stage (ft)	Velocity (ft/s) at 60 Percent Depth
Mean	500,013	32	3.9
Minimum	111,000	11	2.6

Table 5.3-6
Characteristic Ambient Temperature at St. Francisville SOF 5.3-510

Seasonal Conditions	Temperature, °F (°C)
Summer Mean	82.9 (28.3)
Summer Extreme (High)	86 (30.0)
Winter Mean	46.4 (8.0)
Winter Extreme (Low)	39.2 (4.0)

Table 5.3-7
Effluent Discharge and Temperature Characteristics

Maximum Effluent Temperature (Current and Proposed)		Maximum Effluent Flow	
Summer	Winter	Current Operation	Proposed Operation
38.3°C (101°F)	31.1°C (88°F)	0.1391 m^3/s	0.5700 m^3/s

Table 5.3-8 (Sheet 1 of 2)
CORMIX Model Input Values

CORMIX Model Inputs	
Parameter	**Value**
Ambient Flow Characteristics	
Average Depth (m)	
Mean	13.604
Minimum	7.203
Channel Width (m)	
Mean Flow	881.98
Minimum Flow	545.43
River Flow Velocity (m/s)	
Mean	1.18 m/s
Minimum	0.80 m/s
Manning's n	0.025
Water Temperature (^oC)	
Summer Mean	28.3
Summer Extreme	30
Winter Mean	8
Winter Extreme	4
Wind Speed (m/s)	3.5
Effluent Characteristics	
Flow Rate (m^3/s)	
Current	0.1391 m^3/s
Proposed	0.5700 m^3/s
Effluent Temperature (^oC)	
Summer Extreme	38.3
Winter Extreme	31.1
Heat Loss Coefficient ($W/m^2/^oC$)	
At T = 28.3	45
At T = 30.0	48
At T = 8.0	23
At T = 4.0	21.5

Table 5.3-8 (Sheet 2 of 2)
CORMIX Model Input Values

CORMIX Model Inputs	
Parameter	**Value**
Temperature Concentration (°C)	
Mean Summer	10.6
Extreme Summer	8.9
Mean Winter	23.1
Extreme Winter	27.6
Distance to Bank (m)	
Mean Flow	57.0
Minimum Flow	30.2
Port Diameter (m)	0.9144
Port Height (m)	
Mean Flow	2.743
Minimum Flow	2.401
Vertical Discharge Angle (degrees)	0
Horizontal Discharge Angle (degrees)	270
Water Quality Standard	∆T = 2.8°C Max T = 32.2°C

Source: CORMIX Manual.

Table 5.3-9
RBS Thermal Analysis Results

Scenario	Ambient River Temperature (°C)	Seasonal Effluent Temperature (°C)	Mean River Velocity (1.18 m/s) Mixing Zone Length[(a)] (m)		Mean River Velocity (1.18 m/s) Mixing Zone Width[(a)] (m)		Minimum River Velocity (0.80 m/s) Mixing Zone Length (m)		Minimum River Velocity (0.80 m/s) Mixing Zone Width (m)	
			Current	Proposed	Current	Proposed	Current	Proposed	Current	Proposed
Mean Summer River Temperature	28.3	38.3	2.1	3.4	0.7	1.3	2.3	3.8	0.8	1.6
High Summer River Temperature	30	38.3	1.4	2.1	0.7	1.2	1.5	2.4	0.8	1.5
Mean Winter River Temperature	8	31.1	8.4	15.7	1.0	1.9	8.3	15.5	1.2	2.3
Low Winter River Temperature	3.5	31.1	10.7	20.0	1.1	2.1	10.4	19.2	1.3	2.5

a) Mixing zone length and width defined as location where predicted plume is 2.8°C above ambient.

Table 5.3-10
RBS Thermal Analysis Results: Bounding Ambient Flow Rates

Scenario	Ambient River Temperature (°C)	Seasonal Effluent Temperature (°C)	Double Mean River Velocity (2.36 m/s)				One-Half Minimum River Velocity (0.40 m/s)			
			Mixing Zone Length[(a)] (m)		Mixing Zone Width[(a)] (m)		Mixing Zone Length (m)		Mixing Zone Width (m)	
			Current	Proposed	Current	Proposed	Current	Proposed	Current	Proposed
Low Winter River Temperature	3.5	31.1	9.6	18.7	0.7	1.5	8.8	13.9	1.8	3.5

a) Mixing zone length and width defined as location where predicted plume is 2.8°C above ambient.

Table 5.3-11
RBS Thermal Analysis Results: Bounding Ambient Depths

Scenario	Ambient River Temperature (°C)	Seasonal Effluent Temperature (°C)	Double Mean River Velocity (2.36 m/s)				One-Half Minimum River Velocity (0.40 m/s)			
			Mixing Zone Length[a] (m)		Mixing Zone Width[a] (m)		Mixing Zone Length (m)		Mixing Zone Width (m)	
			Current	Proposed	Current	Proposed	Current	Proposed	Current	Proposed
Low Winter River Temperature	3.5	31.1	10.4	19.2	1.3	2.5	1.9	19.3	2.5	2.5

a) Mixing zone length and width defined as location where predicted plume is 2.8°C above ambient.

Table 5.3-12
Temperature Tolerance Ranges of Important Aquatic Species

Scientific Name	Common Name	Temperature Tolerance Range (°C)[a]
Lepisosteus platostomus	Shortnose Gar	10.0 - 18.0
Dorosoma cepedianum	Gizzard Shad	(3.0 - 9.0) - (31.5 - 35)
Dorosoma petenense	Threadfin Shad	(3.0 - 9.0) - (31.5 - 35)
Notropis atherinoides	Emerald Shiner	0.0 - 31.0
Notropis volucellus	Mimic Shiner[b] [c]	--
Ictalurus furcatus	Blue Catfish[d]	35.3
Ictalurus punctatus	Channel Catfish	10.0 - 32.0
Gambusia affinis	Mosquitofish	12.0 - 29.0
Menidia audens	Mississippi Silverside[d]	31.7
Lepomis macrochirus	Bluegill	1.0 - 36.0
Pomoxis annularis	White Crappie[d]	31.3
Pomoxis nigromaculatus	Black Crappie[d]	30.6
Sander canadensis	Sauger[d]	30.1
Aplodinotus grunniens	Freshwater Drum[d]	32.4

a) References 5.3-16 through 5.3-20 were utilized to compile temperature ranges listed in this table.

b) Literature reviewed indicated that temperature tolerance ranges for this species have not been documented.

c) The mimic shiner is a common freshwater minnow, classified by the USGS as a warmwater species (Reference 5.3-1). Temperature tolerance range for this species would be similar to the emerald shiner, another common warmwater minnow.

d) Literature review indicated that lower temperature tolerances for this species have not been documented.

Table 5.3-13
SACTI Input Parameters

Parameter	Natural Draft Tower	Mechanical Draft Tower
Number of Towers	1	1
Number of Cells/Fans per Tower	N/A	12 [a]
Tower Height[b]	550 ft.[c]	61.34 ft. (top of cell)
Total Circulating Water Flow Rate	720,000 gpm (highest expected operation)	220,000 gpm (highest expected operation)
Total Drift Loss Rate	7207 lb/hr (908 grams/s [g/s]) - based on 0.002% of total water flow as drift	2198 lb/hr (277 g/s) - based on 0.002% of total water flow as drift
Total Exit Airflow Rate	174,725,161 lb/hr (22,015 kilograms (kg)/s (highest expected operation)	53,445,623 lb/hr (6734 kg/s) - highest expected operation
Total Heat Rejection Rate	3145 MW (highest expected operation)	962 MW (highest expected operation)
Top Exit Diameter	262 ft.	32.81 ft. (each cell)
Drift Droplet Spectrum	Drop Size (μm)	Mass Fraction
	10	0.12
	15	0.08
	35	0.20
	65	0.20
	115	0.20
	170	0.10
	230	0.05
	375	0.04
	525	0.008

a) Fans are not expected to be operated in reverse mode.

b) Base elevation of towers is approximately 95 to 100 ft. (presented in Figure 2.7-56).

c) Section 1.2 addresses the need for Federal Aviation Administration (FAA) approval prior to erecting the NDCT.

Table 5.3-14
Average Plume Lengths During NDCT Operation

	Winter		Spring		Summer		Fall		Annual	
Direction	Miles	Km	Miles	Km	Miles	Km	Miles	Km	Miles	Km
S	1.88	3.02	0.86	1.39	0.64	1.04	1.34	2.15	1.53	2.46
SSW	1.79	2.88	0.83	1.33	0.48	0.77	0.97	1.57	1.33	2.14
SW	1.63	2.63	1.07	1.72	0.60	0.97	0.96	1.54	1.19	1.91
WSW	1.48	2.38	1.02	1.65	0.83	1.33	0.98	1.58	1.12	1.80
W	1.56	2.51	1.45	2.33	0.72	1.17	0.98	1.58	1.25	2.01
WNW	1.37	2.21	1.34	2.16	0.80	1.29	1.37	2.21	1.30	2.10
NW	1.13	1.81	0.97	1.56	0.69	1.11	1.15	1.86	1.03	1.65
NNW	1.04	1.67	0.87	1.41	0.59	0.96	0.97	1.56	0.93	1.49
N	1.31	2.11	0.88	1.41	0.63	1.01	0.91	1.47	1.02	1.64
NNE	1.19	1.91	1.13	1.82	0.43	0.68	1.08	1.74	1.05	1.69
NE	1.22	1.97	1.19	1.91	0.62	0.99	1.48	2.39	1.17	1.89
ENE	1.25	2.01	1.20	1.93	0.45	0.72	1.11	1.79	1.04	1.67
E	1.64	2.64	1.04	1.67	0.68	1.10	1.23	1.98	1.23	1.98
ESE	1.40	2.25	1.44	2.32	0.66	1.07	1.43	2.31	1.31	2.10
SE	1.80	2.90	1.48	2.38	0.53	0.86	1.40	2.25	1.50	2.41
SSE	2.08	3.35	1.20	1.93	0.89	1.43	1.58	2.55	1.75	2.81
All	1.57	2.53	1.12	1.80	0.68	1.09	1.18	1.90	1.26	2.03

NOTE: Plume moving in the indicated direction.

Table 5.3-15
Average Plume Lengths During MDCT Operation

	Winter		Spring		Summer		Fall		Annual	
Direction	Miles	Km	Miles	Km	Miles	Km	Miles	Km	Miles	Km
S	1.84	2.96	0.96	1.55	0.87	1.39	1.50	2.42	1.62	2.61
SSW	1.80	2.89	0.95	1.53	0.46	0.74	1.11	1.79	1.47	2.36
SW	1.73	2.78	1.36	2.19	0.68	1.10	1.06	1.71	1.39	2.23
WSW	1.72	2.77	1.11	1.78	1.14	1.83	1.12	1.80	1.35	2.17
W	1.73	2.78	1.65	2.65	0.89	1.43	1.26	2.02	1.51	2.43
WNW	1.52	2.44	1.43	2.29	0.93	1.50	1.49	2.40	1.45	2.33
NW	1.18	1.89	1.14	1.84	0.77	1.24	1.41	2.26	1.19	1.91
NNW	1.24	1.99	1.02	1.64	0.57	0.91	1.10	1.78	1.11	1.79
N	1.52	2.45	1.04	1.67	0.73	1.18	1.16	1.86	1.25	2.00
NNE	1.45	2.33	1.38	2.23	0.36	0.58	1.34	2.16	1.30	2.09
NE	1.43	2.30	1.70	2.74	0.78	1.25	1.57	2.52	1.45	2.34
ENE	1.38	2.23	1.52	2.45	0.30	0.49	1.29	2.07	1.27	2.04
E	1.95	3.14	1.38	2.21	0.83	1.33	1.38	2.22	1.55	2.49
ESE	1.68	2.71	1.55	2.49	0.79	1.28	1.58	2.55	1.51	2.43
SE	1.91	3.08	1.53	2.47	0.52	0.84	1.73	2.78	1.71	2.76
SSE	2.06	3.31	1.57	2.52	1.07	1.72	1.64	2.64	1.85	2.98
All	1.70	2.73	1.33	2.14	0.81	1.30	1.36	2.19	1.47	2.36

NOTE: Plume moving in the indicated direction.

Table 5.3-16 (Sheet 1 of 2)
Annual Plume Length Frequency During NDCT Operation

Distance from Tower (m)	Values in percent																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
100.	8.17	7.12	7.75	6.42	5.79	9.13	6.46	5.55	10.96	5.66	3.38	3.71	6.63	4.17	4.05	5.06	100.00
200.	8.17	7.12	7.75	6.42	5.79	9.13	6.46	5.55	10.96	5.66	3.38	3.71	6.63	4.17	4.05	5.06	100.00
300.	7.45	6.60	7.29	6.01	5.40	8.78	6.10	5.17	9.48	4.96	2.83	2.84	5.05	3.71	3.71	4.63	90.02
400.	5.96	5.51	6.04	4.96	4.45	7.64	5.04	3.91	6.41	3.34	2.10	2.00	3.52	2.84	2.83	3.72	70.29
500.	4.90	4.64	5.14	4.19	3.72	6.57	4.03	3.09	4.67	2.33	1.58	1.44	2.71	2.29	2.27	3.08	56.64
600.	4.16	4.00	4.41	3.63	3.20	5.85	3.55	2.52	3.75	1.76	1.21	1.12	2.18	2.00	1.92	2.54	47.82
700.	3.92	3.78	4.23	3.46	3.04	5.65	3.38	2.35	3.46	1.57	1.09	1.00	2.07	1.92	1.81	2.44	45.17
800.	3.92	3.78	4.23	3.46	3.04	5.65	3.38	2.35	3.46	1.57	1.09	1.00	2.07	1.92	1.81	2.44	45.17
900.	3.71	3.49	3.90	3.25	2.88	5.41	3.15	2.14	3.10	1.37	1.00	0.90	1.88	1.79	1.69	2.35	42.02
1000.	3.71	3.49	3.90	3.25	2.88	5.41	3.15	2.14	3.10	1.37	1.00	0.90	1.88	1.79	1.69	2.35	42.02
1100.	3.71	3.49	3.90	3.25	2.88	5.41	3.15	2.14	3.10	1.37	1.00	0.90	1.88	1.79	1.69	2.35	42.02
1200.	3.47	3.25	3.60	2.98	2.65	5.16	2.95	1.93	2.83	1.24	0.92	0.84	1.78	1.68	1.61	2.25	39.13
1300.	3.47	3.25	3.60	2.98	2.65	5.16	2.95	1.93	2.83	1.24	0.92	0.84	1.78	1.68	1.61	2.25	39.13
1400.	3.47	3.25	3.60	2.98	2.65	5.16	2.95	1.93	2.83	1.24	0.92	0.84	1.78	1.68	1.61	2.25	39.13
1500.	3.47	3.25	3.60	2.98	2.65	5.16	2.95	1.93	2.83	1.24	0.92	0.84	1.78	1.68	1.61	2.25	39.13
1600.	3.47	3.25	3.60	2.98	2.65	5.16	2.95	1.93	2.83	1.24	0.92	0.84	1.78	1.68	1.61	2.25	39.13
1700.	3.47	3.25	3.60	2.98	2.65	5.16	2.95	1.93	2.83	1.24	0.92	0.84	1.78	1.68	1.61	2.25	39.13
1800.	3.47	3.25	3.60	2.98	2.65	5.16	2.95	1.93	2.83	1.24	0.92	0.84	1.78	1.68	1.61	2.25	39.13
1900.	3.47	3.25	3.60	2.98	2.65	5.16	2.95	1.93	2.83	1.24	0.92	0.84	1.78	1.68	1.61	2.25	39.13
2000.	3.47	3.25	3.60	2.98	2.65	5.16	2.95	1.93	2.83	1.24	0.92	0.84	1.78	1.68	1.61	2.25	39.13
2100.	3.47	3.25	3.60	2.98	2.65	5.16	2.95	1.93	2.83	1.24	0.92	0.84	1.78	1.68	1.61	2.25	39.13
2200.	3.20	3.02	3.33	2.75	2.47	4.81	2.67	1.86	2.64	1.15	0.85	0.79	1.70	1.55	1.49	2.12	36.40
2300.	2.61	2.57	2.77	2.38	2.17	3.83	2.13	1.56	2.21	1.00	0.74	0.64	1.42	1.23	1.26	1.87	30.39
2400.	2.25	2.10	2.17	1.90	1.85	3.16	1.67	1.18	1.74	0.78	0.62	0.51	1.14	1.02	0.99	1.62	24.71
2500.	1.92	1.70	1.64	1.39	1.39	2.57	1.17	0.80	1.20	0.56	0.49	0.37	0.85	0.80	0.79	1.37	19.02
2600.	1.58	1.26	1.07	0.90	0.90	1.99	0.74	0.39	0.69	0.33	0.33	0.25	0.63	0.60	0.58	1.17	13.41
2700.	1.58	1.26	1.07	0.90	0.90	1.99	0.74	0.39	0.69	0.33	0.33	0.25	0.63	0.60	0.58	1.17	13.41
2800.	1.58	1.26	1.07	0.90	0.90	1.99	0.74	0.39	0.69	0.33	0.33	0.25	0.63	0.60	0.58	1.17	13.41
2900.	1.58	1.26	1.07	0.90	0.90	1.99	0.74	0.39	0.69	0.33	0.33	0.25	0.63	0.60	0.58	1.17	13.41
3000.	1.58	1.26	1.07	0.90	0.90	1.99	0.74	0.39	0.69	0.33	0.33	0.25	0.63	0.60	0.58	1.17	13.41
3100.	1.58	1.26	1.07	0.90	0.90	1.99	0.74	0.39	0.69	0.33	0.33	0.25	0.63	0.60	0.58	1.17	13.41
3200.	1.58	1.26	1.07	0.90	0.90	1.99	0.74	0.39	0.69	0.33	0.33	0.25	0.63	0.60	0.58	1.17	13.41
3300.	1.58	1.26	1.07	0.90	0.90	1.99	0.74	0.39	0.69	0.33	0.33	0.25	0.63	0.60	0.58	1.17	13.41

Table 5.3-16 (Sheet 2 of 2)
Annual Plume Length Frequency During NDCT Operation

Distance from Tower (m)	Values in percent																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
3400.	1.58	1.26	1.07	0.90	0.90	1.99	0.74	0.39	0.69	0.33	0.33	0.25	0.63	0.60	0.58	1.17	13.41
3500.	1.58	1.26	1.07	0.90	0.90	1.99	0.74	0.39	0.69	0.33	0.33	0.25	0.63	0.60	0.58	1.17	13.41
3600.	1.58	1.26	1.07	0.90	0.90	1.99	0.74	0.39	0.69	0.33	0.33	0.25	0.63	0.60	0.58	1.17	13.41
3700.	1.58	1.26	1.07	0.90	0.90	1.99	0.74	0.39	0.69	0.33	0.33	0.25	0.63	0.60	0.58	1.17	13.41
3800.	1.58	1.26	1.07	0.90	0.90	1.99	0.74	0.39	0.69	0.33	0.33	0.25	0.63	0.60	0.58	1.17	13.41
3900.	1.58	1.26	1.07	0.90	0.90	1.99	0.74	0.39	0.69	0.33	0.33	0.25	0.63	0.60	0.58	1.17	13.41
4000.	1.26	1.02	0.79	0.64	0.75	1.45	0.53	0.28	0.57	0.27	0.28	0.21	0.57	0.46	0.50	0.99	10.56
4100.	1.26	1.02	0.79	0.64	0.75	1.45	0.53	0.28	0.57	0.27	0.28	0.21	0.57	0.46	0.50	0.99	10.56
4200.	1.02	0.74	0.51	0.43	0.53	1.01	0.33	0.18	0.40	0.20	0.18	0.14	0.43	0.33	0.39	0.83	7.65
4300.	1.02	0.74	0.51	0.43	0.53	1.01	0.33	0.18	0.40	0.20	0.18	0.14	0.43	0.33	0.39	0.83	7.65
4400.	1.02	0.74	0.51	0.43	0.53	1.01	0.33	0.18	0.40	0.20	0.18	0.14	0.43	0.33	0.39	0.83	7.65
4500.	1.02	0.74	0.51	0.43	0.53	1.01	0.33	0.18	0.40	0.20	0.18	0.14	0.43	0.33	0.39	0.83	7.65
4600.	1.02	0.74	0.51	0.43	0.53	1.01	0.33	0.18	0.40	0.20	0.18	0.14	0.43	0.33	0.39	0.83	7.65
4700.	1.02	0.74	0.51	0.43	0.53	1.01	0.33	0.18	0.40	0.20	0.18	0.14	0.43	0.33	0.39	0.83	7.65
4800.	1.02	0.74	0.51	0.43	0.53	1.01	0.33	0.18	0.40	0.20	0.18	0.14	0.43	0.33	0.39	0.83	7.65
4900.	1.02	0.74	0.51	0.43	0.53	1.01	0.33	0.18	0.40	0.20	0.18	0.14	0.43	0.33	0.39	0.83	7.65
5000.	1.02	0.74	0.51	0.43	0.53	1.01	0.33	0.18	0.40	0.20	0.18	0.14	0.43	0.33	0.39	0.83	7.65

NOTE: Plume moving in the indicated direction.

Table 5.3-17 (Sheet 1 of 2)
Annual Plume Length Frequency During MDCT Operation

Distance from Tower (m)	Values in percent																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
100.	8.17	7.12	7.75	6.42	5.79	9.13	6.46	5.55	10.96	5.66	3.38	3.71	6.63	4.16	4.05	5.06	100.00
200.	4.73	4.38	5.70	4.21	4.23	6.34	4.50	2.97	4.66	2.00	1.64	1.25	2.98	2.18	2.49	2.77	57.03
300.	3.76	3.53	4.16	3.34	3.07	5.40	3.38	2.11	3.12	1.38	1.02	0.85	1.98	1.74	1.82	2.35	42.99
400.	3.14	2.66	3.06	2.46	2.16	4.60	2.51	1.29	2.28	0.86	0.75	0.65	1.48	1.46	1.44	1.87	32.66
500.	2.62	2.20	2.23	1.74	1.53	3.67	1.81	0.98	1.47	0.66	0.56	0.51	1.14	1.17	1.05	1.69	25.03
600.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
700.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
800.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
900.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
1000.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
1100.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
1200.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
1300.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
1400.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
1500.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
1600.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
1700.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
1800.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
1900.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
2000.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
2100.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
2200.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
2300.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
2400.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
2500.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
2600.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
2700.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
2800.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
2900.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
3000.	2.46	1.96	1.88	1.49	1.39	3.30	1.54	0.78	1.27	0.57	0.51	0.45	1.01	1.05	0.92	1.54	22.11
3100.	2.46	1.96	1.88	1.26	1.39	2.98	1.54	0.78	1.27	0.57	0.51	0.39	1.01	0.91	0.92	1.54	21.36
3200.	2.16	1.57	1.58	1.06	1.21	2.50	1.25	0.53	1.06	0.40	0.43	0.32	0.91	0.73	0.80	1.26	17.76
3300.	1.57	1.26	1.08	0.68	1.07	1.53	0.74	0.40	0.69	0.33	0.33	0.19	0.75	0.47	0.58	1.16	12.83

Table 5.3-17 (Sheet 2 of 2)
Annual Plume Length Frequency During MDCT Operation

Distance from Tower (m)	Values in percent																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
3400.	1.00	0.95	0.79	0.43	0.91	1.01	0.55	0.30	0.40	0.27	0.23	0.14	0.63	0.32	0.48	1.00	9.42
3500.	1.00	0.72	0.51	0.43	0.70	1.01	0.32	0.18	0.40	0.20	0.19	0.14	0.50	0.32	0.39	0.82	7.85
3600.	1.00	0.72	0.51	0.43	0.54	1.01	0.32	0.18	0.40	0.20	0.19	0.14	0.44	0.32	0.39	0.82	7.62
3700.	1.00	0.72	0.51	0.43	0.54	1.01	0.32	0.18	0.40	0.20	0.19	0.14	0.44	0.32	0.39	0.82	7.62
3800.	1.00	0.72	0.51	0.43	0.54	1.01	0.32	0.18	0.40	0.20	0.19	0.14	0.44	0.32	0.39	0.82	7.62
3900.	1.00	0.72	0.51	0.43	0.54	1.01	0.32	0.18	0.40	0.20	0.19	0.14	0.44	0.32	0.39	0.82	7.62
4000.	1.00	0.72	0.51	0.43	0.54	1.01	0.32	0.18	0.40	0.20	0.19	0.14	0.44	0.32	0.39	0.82	7.62
4100.	1.00	0.72	0.51	0.43	0.54	1.01	0.32	0.18	0.40	0.20	0.19	0.14	0.44	0.32	0.39	0.82	7.62
4200.	1.00	0.72	0.51	0.43	0.54	1.01	0.32	0.18	0.40	0.20	0.19	0.14	0.44	0.32	0.39	0.82	7.62
4300.	1.00	0.72	0.51	0.43	0.54	1.01	0.32	0.18	0.40	0.20	0.19	0.14	0.44	0.32	0.39	0.82	7.62
4400.	1.00	0.72	0.51	0.43	0.54	1.01	0.32	0.18	0.40	0.20	0.19	0.14	0.44	0.32	0.39	0.82	7.62
4500.	1.00	0.72	0.51	0.43	0.54	1.01	0.32	0.18	0.40	0.20	0.19	0.14	0.44	0.32	0.39	0.82	7.62
4600.	1.00	0.72	0.51	0.43	0.54	1.01	0.32	0.18	0.40	0.20	0.19	0.14	0.44	0.32	0.39	0.82	7.62
4700.	1.00	0.72	0.51	0.22	0.54	0.59	0.32	0.18	0.40	0.20	0.19	0.08	0.44	0.22	0.39	0.82	6.83
4800.	0.71	0.40	0.32	0.22	0.54	0.59	0.15	0.08	0.25	0.12	0.12	0.08	0.44	0.22	0.31	0.57	5.13
4900.	0.71	0.40	0.32	0.22	0.34	0.59	0.15	0.08	0.25	0.12	0.12	0.08	0.30	0.22	0.31	0.57	4.79
5000.	0.71	0.40	0.32	0.22	0.34	0.59	0.15	0.08	0.25	0.12	0.12	0.08	0.30	0.22	0.31	0.57	4.79

NOTE: Plume moving in the indicated direction.

Table 5.3-18 (Sheet 1 of 2)
Annual Salt Deposition During NDCT Operation

Distance from Tower (m)	Values in $kg/km^2/mo$															
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
1100.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1200.	0.01	0.01	0.02	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.01
1300.	0.01	0.01	0.02	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01
1400.	0.01	0.01	0.02	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01
1500.	0.01	0.01	0.02	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01
1600.	0.01	0.01	0.02	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01
1700.	0.01	0.01	0.02	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01
1800.	0.01	0.01	0.02	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01
1900.	0.01	0.01	0.02	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01
2000.	0.01	0.01	0.02	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01
2100.	0.01	0.01	0.02	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01
2200.	0.01	0.01	0.02	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01
2300.	0.01	0.01	0.02	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01
2400.	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01
2500.	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.02
2600.	0.02	0.02	0.03	0.03	0.02	0.03	0.02	0.02	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
2700.	0.02	0.02	0.03	0.03	0.02	0.03	0.02	0.02	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
2800.	0.02	0.02	0.03	0.03	0.02	0.04	0.03	0.02	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
2900.	0.03	0.02	0.03	0.03	0.02	0.04	0.03	0.02	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
3000.	0.05	0.04	0.04	0.04	0.04	0.06	0.03	0.02	0.04	0.02	0.01	0.01	0.03	0.02	0.02	0.03	0.03
3100.	0.07	0.05	0.05	0.05	0.05	0.09	0.04	0.03	0.05	0.02	0.02	0.01	0.04	0.02	0.03	0.04	0.04
3200.	0.07	0.05	0.05	0.05	0.05	0.09	0.04	0.03	0.05	0.02	0.02	0.01	0.04	0.03	0.03	0.04	0.04
3300.	0.07	0.05	0.05	0.05	0.05	0.09	0.04	0.03	0.05	0.02	0.02	0.01	0.04	0.03	0.03	0.04	0.04
3400.	0.07	0.05	0.05	0.05	0.05	0.09	0.04	0.03	0.05	0.02	0.02	0.01	0.04	0.03	0.03	0.04	0.04
3500.	0.07	0.05	0.05	0.05	0.05	0.09	0.04	0.03	0.05	0.02	0.02	0.01	0.04	0.03	0.03	0.04	0.04
3600.	0.08	0.06	0.06	0.06	0.06	0.10	0.05	0.03	0.05	0.03	0.02	0.02	0.04	0.03	0.03	0.05	0.05
3700.	0.09	0.07	0.07	0.06	0.06	0.11	0.05	0.03	0.06	0.03	0.02	0.02	0.05	0.03	0.04	0.06	0.05
3800.	0.10	0.08	0.07	0.06	0.06	0.12	0.05	0.03	0.06	0.03	0.02	0.02	0.05	0.04	0.04	0.07	0.06
3900.	0.10	0.08	0.07	0.06	0.06	0.12	0.05	0.03	0.06	0.03	0.02	0.02	0.05	0.04	0.04	0.07	0.06
4000.	0.10	0.08	0.07	0.06	0.06	0.12	0.05	0.03	0.06	0.03	0.02	0.02	0.05	0.04	0.04	0.07	0.06
4100.	0.10	0.07	0.06	0.05	0.06	0.11	0.05	0.03	0.05	0.03	0.02	0.02	0.04	0.03	0.04	0.07	0.05
4200.	0.09	0.07	0.06	0.05	0.05	0.10	0.04	0.02	0.04	0.02	0.02	0.01	0.04	0.03	0.04	0.06	0.05
4300.	0.09	0.07	0.06	0.05	0.05	0.10	0.04	0.02	0.04	0.02	0.02	0.01	0.04	0.03	0.04	0.06	0.05
4400.	0.09	0.07	0.06	0.05	0.05	0.10	0.04	0.02	0.04	0.02	0.02	0.01	0.04	0.03	0.04	0.06	0.05

Table 5.3-18 (Sheet 2 of 2) Annual Salt Deposition During NDCT Operation

Distance from Tower (m)	Values in kg/km^2/mo																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
4500.	0.09	0.07	0.06	0.05	0.05	0.10	0.04	0.02	0.04	0.02	0.02	0.01	0.04	0.03	0.04	0.06	0.05
4600.	0.08	0.06	0.05	0.04	0.04	0.09	0.04	0.02	0.04	0.02	0.02	0.01	0.03	0.03	0.03	0.06	0.04
4700.	0.06	0.05	0.04	0.03	0.03	0.07	0.03	0.02	0.03	0.01	0.01	0.01	0.02	0.02	0.02	0.05	0.03
4800.	0.06	0.05	0.04	0.03	0.03	0.07	0.03	0.02	0.03	0.01	0.01	0.01	0.02	0.02	0.02	0.05	0.03
4900.	0.06	0.05	0.04	0.03	0.03	0.07	0.03	0.02	0.03	0.01	0.01	0.01	0.02	0.02	0.02	0.05	0.03
5000.	0.06	0.05	0.04	0.03	0.03	0.07	0.03	0.02	0.03	0.01	0.01	0.01	0.02	0.02	0.02	0.05	0.03

NOTES:
Because of the high initial plume from the NDCT, no salt is deposited within 1100 m of the tower center.
Plume moving in the indicated direction.

Table 5.3-19 (Sheet 1 of 2)
Winter Salt Deposition During NDCT Operation

Distance from Tower (m)	Values in $kg/km^2/mo$																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
1100.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1200.	0.01	0.02	0.00	0.01	0.02	0.02	0.01	0.01	0.02	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.01
1300.	0.01	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01
1400.	0.01	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01
1500.	0.01	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01
1600.	0.01	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01
1700.	0.01	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01
1800.	0.01	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01
1900.	0.01	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01
2000.	0.01	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01
2100.	0.01	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01
2200.	0.01	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01
2300.	0.01	0.02	0.01	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01
2400.	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.01	0.02	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01
2500.	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.01	0.03	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01
2600.	0.01	0.02	0.01	0.02	0.02	0.03	0.02	0.02	0.03	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.02
2700.	0.02	0.03	0.02	0.02	0.02	0.03	0.03	0.02	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
2800.	0.02	0.03	0.02	0.02	0.02	0.04	0.03	0.02	0.04	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
2900.	0.03	0.03	0.02	0.03	0.03	0.05	0.03	0.02	0.04	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02
3000.	0.09	0.08	0.05	0.04	0.05	0.09	0.04	0.03	0.06	0.02	0.01	0.01	0.05	0.03	0.03	0.05	0.05
3100.	0.15	0.11	0.08	0.06	0.07	0.13	0.05	0.04	0.08	0.03	0.02	0.02	0.07	0.04	0.05	0.08	0.07
3200.	0.15	0.12	0.08	0.06	0.07	0.13	0.05	0.04	0.08	0.03	0.02	0.02	0.07	0.04	0.05	0.08	0.07
3300.	0.15	0.12	0.08	0.06	0.07	0.13	0.05	0.04	0.08	0.03	0.02	0.02	0.07	0.04	0.05	0.08	0.07
3400.	0.15	0.12	0.08	0.06	0.07	0.13	0.05	0.04	0.08	0.03	0.02	0.02	0.07	0.04	0.05	0.08	0.07
3500.	0.15	0.12	0.08	0.06	0.07	0.13	0.05	0.04	0.08	0.03	0.02	0.02	0.07	0.04	0.05	0.08	0.07
3600.	0.19	0.15	0.09	0.08	0.09	0.17	0.07	0.05	0.09	0.03	0.03	0.03	0.08	0.04	0.06	0.11	0.08
3700.	0.22	0.18	0.11	0.09	0.10	0.18	0.07	0.05	0.10	0.04	0.03	0.03	0.08	0.05	0.07	0.15	0.10
3800.	0.25	0.20	0.13	0.10	0.10	0.19	0.08	0.05	0.11	0.04	0.03	0.03	0.08	0.05	0.08	0.18	0.11
3900.	0.25	0.20	0.13	0.10	0.10	0.19	0.08	0.05	0.11	0.04	0.03	0.03	0.08	0.05	0.08	0.18	0.11
4000.	0.25	0.20	0.13	0.10	0.10	0.19	0.08	0.05	0.11	0.04	0.03	0.03	0.08	0.05	0.08	0.18	0.11
4100.	0.25	0.19	0.12	0.09	0.09	0.18	0.07	0.05	0.10	0.04	0.03	0.03	0.08	0.05	0.08	0.17	0.10
4200.	0.24	0.18	0.12	0.08	0.09	0.17	0.06	0.04	0.09	0.03	0.03	0.03	0.08	0.05	0.07	0.17	0.10
4300.	0.24	0.18	0.12	0.08	0.09	0.17	0.06	0.04	0.09	0.03	0.03	0.03	0.08	0.05	0.07	0.17	0.10
4400.	0.24	0.18	0.12	0.08	0.09	0.17	0.06	0.04	0.09	0.03	0.03	0.03	0.08	0.05	0.07	0.17	0.10

Table 5.3-19 (Sheet 2 of 2)
Winter Salt Deposition During NDCT Operation

Distance from Tower (m)	Values in kg/km^2/mo																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
4500.	0.24	0.18	0.12	0.08	0.09	0.17	0.06	0.04	0.09	0.03	0.03	0.03	0.08	0.05	0.07	0.17	0.10
4600.	0.21	0.16	0.11	0.07	0.07	0.15	0.06	0.04	0.08	0.03	0.03	0.03	0.06	0.04	0.06	0.15	0.08
4700.	0.15	0.12	0.08	0.06	0.06	0.11	0.06	0.03	0.06	0.03	0.02	0.02	0.03	0.03	0.05	0.12	0.06
4800.	0.15	0.12	0.08	0.06	0.06	0.11	0.06	0.03	0.06	0.03	0.02	0.02	0.03	0.03	0.05	0.12	0.06
4900.	0.15	0.12	0.08	0.06	0.06	0.11	0.06	0.03	0.06	0.03	0.02	0.02	0.03	0.03	0.05	0.12	0.06
5000.	0.15	0.12	0.08	0.06	0.06	0.11	0.06	0.03	0.06	0.03	0.02	0.02	0.03	0.03	0.05	0.12	0.06

NOTES:
Because of the high initial plume from the NDCT, no salt is deposited within 1100 m of the tower center.
Plume moving in the indicated direction.

Table 5.3-20 (Sheet 1 of 2)
Spring Salt Deposition During NDCT Operation

Distance from Tower (m)	Values in kg/km²/mo																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
1100.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1200.	0.02	0.01	0.02	0.01	0.00	0.02	0.01	0.02	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
1300.	0.02	0.01	0.02	0.01	0.00	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.01
1400.	0.02	0.01	0.02	0.01	0.00	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.01
1500.	0.02	0.01	0.02	0.01	0.00	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.01
1600.	0.02	0.01	0.02	0.01	0.00	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.01
1700.	0.02	0.01	0.02	0.01	0.00	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.01
1800.	0.02	0.01	0.02	0.01	0.00	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.01
1900.	0.02	0.01	0.02	0.01	0.00	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.01
2000.	0.02	0.01	0.02	0.01	0.00	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.01
2100.	0.02	0.01	0.02	0.01	0.00	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.01
2200.	0.02	0.01	0.02	0.01	0.00	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.01
2300.	0.02	0.01	0.02	0.01	0.00	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.01
2400.	0.02	0.01	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.01
2500.	0.02	0.01	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
2600.	0.02	0.01	0.02	0.01	0.01	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
2700.	0.03	0.01	0.02	0.02	0.01	0.03	0.03	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02
2800.	0.03	0.01	0.02	0.02	0.01	0.04	0.03	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02
2900.	0.03	0.01	0.02	0.02	0.01	0.04	0.03	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02
3000.	0.03	0.02	0.03	0.02	0.03	0.05	0.04	0.03	0.04	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.02
3100.	0.03	0.02	0.04	0.03	0.04	0.07	0.04	0.03	0.04	0.03	0.02	0.01	0.02	0.02	0.01	0.02	0.03
3200.	0.03	0.02	0.04	0.03	0.04	0.07	0.04	0.03	0.04	0.03	0.02	0.01	0.02	0.02	0.01	0.02	0.03
3300.	0.03	0.02	0.04	0.03	0.04	0.07	0.04	0.03	0.04	0.03	0.02	0.01	0.02	0.02	0.01	0.02	0.03
3400.	0.03	0.02	0.04	0.03	0.04	0.07	0.04	0.03	0.04	0.03	0.02	0.01	0.02	0.02	0.01	0.02	0.03
3500.	0.03	0.02	0.04	0.03	0.04	0.07	0.04	0.03	0.04	0.03	0.02	0.01	0.02	0.02	0.01	0.02	0.03
3600.	0.03	0.03	0.04	0.03	0.05	0.08	0.05	0.03	0.05	0.03	0.02	0.01	0.02	0.03	0.02	0.02	0.03
3700.	0.04	0.03	0.05	0.03	0.06	0.09	0.05	0.03	0.05	0.03	0.03	0.02	0.02	0.03	0.02	0.02	0.04
3800.	0.04	0.03	0.05	0.03	0.06	0.10	0.05	0.04	0.05	0.04	0.03	0.02	0.02	0.04	0.03	0.02	0.04
3900.	0.04	0.03	0.05	0.03	0.06	0.10	0.05	0.04	0.05	0.04	0.03	0.02	0.02	0.04	0.03	0.02	0.04
4000.	0.04	0.03	0.05	0.03	0.06	0.10	0.05	0.04	0.05	0.04	0.03	0.02	0.02	0.04	0.03	0.02	0.04
4100.	0.03	0.03	0.04	0.03	0.06	0.09	0.05	0.03	0.05	0.03	0.02	0.02	0.02	0.04	0.03	0.02	0.04
4200.	0.02	0.02	0.03	0.02	0.06	0.08	0.04	0.02	0.04	0.03	0.02	0.01	0.02	0.03	0.02	0.02	0.03
4300.	0.02	0.02	0.03	0.02	0.06	0.08	0.04	0.02	0.04	0.03	0.02	0.01	0.02	0.03	0.02	0.02	0.03
4400.	0.02	0.02	0.03	0.02	0.06	0.08	0.04	0.02	0.04	0.03	0.02	0.01	0.02	0.03	0.02	0.02	0.03

Table 5.3-20 (Sheet 2 of 2)
Spring Salt Deposition During NDCT Operation

Distance from Tower (m)	Values in $kg/km^2/mo$																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
4500.	0.02	0.02	0.03	0.02	0.06	0.08	0.04	0.02	0.04	0.03	0.02	0.01	0.02	0.03	0.02	0.02	0.03
4600.	0.02	0.02	0.03	0.02	0.05	0.08	0.03	0.02	0.03	0.02	0.02	0.01	0.02	0.03	0.02	0.02	0.03
4700.	0.02	0.02	0.02	0.02	0.03	0.06	0.03	0.02	0.03	0.02	0.01	0.01	0.02	0.03	0.02	0.01	0.02
4800.	0.02	0.02	0.02	0.02	0.03	0.06	0.03	0.02	0.03	0.02	0.01	0.01	0.02	0.03	0.02	0.01	0.02
4900.	0.02	0.02	0.02	0.02	0.03	0.06	0.03	0.02	0.03	0.02	0.01	0.01	0.02	0.03	0.02	0.01	0.02
5000.	0.02	0.02	0.02	0.02	0.03	0.06	0.03	0.02	0.03	0.02	0.01	0.01	0.02	0.03	0.02	0.01	0.02

NOTES:
Because of the high initial plume from the NDCT, no salt is deposited within 1100 m of the tower center.
Plume moving in the indicated direction.

Table 5.3-21 (Sheet 1 of 2)
Summer Salt Deposition During NDCT Operation

Distance from Tower (m)	Values in kg/km^2/mo																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
1100.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1200.	0.01	0.01	0.03	0.03	0.02	0.04	0.02	0.01	0.01	0.01	0.00	0.01	0.02	0.01	0.01	0.01	0.02
1300.	0.01	0.01	0.03	0.03	0.02	0.04	0.02	0.01	0.02	0.01	0.00	0.01	0.02	0.01	0.01	0.01	0.02
1400.	0.01	0.01	0.03	0.03	0.02	0.04	0.02	0.01	0.02	0.01	0.00	0.01	0.02	0.01	0.01	0.01	0.02
1500.	0.01	0.01	0.03	0.03	0.02	0.04	0.02	0.01	0.02	0.01	0.00	0.01	0.02	0.01	0.01	0.01	0.02
1600.	0.01	0.01	0.03	0.03	0.02	0.04	0.02	0.01	0.02	0.01	0.00	0.01	0.02	0.01	0.01	0.01	0.02
1700.	0.01	0.01	0.03	0.03	0.02	0.04	0.02	0.01	0.02	0.01	0.00	0.01	0.02	0.01	0.01	0.01	0.02
1800.	0.01	0.01	0.03	0.03	0.02	0.04	0.02	0.01	0.02	0.01	0.00	0.01	0.02	0.01	0.01	0.01	0.02
1900.	0.01	0.01	0.03	0.03	0.02	0.04	0.02	0.01	0.02	0.01	0.00	0.01	0.02	0.01	0.01	0.01	0.02
2000.	0.01	0.01	0.03	0.03	0.02	0.04	0.02	0.01	0.02	0.01	0.00	0.01	0.02	0.01	0.01	0.01	0.02
2100.	0.01	0.01	0.03	0.03	0.02	0.04	0.02	0.01	0.02	0.01	0.00	0.01	0.02	0.01	0.01	0.01	0.02
2200.	0.01	0.01	0.03	0.03	0.02	0.04	0.02	0.01	0.02	0.01	0.00	0.01	0.02	0.01	0.01	0.01	0.02
2300.	0.01	0.01	0.03	0.03	0.02	0.04	0.02	0.01	0.02	0.01	0.00	0.01	0.02	0.01	0.01	0.01	0.02
2400.	0.01	0.01	0.03	0.03	0.03	0.04	0.02	0.01	0.02	0.01	0.00	0.01	0.02	0.01	0.01	0.01	0.02
2500.	0.02	0.01	0.03	0.04	0.03	0.04	0.02	0.01	0.02	0.01	0.00	0.01	0.02	0.01	0.02	0.01	0.02
2600.	0.02	0.01	0.03	0.04	0.03	0.04	0.02	0.02	0.02	0.01	0.00	0.01	0.02	0.01	0.02	0.01	0.02
2700.	0.02	0.01	0.04	0.04	0.03	0.05	0.03	0.02	0.02	0.01	0.00	0.01	0.02	0.01	0.02	0.01	0.02
2800.	0.02	0.01	0.04	0.04	0.03	0.05	0.03	0.02	0.02	0.01	0.00	0.01	0.02	0.01	0.02	0.01	0.02
2900.	0.02	0.01	0.04	0.04	0.03	0.05	0.03	0.02	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.01	0.02
3000.	0.02	0.01	0.04	0.04	0.03	0.05	0.03	0.02	0.02	0.01	0.01	0.01	0.03	0.01	0.02	0.01	0.02
3100.	0.02	0.01	0.04	0.05	0.04	0.05	0.03	0.02	0.02	0.01	0.01	0.01	0.03	0.01	0.02	0.01	0.02
3200.	0.02	0.01	0.04	0.05	0.04	0.05	0.03	0.02	0.02	0.01	0.01	0.01	0.03	0.01	0.02	0.01	0.02
3300.	0.02	0.01	0.04	0.05	0.04	0.05	0.03	0.02	0.02	0.01	0.01	0.01	0.03	0.01	0.02	0.01	0.02
3400.	0.02	0.01	0.04	0.05	0.04	0.05	0.03	0.02	0.02	0.01	0.01	0.01	0.03	0.01	0.02	0.01	0.02
3500.	0.02	0.01	0.04	0.05	0.04	0.05	0.03	0.02	0.02	0.01	0.01	0.01	0.03	0.01	0.02	0.01	0.02
3600.	0.02	0.01	0.04	0.05	0.04	0.06	0.03	0.02	0.02	0.01	0.01	0.01	0.03	0.02	0.02	0.01	0.02
3700.	0.02	0.01	0.04	0.05	0.04	0.06	0.03	0.02	0.02	0.01	0.01	0.01	0.03	0.02	0.02	0.02	0.02
3800.	0.02	0.01	0.04	0.05	0.04	0.06	0.03	0.02	0.02	0.01	0.01	0.01	0.03	0.02	0.02	0.02	0.02
3900.	0.02	0.01	0.04	0.05	0.04	0.06	0.03	0.02	0.02	0.01	0.01	0.01	0.03	0.02	0.02	0.02	0.02
4000.	0.02	0.01	0.04	0.05	0.04	0.06	0.03	0.02	0.02	0.01	0.01	0.01	0.03	0.02	0.02	0.02	0.02
4100.	0.02	0.01	0.03	0.04	0.03	0.04	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.02
4200.	0.01	0.00	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01
4300.	0.01	0.00	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01
4400.	0.01	0.00	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01

Table 5.3-21 (Sheet 2 of 2)
Summer Salt Deposition During NDCT Operation

Distance from Tower (m)	Values in $kg/km^2/mo$																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
4500.	0.01	0.00	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01
4600.	0.01	0.00	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01
4700.	0.01	0.00	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01
4800.	0.01	0.00	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01
4900.	0.01	0.00	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01
5000.	0.01	0.00	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01

NOTES:
Because of the high initial plume from the NDCT, no salt is deposited within 1100 m of the tower center.
Plume moving in the indicated direction.

Table 5.3-22 (Sheet 1 of 2)
Fall Salt Deposition During NDCT Operation

Distance from Tower (m)	Values in kg/km^2/mo																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
1100.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1200.	0.02	0.02	0.02	0.02	0.01	0.00	0.01	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01
1300.	0.02	0.02	0.02	0.02	0.01	0.00	0.01	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01
1400.	0.02	0.02	0.02	0.02	0.01	0.00	0.01	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01
1500.	0.02	0.02	0.02	0.02	0.01	0.00	0.01	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01
1600.	0.02	0.02	0.02	0.02	0.01	0.00	0.01	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01
1700.	0.02	0.02	0.02	0.02	0.01	0.00	0.01	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01
1800.	0.02	0.02	0.02	0.02	0.01	0.00	0.01	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01
1900.	0.02	0.02	0.02	0.02	0.01	0.00	0.01	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01
2000.	0.02	0.02	0.02	0.02	0.01	0.00	0.01	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01
2100.	0.02	0.02	0.02	0.02	0.01	0.00	0.01	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01
2200.	0.02	0.02	0.02	0.02	0.01	0.00	0.01	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01
2300.	0.02	0.02	0.02	0.02	0.01	0.00	0.01	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01
2400.	0.02	0.02	0.02	0.03	0.01	0.01	0.01	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01
2500.	0.03	0.02	0.03	0.03	0.01	0.01	0.01	0.01	0.02	0.02	0.00	0.00	0.01	0.01	0.01	0.02	0.02
2600.	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.03	0.02	0.00	0.00	0.01	0.01	0.01	0.02	0.02
2700.	0.03	0.03	0.04	0.04	0.02	0.02	0.02	0.01	0.03	0.02	0.01	0.00	0.01	0.01	0.01	0.02	0.02
2800.	0.04	0.04	0.04	0.04	0.02	0.02	0.02	0.01	0.03	0.02	0.01	0.00	0.01	0.01	0.01	0.02	0.02
2900.	0.04	0.04	0.04	0.04	0.02	0.03	0.02	0.01	0.03	0.02	0.01	0.00	0.01	0.01	0.01	0.02	0.02
3000.	0.06	0.05	0.05	0.05	0.03	0.06	0.03	0.02	0.04	0.02	0.01	0.01	0.02	0.02	0.02	0.03	0.03
3100.	0.07	0.06	0.06	0.06	0.04	0.10	0.04	0.02	0.05	0.02	0.01	0.01	0.03	0.03	0.03	0.04	0.04
3200.	0.07	0.06	0.06	0.06	0.04	0.10	0.04	0.02	0.05	0.02	0.01	0.01	0.03	0.03	0.03	0.04	0.04
3300.	0.07	0.06	0.06	0.06	0.04	0.10	0.04	0.02	0.05	0.02	0.01	0.01	0.03	0.03	0.03	0.04	0.04
3400.	0.07	0.06	0.06	0.06	0.04	0.10	0.04	0.02	0.05	0.02	0.01	0.01	0.03	0.03	0.03	0.04	0.04
3500.	0.07	0.06	0.06	0.06	0.04	0.10	0.04	0.02	0.05	0.02	0.01	0.01	0.03	0.03	0.03	0.04	0.04
3600.	0.08	0.07	0.07	0.07	0.05	0.12	0.05	0.02	0.05	0.03	0.01	0.01	0.04	0.03	0.04	0.05	0.05
3700.	0.10	0.08	0.08	0.07	0.05	0.13	0.06	0.02	0.05	0.03	0.02	0.01	0.05	0.04	0.04	0.06	0.05
3800.	0.10	0.08	0.08	0.07	0.05	0.13	0.06	0.03	0.05	0.03	0.02	0.01	0.05	0.04	0.04	0.07	0.06
3900.	0.10	0.08	0.08	0.07	0.05	0.13	0.06	0.03	0.05	0.03	0.02	0.01	0.05	0.04	0.04	0.07	0.06
4000.	0.10	0.08	0.08	0.07	0.05	0.13	0.06	0.03	0.05	0.03	0.02	0.01	0.05	0.04	0.04	0.07	0.06
4100.	0.09	0.07	0.07	0.06	0.05	0.13	0.05	0.02	0.04	0.02	0.02	0.01	0.05	0.04	0.04	0.07	0.05
4200.	0.09	0.06	0.06	0.05	0.04	0.13	0.05	0.02	0.03	0.02	0.02	0.01	0.05	0.04	0.04	0.06	0.05
4300.	0.09	0.06	0.06	0.05	0.04	0.13	0.05	0.02	0.03	0.02	0.02	0.01	0.05	0.04	0.04	0.06	0.05
4400.	0.09	0.06	0.06	0.05	0.04	0.13	0.05	0.02	0.03	0.02	0.02	0.01	0.05	0.04	0.04	0.06	0.05

Table 5.3-22 (Sheet 2 of 2)
Fall Salt Deposition During NDCT Operation

Distance from Tower (m)	Values in $kg/km^2/mo$																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
4500.	0.09	0.06	0.06	0.05	0.04	0.13	0.05	0.02	0.03	0.02	0.02	0.01	0.05	0.04	0.04	0.06	0.05
4600.	0.07	0.06	0.06	0.05	0.04	0.11	0.04	0.02	0.03	0.02	0.01	0.01	0.04	0.03	0.03	0.05	0.04
4700.	0.06	0.05	0.05	0.04	0.03	0.08	0.03	0.02	0.02	0.01	0.01	0.01	0.04	0.03	0.02	0.05	0.04
4800.	0.06	0.05	0.05	0.04	0.03	0.08	0.03	0.02	0.02	0.01	0.01	0.01	0.04	0.03	0.02	0.05	0.04
4900.	0.06	0.05	0.05	0.04	0.03	0.08	0.03	0.02	0.02	0.01	0.01	0.01	0.04	0.03	0.02	0.05	0.04
5000.	0.06	0.05	0.05	0.04	0.03	0.08	0.03	0.02	0.02	0.01	0.01	0.01	0.04	0.03	0.02	0.05	0.04

NOTES:
Because of the high initial plume from the NDCT, no salt is deposited within 1100 m of the tower center.
Plume moving in the indicated direction.

Table 5.3-23 (Sheet 1 of 2)
Annual Salt Deposition During MDCT Operation

Distance from Tower (m)	Values in kg/km^2/mo																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
100.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
200.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
300.	0.01	0.00	0.00	0.02	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.02
400.	1.11	1.33	1.57	1.22	1.27	1.23	1.01	0.94	1.96	1.28	0.80	0.59	1.40	0.60	0.78	0.64	1.11
500.	0.58	0.62	0.55	0.53	0.33	0.56	0.37	0.47	0.97	0.60	0.26	0.27	0.31	0.27	0.26	0.32	0.45
600.	0.24	0.21	0.32	0.22	0.25	0.29	0.26	0.18	0.28	0.11	0.08	0.06	0.16	0.10	0.13	0.12	0.19
700.	0.30	0.28	0.37	0.27	0.28	0.41	0.30	0.21	0.31	0.13	0.09	0.08	0.18	0.14	0.15	0.16	0.23
800.	0.31	0.29	0.37	0.28	0.28	0.42	0.31	0.21	0.31	0.13	0.10	0.08	0.19	0.14	0.15	0.17	0.23
900.	0.31	0.29	0.37	0.28	0.28	0.42	0.31	0.21	0.31	0.13	0.10	0.08	0.19	0.14	0.15	0.17	0.23
1000.	0.31	0.29	0.37	0.28	0.28	0.42	0.31	0.21	0.31	0.13	0.10	0.08	0.19	0.14	0.15	0.17	0.23
1100.	0.31	0.29	0.37	0.28	0.28	0.42	0.31	0.21	0.31	0.13	0.10	0.08	0.19	0.14	0.15	0.17	0.23
1200.	0.31	0.29	0.37	0.28	0.28	0.42	0.31	0.21	0.31	0.13	0.10	0.08	0.19	0.14	0.15	0.17	0.23
1300.	0.31	0.29	0.37	0.28	0.28	0.42	0.31	0.21	0.31	0.13	0.10	0.08	0.19	0.14	0.15	0.17	0.23
1400.	0.31	0.29	0.37	0.28	0.28	0.42	0.31	0.21	0.31	0.13	0.10	0.08	0.19	0.14	0.15	0.17	0.23
1500.	0.31	0.29	0.37	0.28	0.28	0.42	0.31	0.21	0.31	0.13	0.10	0.08	0.19	0.14	0.15	0.17	0.23
1600.	0.31	0.29	0.37	0.28	0.28	0.42	0.31	0.21	0.31	0.13	0.10	0.08	0.19	0.14	0.15	0.17	0.23
1700.	0.31	0.29	0.37	0.28	0.28	0.42	0.31	0.21	0.31	0.13	0.10	0.08	0.19	0.14	0.15	0.17	0.23
1800.	0.31	0.29	0.37	0.28	0.28	0.42	0.31	0.21	0.31	0.13	0.10	0.08	0.19	0.14	0.15	0.17	0.23
1900.	0.31	0.29	0.37	0.28	0.25	0.42	0.31	0.21	0.31	0.13	0.10	0.08	0.16	0.14	0.15	0.17	0.23
2000.	0.29	0.29	0.27	0.28	0.13	0.42	0.21	0.21	0.28	0.13	0.08	0.08	0.09	0.14	0.11	0.17	0.20
2100.	0.17	0.23	0.09	0.20	0.06	0.30	0.07	0.17	0.16	0.11	0.03	0.06	0.05	0.10	0.04	0.14	0.12
2200.	0.08	0.09	0.05	0.07	0.03	0.11	0.04	0.07	0.07	0.05	0.02	0.03	0.03	0.04	0.02	0.07	0.06
2300.	0.05	0.05	0.04	0.04	0.02	0.07	0.03	0.03	0.04	0.02	0.02	0.02	0.02	0.03	0.02	0.04	0.03
2400.	0.04	0.02	0.03	0.03	0.02	0.06	0.03	0.02	0.03	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.03
2500.	0.03	0.02	0.03	0.02	0.02	0.03	0.03	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.02	0.02	0.02
2600.	0.03	0.02	0.03	0.02	0.02	0.03	0.03	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.02	0.02	0.02
2700.	0.03	0.02	0.03	0.02	0.02	0.03	0.03	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.02	0.02	0.02
2800.	0.03	0.02	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.02	0.02	0.02
2900.	0.03	0.02	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.02	0.02	0.02
3000.	0.03	0.02	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.02	0.02	0.02
3100.	0.03	0.02	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.02	0.02	0.02
3200.	0.03	0.02	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.02	0.02	0.02
3300.	0.03	0.02	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.02	0.02	0.02
3400.	0.03	0.02	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.02	0.02	0.02

Table 5.3-23 (Sheet 2 of 2)
Annual Salt Deposition During MDCT Operation

Distance from Tower (m)	Values in kg/km^2/mo																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
3500.	0.03	0.02	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.02	0.02	0.02
3600.	0.04	0.03	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.02	0.02	0.02
3700.	0.04	0.03	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.02	0.03	0.02
3800.	0.04	0.03	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.02	0.03	0.02
3900.	0.04	0.03	0.02	0.02	0.02	0.03	0.01	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.03	0.02
4000.	0.04	0.03	0.02	0.02	0.02	0.03	0.01	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.03	0.02
4100.	0.04	0.03	0.02	0.02	0.02	0.03	0.01	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.03	0.02
4200.	0.04	0.03	0.02	0.02	0.02	0.03	0.01	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.03	0.02
4300.	0.04	0.03	0.02	0.02	0.02	0.03	0.01	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.03	0.02
4400.	0.04	0.03	0.02	0.02	0.02	0.03	0.01	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.03	0.02
4500.	0.04	0.03	0.02	0.02	0.02	0.03	0.01	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.03	0.02
4600.	0.04	0.03	0.02	0.02	0.02	0.03	0.01	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.03	0.02
4700.	0.04	0.03	0.02	0.02	0.02	0.03	0.01	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.03	0.02
4800.	0.04	0.03	0.02	0.02	0.02	0.03	0.01	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.03	0.02
4900.	0.04	0.03	0.02	0.02	0.01	0.03	0.01	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.03	0.02
5000.	0.04	0.03	0.02	0.02	0.01	0.03	0.01	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.03	0.02

NOTE:
Plume moving in the indicated direction.

Table 5.3-24 (Sheet 1 of 2) Winter Salt Deposition During MDCT Operation

Distance from Tower (m)	Values in $kg/km^2/mo$																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
100.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
200.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
300.	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.01
400.	1.04	0.56	0.56	0.36	0.51	1.01	0.64	1.53	1.81	0.89	0.24	0.43	0.86	0.80	0.72	0.82	0.80
500.	0.55	0.28	0.23	0.20	0.20	0.49	0.29	0.73	0.92	0.44	0.11	0.20	0.21	0.34	0.25	0.41	0.36
600.	0.28	0.24	0.32	0.19	0.26	0.34	0.35	0.26	0.34	0.15	0.13	0.08	0.16	0.13	0.16	0.15	0.22
700.	0.43	0.37	0.41	0.28	0.31	0.56	0.43	0.31	0.40	0.18	0.16	0.11	0.17	0.17	0.19	0.24	0.30
800.	0.48	0.40	0.42	0.29	0.32	0.59	0.44	0.32	0.41	0.18	0.16	0.12	0.19	0.17	0.20	0.27	0.31
900.	0.48	0.40	0.42	0.29	0.32	0.59	0.44	0.32	0.41	0.18	0.16	0.12	0.19	0.17	0.20	0.27	0.31
1000.	0.48	0.40	0.42	0.29	0.32	0.59	0.44	0.32	0.41	0.18	0.16	0.12	0.19	0.17	0.20	0.27	0.31
1100.	0.48	0.40	0.42	0.29	0.32	0.59	0.44	0.32	0.41	0.18	0.16	0.12	0.19	0.17	0.20	0.27	0.31
1200.	0.48	0.40	0.42	0.29	0.32	0.59	0.44	0.32	0.41	0.18	0.16	0.12	0.19	0.17	0.20	0.27	0.31
1300.	0.48	0.40	0.42	0.29	0.32	0.59	0.44	0.32	0.41	0.18	0.16	0.12	0.19	0.17	0.20	0.27	0.31
1400.	0.48	0.40	0.42	0.29	0.32	0.59	0.44	0.32	0.41	0.18	0.16	0.12	0.19	0.17	0.20	0.27	0.31
1500.	0.48	0.40	0.42	0.29	0.32	0.59	0.44	0.32	0.41	0.18	0.16	0.12	0.19	0.17	0.20	0.27	0.31
1600.	0.48	0.40	0.42	0.29	0.32	0.59	0.44	0.32	0.41	0.18	0.16	0.12	0.19	0.17	0.20	0.27	0.31
1700.	0.48	0.40	0.42	0.29	0.32	0.59	0.44	0.32	0.41	0.18	0.16	0.12	0.19	0.17	0.20	0.27	0.31
1800.	0.48	0.40	0.42	0.29	0.32	0.59	0.44	0.32	0.41	0.18	0.16	0.12	0.19	0.17	0.20	0.27	0.31
1900.	0.48	0.40	0.42	0.29	0.29	0.59	0.44	0.32	0.41	0.18	0.16	0.12	0.17	0.17	0.20	0.27	0.31
2000.	0.45	0.40	0.29	0.29	0.14	0.59	0.29	0.32	0.37	0.18	0.12	0.12	0.10	0.17	0.15	0.27	0.27
2100.	0.30	0.31	0.09	0.22	0.08	0.44	0.09	0.25	0.21	0.16	0.04	0.09	0.06	0.11	0.06	0.23	0.17
2200.	0.14	0.15	0.06	0.09	0.04	0.17	0.05	0.10	0.10	0.06	0.03	0.04	0.04	0.05	0.04	0.12	0.08
2300.	0.12	0.10	0.04	0.06	0.03	0.11	0.03	0.04	0.07	0.03	0.02	0.02	0.03	0.04	0.03	0.09	0.05
2400.	0.09	0.05	0.04	0.05	0.02	0.09	0.03	0.03	0.05	0.02	0.02	0.02	0.03	0.03	0.03	0.05	0.04
2500.	0.07	0.05	0.04	0.02	0.02	0.04	0.03	0.03	0.05	0.02	0.02	0.01	0.03	0.02	0.03	0.05	0.03
2600.	0.07	0.05	0.04	0.02	0.02	0.04	0.03	0.03	0.05	0.02	0.02	0.01	0.03	0.02	0.03	0.05	0.03
2700.	0.07	0.05	0.04	0.02	0.02	0.04	0.03	0.03	0.05	0.02	0.02	0.01	0.03	0.02	0.03	0.05	0.03
2800.	0.07	0.05	0.03	0.02	0.02	0.04	0.02	0.03	0.05	0.02	0.01	0.01	0.03	0.02	0.02	0.05	0.03
2900.	0.07	0.05	0.03	0.02	0.02	0.04	0.02	0.03	0.05	0.02	0.01	0.01	0.03	0.02	0.02	0.05	0.03
3000.	0.07	0.05	0.03	0.02	0.02	0.04	0.02	0.03	0.05	0.02	0.01	0.01	0.03	0.02	0.02	0.05	0.03
3100.	0.07	0.05	0.03	0.02	0.02	0.04	0.02	0.03	0.05	0.02	0.01	0.01	0.03	0.02	0.02	0.05	0.03
3200.	0.07	0.05	0.03	0.02	0.02	0.04	0.02	0.03	0.05	0.02	0.01	0.01	0.03	0.02	0.02	0.05	0.03
3300.	0.07	0.05	0.03	0.02	0.02	0.04	0.02	0.03	0.05	0.02	0.01	0.01	0.03	0.02	0.02	0.05	0.03
3400.	0.07	0.05	0.03	0.02	0.02	0.04	0.02	0.03	0.05	0.02	0.01	0.01	0.03	0.02	0.02	0.05	0.03

Table 5.3-24 (Sheet 2 of 2)
Winter Salt Deposition During MDCT Operation

Distance from Tower (m)	Values in kg/km^2/mo																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
3500.	0.07	0.05	0.03	0.02	0.02	0.04	0.02	0.03	0.05	0.02	0.01	0.01	0.03	0.02	0.02	0.05	0.03
3600.	0.08	0.05	0.03	0.02	0.03	0.04	0.02	0.03	0.05	0.02	0.01	0.01	0.03	0.02	0.03	0.05	0.03
3700.	0.08	0.06	0.04	0.02	0.03	0.04	0.02	0.03	0.05	0.02	0.01	0.01	0.04	0.02	0.03	0.06	0.03
3800.	0.08	0.06	0.04	0.02	0.03	0.04	0.02	0.03	0.05	0.02	0.01	0.01	0.04	0.02	0.03	0.06	0.03
3900.	0.08	0.06	0.03	0.02	0.03	0.04	0.02	0.03	0.05	0.02	0.01	0.01	0.03	0.02	0.03	0.06	0.03
4000.	0.08	0.06	0.03	0.02	0.02	0.04	0.01	0.03	0.05	0.02	0.01	0.01	0.03	0.02	0.03	0.06	0.03
4100.	0.08	0.06	0.03	0.02	0.02	0.04	0.01	0.03	0.05	0.02	0.01	0.01	0.03	0.02	0.03	0.06	0.03
4200.	0.08	0.06	0.03	0.02	0.02	0.04	0.01	0.03	0.05	0.02	0.01	0.01	0.03	0.02	0.03	0.06	0.03
4300.	0.08	0.06	0.03	0.02	0.02	0.04	0.01	0.03	0.05	0.02	0.01	0.01	0.03	0.02	0.03	0.06	0.03
4400.	0.08	0.06	0.03	0.02	0.02	0.04	0.01	0.03	0.05	0.02	0.01	0.01	0.03	0.02	0.03	0.06	0.03
4500.	0.08	0.06	0.03	0.02	0.02	0.04	0.01	0.03	0.05	0.02	0.01	0.01	0.03	0.02	0.02	0.06	0.03
4600.	0.08	0.06	0.03	0.02	0.02	0.04	0.01	0.03	0.05	0.02	0.01	0.01	0.03	0.02	0.02	0.06	0.03
4700.	0.08	0.06	0.03	0.02	0.02	0.04	0.01	0.03	0.05	0.02	0.01	0.01	0.03	0.02	0.02	0.06	0.03
4800.	0.08	0.06	0.03	0.02	0.02	0.04	0.01	0.03	0.05	0.02	0.01	0.01	0.03	0.02	0.02	0.06	0.03
4900.	0.08	0.06	0.03	0.02	0.02	0.04	0.01	0.03	0.05	0.02	0.01	0.01	0.03	0.02	0.02	0.06	0.03
5000.	0.08	0.06	0.03	0.02	0.02	0.04	0.01	0.03	0.05	0.02	0.01	0.01	0.03	0.02	0.02	0.06	0.03

NOTE:
Plume moving in the indicated direction.

Table 5.3-25 (Sheet 1 of 2)
Spring Salt Deposition During MDCT Operation

Distance from Tower (m)	Values in kg/km^2/mo																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
100.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
200.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
300.	0.02	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.01
400.	0.73	1.47	1.46	0.84	1.31	1.20	1.48	0.63	2.93	1.95	0.57	0.37	1.31	0.47	0.56	0.84	1.13
500.	0.42	0.70	0.53	0.34	0.33	0.51	0.51	0.33	1.39	0.84	0.18	0.17	0.30	0.25	0.20	0.40	0.46
600.	0.22	0.18	0.25	0.16	0.20	0.29	0.32	0.17	0.32	0.13	0.08	0.07	0.15	0.09	0.11	0.09	0.18
700.	0.24	0.21	0.27	0.20	0.22	0.37	0.35	0.19	0.35	0.14	0.09	0.08	0.16	0.13	0.12	0.11	0.20
800.	0.23	0.21	0.27	0.20	0.23	0.38	0.35	0.19	0.36	0.15	0.09	0.08	0.16	0.13	0.13	0.11	0.20
900.	0.22	0.21	0.27	0.20	0.23	0.38	0.35	0.19	0.36	0.15	0.09	0.08	0.16	0.13	0.13	0.11	0.20
1000.	0.22	0.21	0.27	0.20	0.23	0.38	0.35	0.19	0.36	0.15	0.09	0.08	0.16	0.13	0.13	0.11	0.20
1100.	0.22	0.21	0.27	0.20	0.23	0.38	0.35	0.19	0.36	0.15	0.09	0.08	0.16	0.13	0.13	0.11	0.20
1200.	0.22	0.21	0.27	0.20	0.23	0.38	0.35	0.19	0.36	0.15	0.09	0.08	0.16	0.13	0.13	0.11	0.20
1300.	0.22	0.21	0.27	0.20	0.23	0.38	0.35	0.19	0.36	0.15	0.09	0.08	0.16	0.13	0.13	0.11	0.20
1400.	0.22	0.21	0.27	0.20	0.23	0.38	0.35	0.19	0.36	0.15	0.09	0.08	0.16	0.13	0.13	0.11	0.20
1500.	0.22	0.21	0.27	0.20	0.23	0.38	0.35	0.19	0.36	0.15	0.09	0.08	0.16	0.13	0.13	0.11	0.20
1600.	0.22	0.21	0.27	0.20	0.23	0.38	0.35	0.19	0.36	0.15	0.09	0.08	0.16	0.13	0.13	0.11	0.20
1700.	0.22	0.21	0.27	0.20	0.23	0.38	0.35	0.19	0.36	0.15	0.09	0.08	0.16	0.13	0.13	0.11	0.20
1800.	0.22	0.21	0.27	0.20	0.23	0.38	0.35	0.19	0.36	0.15	0.09	0.08	0.16	0.13	0.13	0.11	0.20
1900.	0.21	0.21	0.27	0.20	0.21	0.38	0.35	0.19	0.35	0.15	0.09	0.08	0.13	0.13	0.13	0.11	0.20
2000.	0.20	0.21	0.21	0.20	0.10	0.38	0.24	0.19	0.31	0.15	0.07	0.08	0.07	0.13	0.09	0.11	0.17
2100.	0.10	0.17	0.08	0.15	0.05	0.27	0.08	0.17	0.17	0.13	0.03	0.06	0.03	0.09	0.03	0.09	0.11
2200.	0.04	0.06	0.04	0.05	0.03	0.09	0.04	0.07	0.08	0.06	0.02	0.03	0.02	0.03	0.02	0.04	0.04
2300.	0.02	0.03	0.03	0.03	0.02	0.06	0.03	0.03	0.04	0.03	0.01	0.02	0.02	0.02	0.02	0.02	0.03
2400.	0.02	0.02	0.03	0.02	0.02	0.05	0.03	0.02	0.04	0.02	0.01	0.01	0.02	0.02	0.02	0.01	0.02
2500.	0.02	0.02	0.03	0.02	0.02	0.03	0.03	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.02	0.01	0.02
2600.	0.02	0.02	0.03	0.02	0.02	0.03	0.03	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.02	0.01	0.02
2700.	0.02	0.02	0.03	0.02	0.02	0.03	0.03	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.02	0.01	0.02
2800.	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02
2900.	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02
3000.	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02
3100.	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02
3200.	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02
3300.	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02
3400.	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02

Table 5.3-25 (Sheet 2 of 2)
Spring Salt Deposition During MDCT Operation

Distance from Tower (m)	Values in $kg/km^2/mo$																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
3500.	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02
3600.	0.02	0.02	0.02	0.01	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02
3700.	0.02	0.02	0.02	0.01	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02
3800.	0.02	0.02	0.02	0.01	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02
3900.	0.02	0.02	0.02	0.01	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02
4000.	0.02	0.02	0.02	0.01	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02
4100.	0.02	0.02	0.02	0.01	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02
4200.	0.02	0.02	0.02	0.01	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02
4300.	0.02	0.02	0.02	0.01	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02
4400.	0.02	0.02	0.02	0.01	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02
4500.	0.02	0.02	0.01	0.01	0.02	0.03	0.01	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02
4600.	0.02	0.02	0.01	0.01	0.02	0.03	0.01	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02
4700.	0.02	0.02	0.01	0.01	0.02	0.03	0.01	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02
4800.	0.02	0.02	0.01	0.01	0.02	0.03	0.01	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02
4900.	0.02	0.02	0.01	0.01	0.02	0.03	0.01	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02
5000.	0.02	0.02	0.01	0.01	0.02	0.03	0.01	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02

NOTE:
Plume moving in the indicated direction.

Table 5.3-26 (Sheet 1 of 2)
Summer Salt Deposition During MDCT Operation

Distance from Tower (m)	Values in kg/km^2/mo																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
100.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
200.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
300.	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.03
400.	0.88	0.67	2.80	2.32	1.99	1.53	1.09	0.74	1.84	1.58	1.52	1.16	2.15	0.43	0.54	0.34	1.35
500.	0.43	0.33	0.90	0.97	0.45	0.70	0.39	0.38	0.90	0.76	0.48	0.53	0.42	0.20	0.20	0.17	0.51
600.	0.10	0.09	0.27	0.21	0.23	0.24	0.19	0.12	0.18	0.07	0.06	0.06	0.16	0.10	0.09	0.07	0.14
700.	0.11	0.09	0.28	0.23	0.24	0.27	0.20	0.13	0.19	0.07	0.06	0.07	0.17	0.11	0.09	0.08	0.15
800.	0.11	0.09	0.28	0.23	0.24	0.27	0.20	0.13	0.18	0.07	0.06	0.07	0.17	0.11	0.09	0.08	0.15
900.	0.11	0.09	0.28	0.23	0.24	0.27	0.20	0.13	0.17	0.07	0.06	0.07	0.17	0.11	0.09	0.08	0.15
1000.	0.11	0.09	0.28	0.23	0.24	0.27	0.20	0.13	0.17	0.07	0.06	0.07	0.17	0.11	0.09	0.08	0.15
1100.	0.11	0.09	0.28	0.23	0.24	0.27	0.20	0.13	0.17	0.07	0.06	0.07	0.17	0.11	0.09	0.08	0.15
1200.	0.11	0.09	0.28	0.23	0.24	0.27	0.20	0.13	0.17	0.07	0.06	0.07	0.17	0.11	0.09	0.08	0.15
1300.	0.11	0.09	0.28	0.23	0.24	0.27	0.20	0.13	0.17	0.07	0.06	0.07	0.17	0.11	0.09	0.08	0.15
1400.	0.11	0.09	0.28	0.23	0.24	0.27	0.20	0.13	0.17	0.07	0.06	0.07	0.17	0.11	0.09	0.08	0.15
1500.	0.11	0.09	0.28	0.23	0.24	0.27	0.20	0.13	0.17	0.07	0.06	0.07	0.17	0.11	0.09	0.08	0.15
1600.	0.11	0.09	0.28	0.23	0.24	0.27	0.20	0.13	0.17	0.07	0.06	0.07	0.17	0.11	0.09	0.08	0.15
1700.	0.11	0.09	0.28	0.23	0.24	0.27	0.20	0.13	0.17	0.07	0.06	0.07	0.17	0.11	0.09	0.08	0.15
1800.	0.11	0.09	0.28	0.23	0.24	0.27	0.20	0.13	0.17	0.07	0.06	0.07	0.17	0.11	0.09	0.08	0.15
1900.	0.11	0.09	0.28	0.23	0.22	0.27	0.20	0.13	0.17	0.07	0.06	0.07	0.15	0.11	0.09	0.08	0.15
2000.	0.10	0.09	0.21	0.23	0.13	0.27	0.15	0.13	0.16	0.07	0.06	0.07	0.09	0.11	0.07	0.08	0.13
2100.	0.06	0.08	0.09	0.17	0.05	0.19	0.07	0.11	0.09	0.06	0.03	0.06	0.04	0.09	0.02	0.07	0.08
2200.	0.03	0.04	0.04	0.06	0.04	0.07	0.03	0.06	0.05	0.03	0.02	0.04	0.03	0.03	0.01	0.03	0.04
2300.	0.01	0.02	0.04	0.04	0.03	0.04	0.03	0.01	0.02	0.01	0.02	0.03	0.02	0.02	0.01	0.01	0.02
2400.	0.01	0.01	0.04	0.02	0.02	0.03	0.03	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.01	0.01	0.02
2500.	0.01	0.01	0.04	0.02	0.02	0.02	0.03	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.01	0.01	0.02
2600.	0.01	0.01	0.04	0.02	0.02	0.02	0.03	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.01	0.01	0.02
2700.	0.01	0.01	0.04	0.02	0.02	0.02	0.03	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.01	0.01	0.02
2800.	0.01	0.01	0.03	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.02
2900.	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01
3000.	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01
3100.	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01
3200.	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01
3300.	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01
3400.	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01

Table 5.3-26 (Sheet 2 of 2)
Summer Salt Deposition During MDCT Operation

Distance from Tower (m)	Values in kg/km^2/mo																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
3500.	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01
3600.	0.01	0.01	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01
3700.	0.01	0.01	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01
3800.	0.01	0.01	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01
3900.	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
4000.	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
4100.	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
4200.	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
4300.	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
4400.	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
4500.	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01
4600.	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01
4700.	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01
4800.	0.01	0.01	0.01	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01
4900.	0.01	0.01	0.01	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01
5000.	0.01	0.01	0.01	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01

NOTE:
Plume moving in the indicated direction.

Table 5.3-27 (Sheet 1 of 2)
Fall Salt Deposition During MDCT Operation

Distance from Tower (m)	Values in kg/km²/mo																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
100.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
200.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
300.	0.00	0.00	0.00	0.08	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.01
400.	1.81	2.71	1.42	1.34	1.25	1.20	0.84	0.85	1.24	0.70	0.82	0.36	1.25	0.70	1.34	0.57	1.15
500.	0.94	1.20	0.54	0.59	0.35	0.54	0.28	0.43	0.65	0.36	0.25	0.17	0.30	0.28	0.41	0.30	0.47
600.	0.37	0.36	0.45	0.32	0.31	0.29	0.20	0.17	0.27	0.11	0.05	0.05	0.19	0.10	0.17	0.17	0.22
700.	0.42	0.46	0.53	0.39	0.34	0.44	0.24	0.19	0.31	0.12	0.06	0.06	0.23	0.14	0.19	0.22	0.27
800.	0.44	0.47	0.53	0.40	0.34	0.46	0.24	0.19	0.31	0.13	0.06	0.06	0.23	0.15	0.19	0.23	0.28
900.	0.44	0.47	0.53	0.40	0.34	0.46	0.24	0.19	0.31	0.13	0.06	0.06	0.23	0.15	0.19	0.23	0.28
1000.	0.44	0.47	0.53	0.40	0.34	0.46	0.24	0.19	0.31	0.13	0.06	0.06	0.23	0.15	0.19	0.23	0.28
1100.	0.44	0.47	0.53	0.40	0.34	0.46	0.24	0.19	0.31	0.13	0.06	0.06	0.23	0.15	0.19	0.23	0.28
1200.	0.44	0.47	0.53	0.40	0.34	0.46	0.24	0.19	0.31	0.13	0.06	0.06	0.23	0.15	0.19	0.23	0.28
1300.	0.44	0.47	0.53	0.40	0.34	0.46	0.24	0.19	0.31	0.13	0.06	0.06	0.23	0.15	0.19	0.23	0.28
1400.	0.44	0.47	0.53	0.40	0.34	0.46	0.24	0.19	0.31	0.13	0.06	0.06	0.23	0.15	0.19	0.23	0.28
1500.	0.44	0.47	0.53	0.40	0.34	0.46	0.24	0.19	0.31	0.13	0.06	0.06	0.23	0.15	0.19	0.23	0.28
1600.	0.44	0.47	0.53	0.40	0.34	0.46	0.24	0.19	0.31	0.13	0.06	0.06	0.23	0.15	0.19	0.23	0.28
1700.	0.44	0.47	0.53	0.40	0.34	0.46	0.24	0.19	0.31	0.13	0.06	0.06	0.23	0.15	0.19	0.23	0.28
1800.	0.44	0.47	0.53	0.40	0.34	0.46	0.24	0.19	0.31	0.13	0.06	0.06	0.23	0.15	0.19	0.23	0.28
1900.	0.43	0.47	0.53	0.40	0.29	0.46	0.24	0.19	0.31	0.13	0.06	0.06	0.21	0.15	0.19	0.23	0.27
2000.	0.40	0.47	0.35	0.40	0.13	0.46	0.17	0.19	0.28	0.13	0.05	0.06	0.10	0.15	0.13	0.23	0.23
2100.	0.22	0.37	0.11	0.28	0.06	0.32	0.06	0.15	0.16	0.10	0.02	0.05	0.06	0.12	0.05	0.18	0.14
2200.	0.10	0.13	0.05	0.09	0.02	0.12	0.04	0.05	0.07	0.04	0.01	0.02	0.03	0.05	0.02	0.09	0.06
2300.	0.06	0.05	0.04	0.06	0.02	0.08	0.03	0.02	0.03	0.02	0.01	0.01	0.02	0.03	0.02	0.04	0.03
2400.	0.05	0.03	0.03	0.04	0.02	0.06	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.02
2500.	0.04	0.03	0.03	0.02	0.02	0.04	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.03	0.02
2600.	0.04	0.03	0.03	0.02	0.02	0.04	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.03	0.02
2700.	0.04	0.03	0.03	0.02	0.02	0.04	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.03	0.02
2800.	0.04	0.03	0.02	0.02	0.02	0.04	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.03	0.02
2900.	0.04	0.03	0.02	0.02	0.02	0.04	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.03	0.02
3000.	0.04	0.03	0.02	0.02	0.02	0.04	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.03	0.02
3100.	0.04	0.03	0.02	0.02	0.02	0.04	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.03	0.02
3200.	0.04	0.03	0.02	0.02	0.02	0.04	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.03	0.02
3300.	0.04	0.03	0.02	0.02	0.02	0.04	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.03	0.02
3400.	0.04	0.03	0.02	0.02	0.02	0.04	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.03	0.02

Table 5.3-27 (Sheet 2 of 2)
Fall Salt Deposition During MDCT Operation

Distance from Tower (m)	Values in kg/km^2/mo																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
3500.	0.04	0.03	0.02	0.02	0.02	0.04	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.03	0.02
3600.	0.04	0.03	0.02	0.02	0.02	0.04	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.03	0.02
3700.	0.05	0.03	0.02	0.02	0.02	0.04	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.03	0.02
3800.	0.05	0.03	0.02	0.02	0.02	0.04	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.03	0.02
3900.	0.05	0.03	0.02	0.02	0.02	0.04	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.02
4000.	0.05	0.03	0.02	0.02	0.01	0.04	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.02
4100.	0.05	0.03	0.02	0.02	0.01	0.04	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.02
4200.	0.05	0.03	0.02	0.02	0.01	0.04	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.02
4300.	0.05	0.03	0.02	0.02	0.01	0.04	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.02
4400.	0.05	0.03	0.02	0.02	0.01	0.04	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.02
4500.	0.05	0.03	0.01	0.02	0.01	0.04	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.02
4600.	0.05	0.03	0.01	0.02	0.01	0.04	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.02
4700.	0.04	0.03	0.01	0.02	0.01	0.04	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.02
4800.	0.04	0.03	0.01	0.02	0.01	0.04	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.02
4900.	0.04	0.03	0.01	0.02	0.01	0.04	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.02
5000.	0.04	0.03	0.01	0.02	0.01	0.04	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.02

NOTE:
Plume moving in the indicated direction.

Table 5.3-28 (Sheet 1 of 2)
2-Year Total Hours of Plume-Induced Shadowing During NDCT Operation

Distance from Tower (m)	Values in Hours																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
200.	115.4	110.4	149.4	207.4	330.4	457.4	474.4	556.4	515.4	508.4	568.4	487.4	336.4	187.4	151.4	117.4	329.6
400.	51.4	53.3	93.0	196.0	391.4	406.4	401.4	334.5	330.5	370.5	349.5	336.0	330.4	104.4	60.5	65.5	242.2
600.	45.4	53.3	100.8	198.8	314.5	304.4	285.5	192.5	150.5	172.5	232.5	230.5	250.5	107.4	44.3	53.6	171.0
800.	44.2	65.6	96.4	167.8	286.3	212.7	153.9	127.5	92.5	91.5	126.5	139.4	170.2	96.1	37.9	42.7	121.9
1000.	43.0	60.2	84.5	206.5	229.8	187.5	108.6	81.9	59.4	54.5	82.9	92.0	100.8	87.1	38.7	39.7	97.3
1200.	40.9	55.9	75.2	212.8	205.4	175.6	92.5	60.9	39.4	37.4	58.9	97.5	66.3	81.7	31.5	35.7	85.5
1400.	38.0	51.2	71.3	197.0	177.7	153.9	84.7	53.9	38.4	31.8	42.5	91.3	46.8	71.0	31.5	27.7	75.6
1600.	32.6	46.5	62.9	179.5	178.6	135.5	76.1	51.6	33.4	30.9	37.7	65.3	45.6	60.7	29.5	27.4	68.4
1800.	31.6	44.5	64.4	166.6	165.5	125.0	75.8	51.6	30.9	24.9	32.8	55.1	41.9	53.3	27.5	26.4	63.6
2000.	24.9	40.3	60.8	154.4	159.7	111.2	79.3	47.3	25.9	21.4	24.8	44.4	32.9	40.7	28.5	26.4	57.7
2200.	22.4	33.8	55.9	147.9	161.3	97.9	71.9	46.3	22.9	16.4	22.8	28.8	30.6	31.2	29.5	23.1	52.7
2400.	20.4	30.2	57.6	148.6	161.6	85.7	69.9	45.3	18.9	14.4	16.3	24.2	29.9	27.4	26.2	22.1	49.9
2600.	19.4	29.2	54.3	147.5	158.5	77.6	70.7	42.3	16.9	14.4	12.3	19.0	27.0	23.7	25.2	19.1	47.3
2800.	18.4	29.2	52.3	130.5	161.9	72.2	60.8	42.7	16.3	12.0	8.5	17.9	28.8	22.7	22.2	18.5	44.7
3000.	14.4	23.4	51.7	124.4	156.8	66.8	57.4	37.7	17.3	13.0	6.5	18.6	29.5	21.7	22.2	16.2	42.4
3200.	15.8	22.0	51.4	116.2	150.6	60.1	54.4	33.7	15.9	12.0	5.5	15.1	30.5	21.7	22.3	15.6	40.2
3400.	13.8	20.0	45.3	107.8	145.4	54.4	52.4	31.1	14.9	12.0	5.5	15.9	30.1	20.9	22.3	14.2	37.9
3600.	13.8	20.0	43.3	98.1	145.5	51.2	50.4	31.1	12.5	10.0	5.5	13.8	28.3	23.0	22.3	12.2	36.3
3800.	11.4	18.0	39.7	89.0	139.8	50.1	42.6	28.6	11.5	9.0	7.7	13.8	26.6	21.8	20.3	12.2	33.9
4000.	12.4	14.7	38.7	81.3	123.2	49.5	42.6	24.6	10.0	8.0	8.9	13.0	24.4	21.8	18.3	12.2	31.5
4200.	12.4	13.3	37.8	80.2	113.2	44.9	40.6	22.6	10.0	6.5	8.9	14.0	24.1	20.8	17.3	11.2	29.9
4400.	12.4	11.3	34.0	75.2	107.1	45.6	36.6	22.6	10.0	5.5	6.7	14.0	21.2	19.8	17.3	11.2	28.2
4600.	12.4	8.0	33.1	72.3	101.6	45.3	32.8	21.6	10.0	6.5	6.7	14.0	20.0	20.9	15.3	11.2	27.0
4800.	10.4	9.0	33.1	69.0	99.5	46.2	30.8	17.6	10.0	6.5	8.1	14.0	17.5	19.9	13.8	11.2	26.1
5000.	8.4	8.0	30.0	64.6	90.7	47.6	25.4	16.6	9.0	6.5	8.1	13.1	17.5	16.9	12.8	12.7	24.3
5200.	7.4	8.9	28.6	60.1	90.6	47.6	22.4	16.6	7.0	6.5	8.1	11.3	17.5	15.9	10.8	13.7	23.3
5400.	7.4	7.9	26.0	57.6	87.1	47.6	17.1	15.6	6.0	6.5	8.1	10.0	15.4	15.9	10.8	12.3	22.0
5600.	7.4	6.9	26.6	59.5	83.1	45.7	15.1	14.6	5.0	6.5	5.9	9.1	14.6	14.9	10.8	11.3	21.1
5800.	5.0	6.9	24.6	56.3	82.4	44.9	15.1	14.6	4.0	5.5	3.7	8.1	13.7	13.4	9.8	8.9	19.8
6000.	5.0	6.9	21.9	53.3	76.2	43.9	12.1	12.6	4.0	5.5	3.7	8.1	13.5	12.4	9.8	8.9	18.6
6200.	3.0	6.9	19.9	49.3	69.6	44.5	12.1	10.2	4.0	4.5	1.4	6.3	13.5	12.4	7.4	7.4	17.0
6400.	2.0	6.9	17.5	47.3	64.2	43.5	10.7	10.2	4.0	4.5	1.4	5.3	11.8	10.3	6.4	6.4	15.8
6600.	2.0	4.9	16.5	45.7	56.8	42.2	7.7	9.2	3.0	4.5	1.4	4.4	11.8	10.3	4.4	5.0	14.4
6800.	2.0	3.9	16.5	40.1	54.3	40.2	7.7	9.2	3.0	4.5	1.4	4.4	9.4	8.3	2.4	5.0	13.3

Table 5.3-28 (Sheet 2 of 2)
2-Year Total Hours of Plume-Induced Shadowing During NDCT Operation

Distance from Tower (m)	Values in Hours																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
7000.	2.0	2.9	13.5	39.1	51.3	39.4	6.7	7.8	3.0	4.5	1.4	4.4	10.1	7.3	0.0	4.0	12.4
7200.	2.0	2.9	12.5	37.1	49.9	37.2	4.4	7.8	2.0	3.5	1.4	4.4	10.1	5.0	0.0	4.0	11.5
7400.	2.0	2.9	11.5	34.7	39.8	37.1	3.4	6.8	2.0	1.0	1.4	5.3	10.1	5.0	0.0	3.0	10.4
7600.	2.0	2.9	8.5	33.3	36.4	33.7	1.0	5.8	2.0	1.0	1.4	4.4	10.1	5.0	0.0	3.0	9.4
7800.	2.0	2.9	6.4	30.9	26.0	33.4	1.0	5.8	2.0	0.0	1.4	4.4	10.1	4.0	0.0	3.0	8.3
8000.	1.0	2.9	4.4	30.2	24.6	31.0	1.0	5.8	2.0	0.0	1.4	3.4	7.5	4.0	0.0	3.0	7.6

NOTES:
Total hours of shadowing over 2 years. Average annual hours of cooling tower-induced shadowing were obtained by dividing the table value by 2.
Plume moving in the indicated direction.

Table 5.3-29 (Sheet 1 of 2)
2-Year Total Hours of Plume-Induced Shadowing During MDCT Operation

Distance from Tower (m)	Value in Hours															
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
200.	124.4	185.6	324.9	687.6	960.7	848.8	567.1	352.9	266.4	254.2	352.5	410.6	388.5	292.4	149.4	133.7	393.7
400.	71.8	91.4	139.5	382.5	398.6	356.9	184.3	107.0	63.8	50.8	55.5	126.0	87.3	76.5	63.0	61.7	144.8
600.	56.1	69.7	107.7	252.4	259.0	203.6	108.3	65.4	33.8	27.8	35.0	58.5	62.0	50.3	50.1	49.7	93.1
800.	46.1	59.2	91.9	193.3	203.7	142.4	72.9	48.4	29.4	23.4	24.6	43.4	47.7	43.5	44.5	44.7	72.4
1000.	44.1	49.2	82.6	158.4	174.0	109.2	57.2	39.4	24.9	20.4	21.1	32.7	32.7	42.0	39.5	43.7	60.7
1200.	43.1	45.2	80.6	141.6	138.0	87.3	50.1	37.4	21.9	18.4	21.1	25.5	29.7	37.0	36.5	41.7	53.4
1400.	41.7	45.2	76.6	129.2	120.8	77.8	42.8	34.4	21.9	17.4	21.1	20.7	27.5	32.8	36.5	38.4	49.1
1600.	39.7	45.2	73.4	118.9	109.3	68.3	37.3	34.4	20.9	17.4	21.1	20.0	26.5	29.0	36.5	36.4	45.9
1800.	34.3	41.2	72.4	109.0	100.8	61.9	35.3	32.4	18.9	17.4	21.1	19.9	24.7	25.7	34.2	35.4	42.8
2000.	30.3	39.2	67.4	104.2	96.6	61.9	33.3	31.4	16.9	16.4	20.1	19.0	22.8	21.7	30.8	30.4	40.1
2200.	25.3	37.3	63.0	97.7	95.6	61.0	31.3	30.4	16.9	15.4	19.1	17.9	22.9	21.7	29.8	28.0	38.3
2400.	19.3	34.3	59.8	90.8	94.8	60.0	31.3	30.4	16.9	12.0	15.1	16.9	21.9	21.7	26.8	21.0	35.8
2600.	18.3	30.2	53.5	85.2	91.6	55.7	31.3	30.4	16.9	12.0	13.1	15.9	21.2	21.7	24.8	21.0	33.9
2800.	18.3	29.2	50.5	84.2	90.0	52.5	29.3	30.4	16.9	11.0	13.1	15.6	19.5	21.7	21.5	21.0	32.8
3000.	13.9	22.0	45.5	77.9	88.4	50.7	29.3	28.9	15.9	10.0	13.1	15.6	17.8	21.7	18.5	21.0	30.6
3200.	12.9	22.0	42.0	70.5	87.4	49.7	29.3	28.9	12.0	10.0	12.1	14.2	17.8	21.7	16.5	19.0	29.1
3400.	12.9	21.0	41.0	61.0	83.7	48.8	29.3	27.4	11.0	8.5	12.1	12.3	17.8	19.7	15.5	19.0	27.6
3600.	12.9	17.0	39.0	54.1	83.7	48.2	29.3	26.4	10.0	8.5	11.1	12.3	16.8	18.7	15.5	17.7	26.3
3800.	10.4	15.7	34.2	53.1	81.9	47.5	29.3	25.4	9.0	8.5	10.1	12.3	13.7	17.7	13.5	15.7	24.9
4000.	10.4	13.7	34.2	49.1	82.5	46.5	26.3	23.4	9.0	7.5	10.1	10.2	11.6	17.7	12.5	15.7	23.8
4200.	10.4	11.3	31.9	46.1	79.8	41.1	24.3	21.1	9.0	6.5	8.9	10.2	9.6	16.7	11.5	13.2	22.0
4400.	8.0	11.3	30.4	42.1	76.2	39.4	22.3	18.6	5.0	5.5	7.9	10.2	9.6	15.7	11.5	13.2	20.4
4600.	7.0	11.3	28.2	38.5	74.2	38.1	19.3	16.6	5.0	4.5	6.6	10.2	9.6	14.7	11.5	13.2	19.3
4800.	7.0	10.0	26.2	36.2	70.2	38.1	17.1	14.6	4.0	4.5	6.6	9.6	9.6	14.7	10.5	13.2	18.3
5000.	7.0	10.0	24.8	35.2	67.2	38.1	17.1	13.6	4.0	4.5	6.6	9.6	9.6	14.7	9.5	11.8	17.7
5200.	7.0	10.0	23.8	34.2	63.3	34.8	17.1	13.6	4.0	4.5	6.6	9.0	9.6	13.2	9.5	11.8	17.0
5400.	7.0	10.0	21.8	32.9	58.8	32.8	17.1	12.2	4.0	3.5	6.6	9.0	9.6	12.2	8.5	11.8	16.1
5600.	6.0	9.0	21.8	27.6	53.1	32.8	16.1	11.2	4.0	3.5	6.6	9.0	9.6	10.2	8.5	10.8	15.0
5800.	6.0	7.0	20.6	27.6	51.1	30.8	13.1	9.8	4.0	3.5	6.6	9.0	9.6	10.2	8.5	10.8	14.3
6000.	6.0	7.0	20.6	25.1	46.8	28.1	12.1	9.8	4.0	1.0	6.6	8.0	9.6	10.2	8.5	9.4	13.3
6200.	3.0	7.0	19.5	23.9	44.4	28.1	12.1	9.8	3.0	1.0	5.6	8.0	8.4	9.1	8.5	9.4	12.6
6400.	3.0	6.0	18.6	22.9	38.9	28.1	12.1	9.8	3.0	1.0	5.6	8.0	8.4	9.1	8.5	8.4	12.0
6600.	2.0	6.0	17.6	22.9	37.5	27.1	10.1	9.8	3.0	0.0	5.6	8.0	7.4	7.0	7.5	6.4	11.1

Table 5.3-29 (Sheet 2 of 2)
2-Year Total Hours of Plume-Induced Shadowing During MDCT Operation

Distance from Tower (m)	Value in Hours															
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
6800.	1.0	5.0	16.6	19.4	37.5	26.1	8.9	8.8	3.0	0.0	4.6	6.4	7.4	7.0	7.5	5.0	10.3
7000.	0.0	3.0	15.5	19.4	34.1	24.7	8.9	8.8	3.0	0.0	3.6	6.4	6.5	7.0	5.0	4.0	9.4
7200.	0.0	1.0	13.0	19.4	34.1	23.7	6.9	8.8	1.0	0.0	3.6	5.4	5.5	7.0	3.0	3.0	8.5
7400.	0.0	1.0	9.2	19.4	31.7	22.7	5.7	8.8	1.0	0.0	3.6	5.4	5.5	6.0	2.0	3.0	7.8
7600.	0.0	1.0	9.2	19.4	27.7	22.7	5.7	8.8	1.0	0.0	3.6	5.4	4.5	6.0	1.0	2.0	7.4
7800.	0.0	0.0	7.9	17.4	26.5	21.3	4.7	8.8	1.0	0.0	3.6	5.4	3.3	6.0	0.0	2.0	6.7
8000.	0.0	0.0	6.9	16.4	22.0	21.3	3.4	8.8	1.0	0.0	3.6	5.4	3.3	6.0	0.0	2.0	6.3

NOTES:
Total hours of shadowing over 2 years. Average annual hours of cooling tower-induced shadowing were obtained by dividing the table value by 2.
Plume moving in the indicated direction.

Table 5.3-30 (Sheet 1 of 2)
Annual Plume Water Deposition During NDCT Operation

Distance from Tower (m)	Values in $kg/km^2/mo$																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
1100	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
1200	.96E+00	.77E+00	.11E+01	.13E+01	.88E+00	.12E+01	.96E+00	.75E+00	.12E+01	.63E+00	.22E+00	.33E+00	.55E+00	.33E+00	.47E+00	.49E+00	.76E+00
1300	.97E+00	.78E+00	.11E+01	.13E+01	.89E+00	.12E+01	.97E+00	.76E+00	.12E+01	.64E+00	.23E+00	.34E+00	.56E+00	.34E+00	.47E+00	.50E+00	.77E+00
1400	.97E+00	.78E+00	.11E+01	.13E+01	.89E+00	.12E+01	.97E+00	.76E+00	.12E+01	.64E+00	.23E+00	.34E+00	.56E+00	.34E+00	.47E+00	.50E+00	.77E+00
1500	.97E+00	.78E+00	.11E+01	.13E+01	.89E+00	.12E+01	.97E+00	.76E+00	.12E+01	.64E+00	.23E+00	.34E+00	.56E+00	.34E+00	.47E+00	.50E+00	.77E+00
1600	.97E+00	.78E+00	.11E+01	.13E+01	.89E+00	.12E+01	.97E+00	.76E+00	.12E+01	.64E+00	.23E+00	.34E+00	.56E+00	.34E+00	.47E+00	.50E+00	.77E+00
1700	.97E+00	.78E+00	.11E+01	.13E+01	.89E+00	.12E+01	.97E+00	.76E+00	.12E+01	.64E+00	.23E+00	.34E+00	.56E+00	.34E+00	.47E+00	.50E+00	.77E+00
1800	.97E+00	.78E+00	.11E+01	.13E+01	.89E+00	.12E+01	.97E+00	.76E+00	.12E+01	.64E+00	.23E+00	.34E+00	.56E+00	.34E+00	.47E+00	.50E+00	.77E+00
1900	.97E+00	.78E+00	.11E+01	.13E+01	.89E+00	.12E+01	.97E+00	.76E+00	.12E+01	.64E+00	.23E+00	.34E+00	.56E+00	.34E+00	.47E+00	.50E+00	.77E+00
2000	.97E+00	.78E+00	.11E+01	.13E+01	.89E+00	.12E+01	.97E+00	.76E+00	.12E+01	.64E+00	.23E+00	.34E+00	.56E+00	.34E+00	.47E+00	.50E+00	.77E+00
2100	.97E+00	.78E+00	.11E+01	.13E+01	.89E+00	.12E+01	.97E+00	.76E+00	.12E+01	.64E+00	.23E+00	.34E+00	.56E+00	.34E+00	.47E+00	.50E+00	.77E+00
2200	.98E+00	.79E+00	.11E+01	.13E+01	.89E+00	.13E+01	.97E+00	.76E+00	.12E+01	.65E+00	.23E+00	.34E+00	.56E+00	.34E+00	.47E+00	.50E+00	.77E+00
2300	.98E+00	.80E+00	.12E+01	.13E+01	.91E+00	.13E+01	.99E+00	.77E+00	.12E+01	.65E+00	.23E+00	.34E+00	.57E+00	.34E+00	.48E+00	.51E+00	.78E+00
2400	.11E+01	.95E+00	.13E+01	.15E+01	.11E+01	.15E+01	.12E+01	.89E+00	.14E+01	.72E+00	.28E+00	.38E+00	.65E+00	.40E+00	.57E+00	.58E+00	.90E+00
2500	.13E+01	.12E+01	.17E+01	.17E+01	.13E+01	.19E+01	.15E+01	.11E+01	.17E+01	.84E+00	.35E+00	.45E+00	.83E+00	.56E+00	.71E+00	.73E+00	.11E+01
2600	.16E+01	.13E+01	.19E+01	.19E+01	.14E+01	.22E+01	.17E+01	.12E+01	.18E+01	.90E+00	.39E+00	.50E+00	.92E+00	.68E+00	.80E+00	.84E+00	.13E+01
2700	.20E+01	.17E+01	.23E+01	.21E+01	.16E+01	.29E+01	.21E+01	.14E+01	.21E+01	.10E+01	.48E+00	.59E+00	.11E+01	.87E+00	.96E+00	.98E+00	.15E+01
2800	.21E+01	.19E+01	.24E+01	.22E+01	.17E+01	.31E+01	.22E+01	.14E+01	.22E+01	.10E+01	.51E+00	.62E+00	.11E+01	.92E+00	.10E+01	.10E+01	.16E+01
2900	.25E+01	.21E+01	.27E+01	.25E+01	.19E+01	.37E+01	.24E+01	.16E+01	.23E+01	.11E+01	.57E+00	.66E+00	.12E+01	.11E+01	.11E+01	.12E+01	.18E+01
3000	.17E+02	.10E+02	.95E+01	.81E+01	.10E+02	.19E+02	.60E+01	.33E+01	.82E+01	.39E+01	.35E+01	.24E+01	.90E+01	.53E+01	.64E+01	.95E+01	.82E+01
3100	.27E+02	.17E+02	.15E+02	.12E+02	.16E+02	.30E+02	.90E+01	.47E+01	.13E+02	.58E+01	.57E+01	.37E+01	.14E+02	.85E+01	.10E+02	.15E+02	.13E+02
3200	.27E+02	.17E+02	.15E+02	.12E+02	.16E+02	.30E+02	.91E+01	.47E+01	.13E+02	.59E+01	.58E+01	.37E+01	.15E+02	.85E+01	.10E+02	.15E+02	.13E+02
3300	.27E+02	.17E+02	.15E+02	.12E+02	.16E+02	.30E+02	.91E+01	.47E+01	.13E+02	.59E+01	.58E+01	.37E+01	.15E+02	.85E+01	.10E+02	.15E+02	.13E+02
3400	.27E+02	.17E+02	.15E+02	.12E+02	.16E+02	.30E+02	.91E+01	.47E+01	.13E+02	.59E+01	.58E+01	.37E+01	.15E+02	.85E+01	.10E+02	.15E+02	.13E+02
3500	.27E+02	.17E+02	.15E+02	.12E+02	.16E+02	.30E+02	.91E+01	.47E+01	.13E+02	.59E+01	.58E+01	.37E+01	.15E+02	.85E+01	.10E+02	.15E+02	.13E+02
3600	.31E+02	.21E+02	.17E+02	.15E+02	.19E+02	.35E+02	.11E+02	.60E+01	.14E+02	.67E+01	.65E+01	.45E+01	.16E+02	.10E+02	.11E+02	.19E+02	.15E+02
3700	.41E+02	.27E+02	.22E+02	.17E+02	.22E+02	.41E+02	.13E+02	.72E+01	.18E+02	.86E+01	.78E+01	.56E+01	.19E+02	.13E+02	.16E+02	.29E+02	.19E+02
3800	.49E+02	.31E+02	.25E+02	.19E+02	.24E+02	.46E+02	.15E+02	.81E+01	.20E+02	.10E+02	.89E+01	.65E+01	.21E+02	.16E+02	.21E+02	.39E+02	.22E+02
3900	.49E+02	.31E+02	.25E+02	.19E+02	.24E+02	.46E+02	.15E+02	.81E+01	.20E+02	.10E+02	.89E+01	.65E+01	.21E+02	.16E+02	.21E+02	.39E+02	.22E+02
4000	.49E+02	.31E+02	.25E+02	.19E+02	.24E+02	.46E+02	.15E+02	.81E+01	.20E+02	.10E+02	.89E+01	.65E+01	.21E+02	.16E+02	.21E+02	.39E+02	.22E+02
4100	.49E+02	.31E+02	.25E+02	.19E+02	.24E+02	.45E+02	.14E+02	.78E+01	.19E+02	.99E+01	.87E+01	.63E+01	.20E+02	.16E+02	.20E+02	.39E+02	.22E+02
4200	.48E+02	.31E+02	.24E+02	.18E+02	.23E+02	.45E+02	.14E+02	.74E+01	.19E+02	.96E+01	.86E+01	.62E+01	.20E+02	.15E+02	.20E+02	.38E+02	.22E+02
4300	.48E+02	.31E+02	.24E+02	.18E+02	.23E+02	.45E+02	.14E+02	.74E+01	.19E+02	.96E+01	.86E+01	.62E+01	.20E+02	.15E+02	.20E+02	.38E+02	.22E+02
4400	.48E+02	.31E+02	.24E+02	.18E+02	.23E+02	.45E+02	.14E+02	.74E+01	.19E+02	.96E+01	.86E+01	.62E+01	.20E+02	.15E+02	.20E+02	.38E+02	.22E+02
4500	.48E+02	.31E+02	.24E+02	.18E+02	.23E+02	.45E+02	.14E+02	.74E+01	.19E+02	.96E+01	.86E+01	.62E+01	.20E+02	.15E+02	.20E+02	.38E+02	.22E+02
4600	.39E+02	.25E+02	.20E+02	.15E+02	.18E+02	.35E+02	.11E+02	.63E+01	.15E+02	.79E+01	.68E+01	.51E+01	.15E+02	.13E+02	.17E+02	.33E+02	.18E+02
4700	.26E+02	.17E+02	.14E+02	.93E+01	.10E+02	.21E+02	.79E+01	.47E+01	.95E+01	.53E+01	.40E+01	.35E+01	.78E+01	.88E+01	.12E+02	.25E+02	.12E+02

Table 5.3-30 (Sheet 2 of 2)
Annual Plume Water Deposition During NDCT Operation

Distance from Tower (m)	Values in kg/km^2/mo																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
4800	.26E+02	.17E+02	.14E+02	.93E+01	.10E+02	.21E+02	.79E+01	.47E+01	.95E+01	.53E+01	.40E+01	.35E+01	.78E+01	.88E+01	.12E+02	.25E+02	.12E+02
4900	.26E+02	.17E+02	.14E+02	.93E+01	.10E+02	.21E+02	.79E+01	.47E+01	.95E+01	.53E+01	.40E+01	.35E+01	.78E+01	.88E+01	.12E+02	.25E+02	.12E+02
5000	.26E+02	.17E+02	.14E+02	.93E+01	.10E+02	.21E+02	.79E+01	.47E+01	.95E+01	.53E+01	.40E+01	.35E+01	.78E+01	.88E+01	.12E+02	.25E+02	.12E+02

NOTES:
Because of the high initial plume from the NDCT, no water deposition occurs within 1100 meters of the tower center.
Plume moving in the indicated direction.

Table 5.3-31 (Sheet 1 of 2)
Annual Plume Water Deposition During MDCT Operation

Distance from Tower (m)	Values in kg/km²/mo																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
100	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
200	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
300	.93E+00	.00E+00	.00E+00	.63E+01	.53E+02	.00E+00	.00E+00	.00E+00	.47E+00	.00E+00	.00E+00	.00E+00	.67E+02	.00E+00	.00E+00	.00E+00	.80E+01
400	.63E+03	.79E+03	.93E+03	.72E+03	.77E+03	.72E+03	.61E+03	.55E+03	.11E+04	.74E+03	.46E+03	.34E+03	.85E+03	.35E+03	.47E+03	.36E+03	.65E+03
500	.31E+03	.35E+03	.30E+03	.29E+03	.18E+03	.30E+03	.20E+03	.25E+03	.53E+03	.33E+03	.14E+03	.14E+03	.17E+03	.14E+03	.14E+03	.17E+03	.25E+03
600	.11E+03	.99E+02	.15E+03	.94E+02	.13E+03	.13E+03	.13E+03	.76E+02	.12E+03	.46E+02	.36E+02	.25E+02	.80E+02	.46E+02	.62E+02	.55E+02	.87E+02
700	.15E+03	.14E+03	.19E+03	.13E+03	.15E+03	.22E+03	.16E+03	.94E+02	.14E+03	.58E+02	.46E+02	.36E+02	.93E+02	.69E+02	.76E+02	.85E+02	.11E+03
800	.17E+03	.15E+03	.19E+03	.14E+03	.15E+03	.23E+03	.16E+03	.95E+02	.15E+03	.60E+02	.48E+02	.38E+02	.97E+02	.73E+02	.80E+02	.95E+02	.12E+03
900	.16E+03	.15E+03	.19E+03	.14E+03	.15E+03	.23E+03	.16E+03	.95E+02	.14E+03	.60E+02	.48E+02	.38E+02	.97E+02	.73E+02	.80E+02	.95E+02	.12E+03
1000	.16E+03	.15E+03	.19E+03	.14E+03	.15E+03	.23E+03	.16E+03	.95E+02	.14E+03	.60E+02	.48E+02	.38E+02	.97E+02	.73E+02	.80E+02	.95E+02	.12E+03
1100	.16E+03	.15E+03	.19E+03	.14E+03	.15E+03	.23E+03	.16E+03	.95E+02	.14E+03	.60E+02	.48E+02	.38E+02	.97E+02	.73E+02	.80E+02	.95E+02	.12E+03
1200	.16E+03	.15E+03	.19E+03	.14E+03	.15E+03	.23E+03	.16E+03	.95E+02	.14E+03	.60E+02	.48E+02	.38E+02	.97E+02	.73E+02	.80E+02	.95E+02	.12E+03
1300	.16E+03	.15E+03	.19E+03	.14E+03	.15E+03	.23E+03	.16E+03	.95E+02	.14E+03	.60E+02	.48E+02	.38E+02	.97E+02	.73E+02	.80E+02	.95E+02	.12E+03
1400	.16E+03	.15E+03	.19E+03	.14E+03	.15E+03	.23E+03	.16E+03	.95E+02	.14E+03	.60E+02	.48E+02	.38E+02	.97E+02	.73E+02	.80E+02	.95E+02	.12E+03
1500	.16E+03	.15E+03	.19E+03	.14E+03	.15E+03	.23E+03	.16E+03	.95E+02	.14E+03	.60E+02	.48E+02	.38E+02	.97E+02	.73E+02	.80E+02	.95E+02	.12E+03
1600	.16E+03	.15E+03	.19E+03	.14E+03	.15E+03	.23E+03	.16E+03	.95E+02	.14E+03	.60E+02	.48E+02	.38E+02	.97E+02	.73E+02	.80E+02	.95E+02	.12E+03
1700	.16E+03	.15E+03	.19E+03	.14E+03	.15E+03	.23E+03	.16E+03	.95E+02	.14E+03	.60E+02	.48E+02	.38E+02	.97E+02	.73E+02	.80E+02	.95E+02	.12E+03
1800	.16E+03	.15E+03	.19E+03	.14E+03	.15E+03	.23E+03	.16E+03	.95E+02	.14E+03	.60E+02	.48E+02	.38E+02	.97E+02	.73E+02	.80E+02	.95E+02	.12E+03
1900	.16E+03	.15E+03	.19E+03	.14E+03	.13E+03	.23E+03	.16E+03	.95E+02	.14E+03	.60E+02	.48E+02	.38E+02	.85E+02	.73E+02	.80E+02	.95E+02	.12E+03
2000	.15E+03	.15E+03	.13E+03	.14E+03	.60E+02	.23E+03	.11E+03	.95E+02	.13E+03	.60E+02	.36E+02	.38E+02	.41E+02	.73E+02	.55E+02	.95E+02	.99E+02
2100	.92E+02	.12E+03	.38E+02	.95E+02	.31E+02	.16E+03	.31E+02	.73E+02	.69E+02	.48E+02	.12E+02	.28E+02	.23E+02	.52E+02	.19E+02	.75E+02	.60E+02
2200	.40E+02	.44E+02	.22E+02	.30E+02	.15E+02	.56E+02	.16E+02	.25E+02	.26E+02	.19E+02	.79E+01	.11E+02	.13E+02	.18E+02	.13E+02	.37E+02	.24E+02
2300	.31E+02	.26E+02	.14E+02	.18E+02	.98E+01	.37E+02	.10E+02	.95E+01	.16E+02	.91E+01	.56E+01	.73E+01	.87E+01	.12E+02	.96E+01	.25E+02	.16E+02
2400	.23E+02	.11E+02	.11E+02	.15E+02	.95E+01	.32E+02	.75E+01	.39E+01	.12E+02	.46E+01	.47E+01	.55E+01	.84E+01	.98E+01	.83E+01	.13E+02	.11E+02
2500	.18E+02	.11E+02	.11E+02	.67E+01	.95E+01	.15E+02	.75E+01	.39E+01	.94E+01	.46E+01	.47E+01	.30E+01	.84E+01	.56E+01	.83E+01	.13E+02	.87E+01
2600	.18E+02	.11E+02	.11E+02	.67E+01	.95E+01	.15E+02	.75E+01	.39E+01	.94E+01	.46E+01	.47E+01	.30E+01	.84E+01	.56E+01	.83E+01	.13E+02	.87E+01
2700	.18E+02	.11E+02	.11E+02	.67E+01	.95E+01	.15E+02	.75E+01	.39E+01	.94E+01	.46E+01	.47E+01	.30E+01	.84E+01	.56E+01	.83E+01	.13E+02	.87E+01
2800	.18E+02	.11E+02	.96E+01	.67E+01	.95E+01	.15E+02	.58E+01	.39E+01	.94E+01	.46E+01	.41E+01	.30E+01	.84E+01	.56E+01	.77E+01	.13E+02	.85E+01
2900	.18E+02	.11E+02	.95E+01	.67E+01	.95E+01	.15E+02	.57E+01	.39E+01	.94E+01	.46E+01	.40E+01	.30E+01	.84E+01	.56E+01	.77E+01	.13E+02	.84E+01
3000	.18E+02	.11E+02	.95E+01	.67E+01	.95E+01	.15E+02	.57E+01	.39E+01	.94E+01	.46E+01	.40E+01	.30E+01	.84E+01	.56E+01	.77E+01	.13E+02	.84E+01
3100	.18E+02	.11E+02	.95E+01	.67E+01	.95E+01	.15E+02	.57E+01	.39E+01	.94E+01	.46E+01	.40E+01	.30E+01	.84E+01	.56E+01	.77E+01	.13E+02	.84E+01
3200	.18E+02	.11E+02	.95E+01	.67E+01	.95E+01	.15E+02	.57E+01	.39E+01	.94E+01	.46E+01	.40E+01	.30E+01	.84E+01	.56E+01	.77E+01	.13E+02	.84E+01
3300	.18E+02	.11E+02	.95E+01	.67E+01	.95E+01	.15E+02	.57E+01	.39E+01	.94E+01	.46E+01	.40E+01	.30E+01	.84E+01	.56E+01	.77E+01	.13E+02	.84E+01
3400	.18E+02	.11E+02	.95E+01	.67E+01	.95E+01	.15E+02	.57E+01	.39E+01	.94E+01	.46E+01	.40E+01	.30E+01	.84E+01	.56E+01	.77E+01	.13E+02	.84E+01
3500	.18E+02	.11E+02	.95E+01	.67E+01	.95E+01	.15E+02	.57E+01	.39E+01	.94E+01	.46E+01	.40E+01	.30E+01	.84E+01	.56E+01	.77E+01	.13E+02	.84E+01
3600	.16E+02	.99E+01	.88E+01	.55E+01	.90E+01	.13E+02	.53E+01	.37E+01	.87E+01	.43E+01	.37E+01	.25E+01	.80E+01	.47E+01	.70E+01	.12E+02	.76E+01
3700	.12E+02	.77E+01	.74E+01	.45E+01	.70E+01	.99E+01	.45E+01	.32E+01	.73E+01	.37E+01	.31E+01	.20E+01	.62E+01	.38E+01	.56E+01	.92E+01	.61E+01

Table 5.3-31 (Sheet 2 of 2)
Annual Plume Water Deposition During MDCT Operation

Distance from Tower (m)	Values in $kg/km^2/mo$																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
3800	.12E+02	.77E+01	.74E+01	.45E+01	.70E+01	.99E+01	.45E+01	.32E+01	.73E+01	.37E+01	.31E+01	.20E+01	.62E+01	.38E+01	.56E+01	.92E+01	.61E+01
3900	.12E+02	.77E+01	.63E+01	.45E+01	.63E+01	.99E+01	.38E+01	.32E+01	.73E+01	.37E+01	.27E+01	.20E+01	.58E+01	.38E+01	.52E+01	.92E+01	.58E+01
4000	.12E+02	.77E+01	.61E+01	.45E+01	.61E+01	.99E+01	.36E+01	.32E+01	.73E+01	.37E+01	.26E+01	.20E+01	.56E+01	.38E+01	.51E+01	.92E+01	.58E+01
4100	.12E+02	.77E+01	.61E+01	.45E+01	.61E+01	.99E+01	.36E+01	.32E+01	.73E+01	.37E+01	.26E+01	.20E+01	.56E+01	.38E+01	.51E+01	.92E+01	.58E+01
4200	.12E+02	.77E+01	.61E+01	.45E+01	.61E+01	.99E+01	.36E+01	.32E+01	.73E+01	.37E+01	.26E+01	.20E+01	.56E+01	.38E+01	.51E+01	.92E+01	.58E+01
4300	.12E+02	.77E+01	.61E+01	.45E+01	.61E+01	.99E+01	.36E+01	.32E+01	.73E+01	.37E+01	.26E+01	.20E+01	.56E+01	.38E+01	.51E+01	.92E+01	.58E+01
4400	.12E+02	.77E+01	.61E+01	.45E+01	.61E+01	.99E+01	.36E+01	.32E+01	.73E+01	.37E+01	.26E+01	.20E+01	.56E+01	.38E+01	.51E+01	.92E+01	.58E+01
4500	.12E+02	.77E+01	.56E+01	.45E+01	.61E+01	.99E+01	.33E+01	.32E+01	.73E+01	.37E+01	.23E+01	.20E+01	.56E+01	.38E+01	.48E+01	.92E+01	.57E+01
4600	.12E+02	.77E+01	.54E+01	.45E+01	.61E+01	.99E+01	.31E+01	.32E+01	.73E+01	.37E+01	.22E+01	.20E+01	.56E+01	.38E+01	.47E+01	.92E+01	.56E+01
4700	.11E+02	.77E+01	.54E+01	.45E+01	.57E+01	.99E+01	.31E+01	.32E+01	.65E+01	.37E+01	.22E+01	.20E+01	.52E+01	.38E+01	.47E+01	.92E+01	.55E+01
4800	.11E+02	.78E+01	.55E+01	.45E+01	.55E+01	.99E+01	.31E+01	.32E+01	.65E+01	.37E+01	.22E+01	.20E+01	.50E+01	.38E+01	.48E+01	.94E+01	.55E+01
4900	.12E+02	.78E+01	.57E+01	.47E+01	.50E+01	.10E+02	.31E+01	.33E+01	.65E+01	.38E+01	.23E+01	.20E+01	.46E+01	.40E+01	.50E+01	.97E+01	.56E+01
5000	.12E+02	.78E+01	.57E+01	.48E+01	.51E+01	.10E+02	.31E+01	.33E+01	.65E+01	.38E+01	.23E+01	.20E+01	.47E+01	.40E+01	.50E+01	.97E+01	.56E+01

NOTE:
Plume moving in the indicated direction.

ER 5.3 Figures

Due to the large file sizes of the figures for ER Chapter 5, they are collected in a single .pdf file, which you can navigate via the figure numbers in the Bookmark pane. When cited in the text, the links for these figures will launch the .pdf file.

5.4 RADIOLOGICAL IMPACTS OF NORMAL OPERATION

This section discusses the radiological impacts of normal operation. Included in the discussion are exposure pathways, descriptions of the calculation of dose to members of the public and the maximally exposed individual (MEI), and comparison of the calculated dose values to regulatory requirements. It should be noted that the airborne releases analyzed were based on the ESBWR DCD, Revision 5, as reflected in FSAR Chapter 12.

5.4.1 EXPOSURE PATHWAYS

Radioactive liquids and gases would be discharged to the environment during normal operation of RBS Unit 3. Released quantities of liquids have been estimated in ESBWR DCD, Revision 4, Table 12.2-19b. Released quantities of gases have been estimated in FSAR Table 12.2-16R. The impact of these releases on individuals, population groups, and biota in the vicinity of the new unit was evaluated by considering the most important pathways from the release to the receptors of interest. The exposure pathways considered and the analytical methods used to estimate doses to the hypothetical MEI and to the population surrounding the new unit were based on NRC Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I." An MEI is a member of the public located to receive the maximum possible calculated dose. Doses calculated for this hypothetical individual were compared with the established dose criteria to the public to ensure a conservative comparison. The existing Radiological Environmental Monitoring Program will be utilized to monitor specified exposure pathways and will be modified as necessary to accommodate Unit 3 operations. In summary, impacts are anticipated to be SMALL.

5.4.1.1 Liquid Pathways

RBS Unit 3 would release liquid effluents through the existing RBS Unit 1 discharge piping into the Mississippi River. The NRC-endorsed LADTAP II computer program (Reference 5.4-1) was used to calculate the doses due to liquid effluents. This program implements the radiological exposure models described in Regulatory Guide 1.109 for radioactivity releases in liquid effluents. The impact of liquid releases was considered for both the MEI and the collective population within 50 mi. of the plant.

The following exposure pathways are considered for the hypothetical MEI at RBS Unit 3:

- Ingestion of aquatic organisms as food (both fish and invertebrates).
- External exposure to contaminated sediments deposited along the shoreline (shoreline exposure).
- Ingestion of contaminated drinking water.

The shoreline exposure and drinking water pathways were conservatively included in the MEI dose calculation, even though shoreline use is limited in the vicinity of the RBS site, and the nearest drinking water location is 87 river miles downstream, as indicated in Subsection 2.3.2. LADTAP II also has the ability to consider swimming and boating pathways when calculating dose to the MEI. However, the boating and swimming pathways were omitted because

Subsection 2.3.2 indicates that essentially no swimming or boating occurs in the area, and the nearest recreational water bodies are either upstream of the plant site or not connected to the Mississippi River. Omitting the swimming and boating pathways while including the shoreline exposure pathway is consistent with the default ALARA (as low as reasonably achievable) usage rates provided in Regulatory Guide 1.109.

The pathways considered for the 50-mi. population exposure are as follows:

- Ingestion of commercial fish and invertebrate catches.
- Ingestion of contaminated drinking water.

The fish and invertebrate catches were conservatively assumed to be totally consumed by people within 50 mi. The drinking water population dose was calculated for the closest drinking water location, which is 87 river miles downstream, in Donaldsonville, Louisiana. The swimming, boating, and shoreline use pathways were not considered for the population dose because Subsection 2.3.2 indicates that this type of water usage is limited or nonexistent. Also, the dose due to irrigated agricultural products was not calculated, because Subsection 2.3.2 indicates that irrigation using Mississippi River water is not common in the RBS area. The site-specific input parameters for the liquid pathways are presented in Tables 5.4-1 and 5.4-2.

5.4.1.2 Gaseous Pathways

RBS Unit 3 would release gaseous effluents through the plant stacks into the air. The NRC-endorsed GASPAR II computer program (Reference 5.4-2) was used to calculate the doses due to gaseous effluents. This program implements the radiological exposure models described in Regulatory Guide 1.109 for radioactivity releases in gaseous effluents. The impact of gaseous releases was considered for both the MEI and the collective population within 50 mi. of the plant.

Based on guidance in Table 1 of Regulatory Guide 1.109, the MEI dose from the release of noble gases in the plume was calculated at the nearest site boundary location with the most limiting atmospheric dispersion factors. In addition, the MEI dose from radioiodines and particulates, including carbon-14 and tritium, was calculated at the site boundary location with the most limiting atmospheric dispersion factors. This bounds any doses calculated at the nearest receptor locations that may exist at the time of licensing.

The MEI exposure pathways for radioiodines and particulates considered at RBS Unit 3 include ground exposure, vegetable consumption, cow meat consumption, and inhalation of contaminated air. No milk pathway was considered because there are no milk animals within 5 mi. of the site. All MEI exposure pathways for RBS Unit 3 were assumed to be located at the site boundary location with the most limiting atmospheric dispersion factors.

The exposure pathways for the population dose include the radioactive plume, ground exposure, inhalation of contaminated air, vegetable and grain consumption, meat consumption, and milk consumption. The vegetable, meat, and milk doses come from those products that are produced within a 50-mi. radius of the plant site.

The site boundary location(s) with the most limiting atmospheric dispersion factors are determined from the long-term atmospheric dispersion factors for each of the three release points presented in Section 3.5. The 50-mi. long-term atmospheric dispersion factors used in calculating the population dose were taken from Subsection 2.7.6. Default values from the ESBWR DCD were used unless otherwise specified. The site-specific input parameters for GASPAR II are provided in Tables 5.4-3 and 5.4-4.

Since different atmospheric dispersion factors apply to different release points, the individual system releases provided in FSAR Table 12.2-16R must be combined into three source terms. The releases labeled "Radwaste Building" were entered as one source term that utilizes the ground-level atmospheric dispersion factors. The releases labeled "Reactor Building" and "Drywell" were combined into a second source term that utilizes the mixed mode atmospheric dispersion factors calculated for the Reactor and Fuel Buildings stack. The remaining releases labeled "Turbine Building," "Mechanical Vacuum Pump," "Turbine Seal," and "Offgas System" were combined into a third source term that utilizes the mixed mode atmospheric dispersion factors calculated for the Turbine Building stack.

5.4.1.3 Direct Radiation from RBS Unit 3

The primary objective of radiation shielding is to protect operating personnel and the general public from radiation emanating from the reactor, power conversion systems, radwaste process systems, and auxiliary systems.

Figure 6.2-2 shows the locations of thermoluminescent dosimeter (TLD) measurements at RBS Unit 1. Measurements show that the direct dose levels at the site boundary are at background levels. An evaluation of operating plants by the NRC states that:

> "… because the primary coolant of an LWR is contained in a heavily shielded area, dose rates in the vicinity of light water reactors are generally undetectable and are less than 1 mrem/year at the site boundary."

Shielding at RBS Unit 3 is provided to protect the general public outside the controlled area. The direct dose contribution at two distances from RBS Unit 3 is provided in DCD Table 12.2-21. The DCD annual dose at 800 m is 5.93E-04 mrem/year. The distance from RBS Unit 3 to the site boundary is slightly less than this distance, at approximately 760 m. The annual dose at this distance is still considered to be negligible. Therefore, impacts are anticipated to be SMALL.

5.4.2 RADIATION DOSES TO MEMBERS OF THE PUBLIC (INDIVIDUALS)

In this subsection, the doses from liquid and gaseous effluents from the new unit to MEIs residing near the proposed site were estimated using the methodologies and parameters specified in Subsection 5.4.1. Collective doses to the general public are described in the next subsection, with impacts considered to be SMALL.

Occupational dose estimates are provided in ESBWR DCD, Table 12.4-1.

5.4.2.1 Liquid Pathway Doses

Based on the parameters shown in Tables 5.4-1 and 5.4-2, the LADTAP II computer program was used to calculate the doses to the MEI via the following activities:

- Eating fish and invertebrates caught in the Mississippi River.
- Shoreline exposure.
- Drinking contaminated drinking water.

The liquid activity releases (source terms) for each radionuclide to the discharge are described in Subsection 3.5.1. The MEI for the total body dose was determined to be an adult. The maximum organ dose occurs to the bone for a child. The maximum annual doses to the total body and organs from all pathways for all age groups calculated by the computer program are presented in Table 5.4-5.

5.4.2.2 Gaseous Pathway Doses

Based on the parameters in Table 5.4-3, the GASPAR II computer program was used to calculate the doses to the MEI via the following activities, assumed to be located at the site boundary 0.76 mi. northwest of RBS Unit 3:

- Eating vegetables grown in a garden at the location.
- Eating meat from a cow raised at the location.
- Exposure to radioactivity deposited on the ground.
- Breathing contaminated air.

The gaseous activity releases (source terms) for each radionuclide to the air are shown in FSAR Table 12.2-16R. The MEI for the maximum organ dose was determined to be a child's thyroid. The maximum annual doses to the total body, thyroid, skin, and air from all applicable gaseous release pathways for all age groups calculated by the computer program are presented in Table 5.4-6.

5.4.3 IMPACTS TO MEMBERS OF THE PUBLIC

In this subsection, the radiological impacts to individuals and population groups from liquid and gaseous effluents are presented. Table 5.4-7 compares the total body and organ doses to the MEI from liquid effluents and gaseous releases from RBS Unit 3 for the applicable locations with the regulatory limits in 10 CFR 50, Appendix I. As the table indicates, the liquid doses are below Appendix I limits. Therefore, impacts are anticipated to be SMALL.

The 50-mi. population doses due to liquid effluents are shown in Table 5.4-8. The 50-mi. population doses due to gaseous effluents are shown in Table 5.4-9. The population dose is given both as a total person-rem dose per year and an individual mrem/person/yr dose, based on the applicable population served by the pathway.

The total site liquid and gaseous effluent doses from RBS Units 1 and 3 would be well within the regulatory limits of 40 CFR 190 (refer to Table 5.4-10). As indicated in NUREG-1555, demonstration of compliance with the limits of 40 CFR 190 is considered to be in compliance with the 0.1 rem limit of 10 CFR 20.1301.

Impacts to members of the public are expected to be SMALL.

5.4.4 IMPACTS TO BIOTA OTHER THAN MEMBERS OF THE PUBLIC

Radiation exposure pathways to biota are expected to be the same as those to humans, i.e., inhalation, external (from ground, airborne plume, water submersion, and shoreline), drinking water, and ingestion. These pathways were examined to determine if they could result in doses to biota significantly greater than those predicted for humans from the operation of RBS Unit 3. This assessment used surrogate species that provide representative information about the various dose pathways potentially affecting broader classes of living organisms. The gaseous pathway doses for muskrats, raccoons, herons, and ducks were taken as equivalent to human doses for the inhalation (child), plume (adult), and twice the ground (adult) pathways. The doubling of doses from ground deposition reflects the closer proximity of these organisms to the ground. Doses to those same species plus fish, invertebrates, and algae were calculated by the LADTAP II computer program.

Doses to biota from liquid and gaseous effluents from RBS Unit 3 are shown in Table 5.4-11. The total dose is taken as the sum of the internal and external dose. Annual doses to all of the surrogates meet the requirements of 40 CFR 190.

Use of exposure guidelines, such as 40 CFR 190, which apply to members of the public in unrestricted areas, is considered very conservative when evaluating calculated doses to biota. The International Council on Radiation Protection states that "…if man is adequately protected, then other living things are also likely to be sufficiently protected," and uses human protection to infer environmental protection from the effects of ionizing radiation (References 5.4-3 and 5.4-4). This assumption is appropriate in cases where humans and other biota inhabit the same environment and have common routes of exposure. It is less appropriate in cases where human access is restricted or pathways exist that are much more important for biota than for humans.

Species in most ecosystems experience dramatically higher mortality rates from natural causes than man, as evidenced by their shorter life spans. From an ecological viewpoint, population stability is considered more important to the survival of the species than the survival of individual organisms. Thus, higher dose limits could be permitted. In addition, no biota has been discovered that shows significant changes in morbidity or mortality due to radiation exposures predicted from nuclear power plants.

An international consensus has been developing with respect to permissible dose exposures to biota. The International Atomic Energy Agency (IAEA) (Reference 5.4-5) evaluated available evidence, including the *Recommendations of the International Commission on Radiological Protection* (Reference 5.4-3). The IAEA found that appreciable effects in aquatic populations would not be expected at doses lower than 1 rad per day and that limiting the dose to the MEI organism to less than 1 rad per day would provide adequate protection of the population. The IAEA also concluded that chronic dose rates of 0.1 rad per day or less do not appear to cause observable changes in terrestrial animal populations. The assumed lower threshold occurs for terrestrial rather than for aquatic animals, primarily because some species of mammals and reptiles are considered more radiosensitive than aquatic organisms. The permissible dose rates are considered screening levels; higher species-specific dose rates could be acceptable with additional study or data. This provides further confidence that, if the screening levels are met as presented herein, biota would be protected.

A rad (radiation absorbed dose) is the absorption of 100 ergs per gram of (in this case) biological mass. The absorbed dose can be related to the biological effects on humans through the unit of rem (roentgen equivalent man). For many types of radiation, including nearly all of those normally released by nuclear power plants (gamma and beta emitters), one rem is equivalent to the absorption of one rad.

The calculated total doses in Table 5.4-11 can be compared to the 1 rad per day dose criteria evaluated in the *Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Protection Standards* (Reference 5.4-5). The biota doses meet the dose guidelines by a wide margin. In these cases, the annual dose to biota is much lower than the daily allowable doses to aquatic and terrestrial organisms. Impacts to biota other than members of the public from exposure to sources of radiation would be SMALL and would not warrant mitigation.

5.4.5 REFERENCES

5.4-1 U.S. Nuclear Regulatory Commission, *LADTAP II - Technical Reference and User Guide*, NUREG/CR-4013, April 1986.

5.4-2 U.S. Nuclear Regulatory Commission, *GASPAR II - Technical Reference and User Guide*, NUREG/CR-4653, March 1987.

5.4-3 International Council on Radiation Protection, *Recommendations of the International Commission on Radiological Protection*, Publication No. 26, 1977.

5.4-4 International Council on Radiation Protection, *Recommendations of the International Commission on Radiological Protection*, Publication No. 60, 1991.

5.4-5 International Atomic Energy Agency, *Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Protection Standards*, Report Series No. 332, 1992.

Table 5.4-1
Liquid Pathway Parameters

Parameter	Value
Release Source Term	As discussed in Subsection 3.5.1
Discharge Flow Rate	0.234 ft^3/sec[(a)]
Impoundment Reconcentration Model	None
Dilution Factor for MEI Pathways	697[(b)]
Transit Time for MEI Pathways	0 hr[(c)]
MEI Consumption/Usage Rates	Table 5.4-2
50-mi. Population	1,803,302[(d)]
50-mi. Sport Fish Catch	3.00E+06 kg/yr[(e)]
50-mi. Commercial Invertebrate Catch	6.53E+06 kg/yr[(f)]
Dilution Factor for Fish and Invertebrate Catches	697
Transit Time for Fish and Invertebrate Catches	24 hr[(g)]
Population Served by Nearest Drinking Water Source	300,000[(h)]
Dilution Factor for Population Drinking Water	30,581
Transit Time for Population Drinking Water	30.2 hr[(i)]

a) Discharge flow rate is 105 gpm, from Figure 3.3-1.

b) Blowdown flow rate (from Figure 3.3-1) divided by discharge flow rate x 11.4.

c) Transit times were entered as 0 hr. so that the internal LADTAP II default values of 24 or 12 hr, depending on the pathway, could be used.

d) Estimated population for the year 2057, from Section 2.5.

e) Classifying the fish catch as a sport catch provides the most conservative doses calculated by LADTAP II.

f) Classifying the invertebrate catch as a commercial catch provides the most conservative doses calculated by LADTAP II.

g) The transit time for both fish and invertebrate harvests are set to a total of 24 hours. The LADTAP II default processing times of 168 and 240 hr for sport and commercial harvests were changed to 0 hr for conservatism.

h) Nearest drinking water source is Donaldsonville, Louisiana, from Subsection 2.3.2.

i) Includes LADTAP II default value of 24 hr.

Table 5.4-2
Annual Consumption/Usage Rates for MEI Liquid Pathways

MEI Pathway Annual Consumption/Usage[a]	Infant	Child	Teen	Adult
Fish (kg/yr)	0	6.9	16	21
Invertebrates (kg/yr)	0	1.7	3.8	5
Aquatic Plants (kg/yr)	0	0	0	0
Drinking Water (L/yr)	330	510	510	730
Shoreline Use (hr/yr)	0	14	67	12
Swimming (hr/yr)	0	0	0	0
Boating (hr/yr)	0	0	0	0

a) Default values from Regulatory Guide 1.109, Table E-5 were used. The default invertebrate consumption rates for saltwater sites were also used for RBS Unit 3 because freshwater invertebrates are a significant regional pathway for Louisiana.

Table 5.4-3
Gaseous Pathway Parameters

Parameter	Value
Release Source Term	As discussed in Subsection 3.5.1
Meteorology χ/Q	Subsection 2.7.6; refer to Table 5.4-4 for individual receptors
Meteorology D/Q	Subsection 2.7.6; refer to Table 5.4-4 for individual receptors
Fraction of Year Leafy Vegetables are Grown	0.58
Fraction of Year Beef Cattle on Pasture	0.75
Fraction of Beef Cattle Feed Intake from Pasture while on Pasture	0.75
Animal for Milk Pathway	None, no milk animals within 5 mi.
Average Absolute Humidity	12.9 g/m^3
MEI Consumption Rates	Regulatory Guide 1.109 values
50-mi. Population	1,803,302[(a)]
Annual 50-mi. Cow Milk Production	5.42E+07 L/yr[(b)]
Annual 50-mi. Meat Production	3.94E+07 kg/yr[(b)]
Annual 50-mi. Vegetable Production	6.35E+08 kg/yr[(b)]

a) Estimated population for the year 2057, from Section 2.5. Entered into GASPAR II by distance and direction.

b) Section 2.2.

Table 5.4-4
Annual Average χ/Q Values for Individual Gaseous Dose Receptors

Location	Sector	Distance (miles)	Undecayed, Undepleted χ/Q (sec/m^3)	2.26-Day Decay, Undepleted χ/Q (sec/m^3)	8-Day Decay, Depleted χ/Q (sec/m^3)	D/Q (m^{-2})
Ground-Level Release for Radwaste Building						
Site Boundary	NW	0.76	2.1E-05[(a)]	2.1E-05	1.9E-05	4.40E-08
Site Boundary	N	0.76	1.2E-05	1.1E-05	1.0E-05	3.2E-08
Reactor Building/Fuel Building Stack						
Site Boundary	NW	0.76	5.6E-07[(a)]	5.6E-07	5.3E-07	8.5E-09
Site Boundary	N	0.76	6.0E-07[(a)]	6.0E-07	5.6E-07	8.9E-09
Turbine Building Stack						
Site Boundary	NW	0.76	4.8E-07[(a)]	4.8E-07	4.5E-07	7.5E-09
Site Boundary	N	0.76	5.3E-07[(a)]	5.3E-07	4.9E-07	7.9E-09

a) Undecayed, undepleted χ/Q was conservatively increased by 0.10E-05 (or 0.10E-07) in the analysis to avoid a divide-by-0 error in the GASPAR II computer code.

Table 5.4-5
Liquid Pathway Doses for MEI

Dose (mrem/yr)

Skin[a]	Bone[b]	Liver[a]	Total Body[c]	Thyroid[d]	Kidney[a],[c]	Lung[a]	GI-LLI[c]
7.05E-04	1.73E+00	1.94E-01	1.24E-01	2.40E-01	4.47E-02	1.73E-02	1.63E-01

a) Total of all pathways for teen.

b) Total of all pathways for child.

c) Total of all pathways for adult.

d) Total of all pathways for infant.

Table 5.4-6
Gaseous Pathway Doses for MEI

Location	Pathway	Annual Dose (mrads/yr)	Annual Dose (mrem/yr)		
		Air	Total Body	Thyroid	Skin
Site Boundary (0.76 mi. NW)	Plume	N/A	1.55E-01	1.55E-01	4.09E-01
	Beta Air Dose	3.67E-01	N/A	N/A	N/A
	Gamma Air Dose	2.39E-01	N/A	N/A	N/A
	Ground	N/A	2.67E-01	2.67E-01	3.13E-01
	Vegetable				
	Adult	N/A	1.02E-01	3.15E+00	3.80E-02
	Teen	N/A	1.24E-01	4.18E+00	6.28E-02
	Child	N/A	2.15E-01	8.01E+00	1.52E-01
	Meat				
	Adult	N/A	2.10E-02	1.05E-01	1.47E-02
	Teen	N/A	1.58E-02	7.77E-02	1.24E-02
	Child	N/A	2.66E-02	1.22E-01	2.33E-02
	Inhalation				
	Adult	N/A	2.97E-03	2.48E-01	8.63E-04
	Teen	N/A	2.84E-03	3.23E-01	8.71E-04
	Child	N/A	2.26E-03	3.96E-01	7.69E-04
	Infant	N/A	1.32E-03	3.61E-01	4.42E-04
	Total				
	Adult	N/A	5.48E-01	3.93E+00	7.76E-01
	Teen	N/A	5.65E-01	5.01E+00	7.98E-01
	Child	N/A	6.66E-01	8.96E+00	8.98E-01
	Infant	N/A	4.24E-01	7.83E-01	7.23E-01

Table 5.4-7
Comparison of Annual MEI Doses with 10 CFR 50, Appendix I Limits

Type of Dose	Location	Annual Dose	
		RBS Unit 3	Limit
Liquid Effluents	Mississippi River		
Total Body (mrem/yr)		1.24E-01[a]	3
Max. Organ - Bone (mrem/yr)		1.73[b]	10
Gaseous Effluents			
Noble Gases	Site Boundary 0.76 mi. NW		
Total External Body (mrem/yr)		1.55E-01	5
Skin (mrem/yr)		4.09E-01	15
Beta Air Dose (mrad/yr)		3.67E-01	20
Gamma Air Dose (mrad/yr)		2.39E-01	10
Iodine and Particulates	Site Boundary 0.76 mi. NW		
Max. Organ - Thyroid (mrem/yr)		8.96E+00[b]	15

a) Total dose from all pathways for an adult.

b) Total dose from all pathways for a child.

Table 5.4-8
50-Mi. Population Doses from Liquid Effluents

Pathway	Dose (person-rem/yr)
Fish	
Total Body	1.65E+01
Organ - Bone	2.10E+02
Organ - Thyroid	3.99E+00
Invertebrates	
Total Body	1.04E+01
Organ - Bone	6.84E+01
Organ - Thyroid	2.08E+00
Drinking Water	
Total Body	1.92E-02
Organ - Bone	1.25E-02
Organ - Thyroid	2.27E-01
Total	
Total Body	2.69E+01
Total Organ - Bone	2.78E+02
Total Organ - Thyroid	6.30E+00

Table 5.4-9
50-Mi. Population Doses from Gaseous Effluents

Pathway	Dose (person-rem/yr)
Plume	
Total Body	6.69E-01
Max Organ - Skin	1.99E+00
Ground	
Total Body	4.65E-01
Max Organ - Skin	5.45E-01
Inhalation	
Total Body	3.32E-02
Max Organ - Thyroid	2.53E+00
Vegetable	
Total Body	6.58E-01
Max Organ - Bone	3.08E+00
Cow Milk	
Total Body	7.10E-02
Max Organ - Thyroid	8.75E-01
Meat	
Total Body	8.45E-02
Max Organ - Bone	4.08E-01
Total	
Total Body	1.99E+00
Max Organ - Thyroid	5.37E+00

Table 5.4-10
Comparison of MEI Doses with 40 CFR 190 Criteria

Type of Dose	RBS Unit 3 (ESBWR)			RBS Unit 1	Site Total[(a)]	40 CFR 190 Limit
	Liquid	Gaseous	Total			
Total Body (mrem/yr)	0.12	0.67	0.79	1.65	2.44	25
Thyroid (mrem/yr)	0.24	8.96	9.20	1.16	10.36	75
Bone (mrem/yr)	1.73	--	1.73	0.05	1.78	25

a) This site total dose includes the RBS Unit 3 total dose and the dose from the RBS Unit 1.

Table 5.4-11
Doses to Biota from Liquid and Gaseous Effluents

Biota	Dose (millirad per year)			40 CFR 190 Limit
	Liquid Effluents	Gaseous Effluents[a]	Total	
Fish	2.28	0	2.28	25
Invertebrate	8.13	0	8.13	25
Algae	11.8	0	11.8	25
Muskrat	14.6	0.69	15.29	25
Raccoon	0.426	0.69	1.12	25
Heron	6.79	0.69	7.48	25
Duck	14.6	0.69	15.29	25

a) Dose from gaseous effluents determined from whole-body inhalation dose for infant at site boundary + whole-body ground and plume exposure at site boundary. Ground exposures increased by a factor of two to account for ground proximity.

5.5 ENVIRONMENTAL IMPACTS OF WASTE

This section describes the environmental impacts that could result from the operation of the nonradioactive waste systems, storage and disposal of mixed wastes, and low-level radioactive waste (LLW). Mixed waste contains hazardous waste and a low-level radioactive source, special nuclear material, or byproduct material. Federal regulations governing generation, management, handling, storage, treatment, disposal, and protection requirements associated with these wastes are contained in Titles 10 (NRC regulations) and 40 (EPA regulations) of the Code of Federal Regulations (CFR).

RBS has utilized dumpsters for the collection of typical facility solid wastes (nonhazardous, nonradioactive) such as office waste, packaging and warehouse waste, and other plant-related maintenance waste. This nonhazardous solid waste is managed through local waste haulers. Other selected waste materials, such as used batteries, scrap metal, lubricating oils, and antifreeze, are recycled as much as possible.

RBS generates EPA "hazardous waste," as defined in the EPA implementing regulations under the Resource Conservation and Recovery Act (RCRA) in 40 CFR 261. These nonradioactive hazardous wastes typically include laboratory solvent waste, paint waste, aerosol residues, and photographic wastes. Waste minimization programs at RBS have tended to minimize the generation of these types of wastes to the extent practical through hazardous materials substitution (such as the use of citrus-based nonhazardous solvents and the use of water-based epoxy paints) and the use of waste minimization strategies (such as using paints with high solids and low volatile organic content). Hazardous wastes are accumulated in satellite accumulation areas, transferred to the on-site hazardous waste storage building, and are then transported to licensed RCRA waste management facilities.

The section is divided into three subsections: nonradioactive waste impacts, mixed waste impacts, and low-level radioactive waste impacts.

5.5.1 NONRADIOACTIVE WASTE SYSTEM IMPACTS

Descriptions of the RBS Unit 3 nonradioactive waste systems are presented in Section 3.6.

Nonradioactive wastes generated at the RBS site, including those from the new RBS Unit 3 (e.g., solid wastes, liquid wastes, air/gaseous emissions), would continue to be managed in accordance with applicable federal, Louisiana, and local laws and regulations and permit requirements. Management practices are expected to be the same as those implemented for the existing RBS Unit 1 and would include the following:

- Nonradioactive solid waste would be collected and stored temporarily on the RBS site and disposed of at off-site licensed commercial waste disposal site(s) or sent to an off-site permitted recycling or a recovery facility, as appropriate. This includes typical nonhazardous solid waste from offices and facility support activities and EPA RCRA hazardous wastes.

- Dredge spoils resulting from required maintenance would be handled in accordance with the current USACE permit (Subsection 5.2.2).

- Scrap metal and lead acid batteries at the RBS site would be recycled.
- Water discharges from cooling and auxiliary systems (e.g., sanitary wastewater treatment effluent and other chemically treated wastewater effluent streams) would be discharged directly or indirectly to the Mississippi River through the permitted outfalls as discussed in Subsection 5.2.2. A modified LPDES permit would be obtained (Reference 5.5-1).
- Sanitary sewage treatment sludge is expected to be disposed of (if necessary) at an off-site licensed land application facility.

For further descriptions of plant systems generating nonradioactive wastes, refer to Section 3.6. It is not anticipated that there would be any other site-specific waste disposal activities unique to the new unit. The assessment of potential impacts resulting from the discharge of nonradioactive wastes is presented in the following subsections.

5.5.1.1 Impacts of Discharges to Water

Nonradioactive wastewater discharges to surface water would increase as a result of several aspects of RBS Unit 3 operation, such as additional cooling water system blowdown, permitted wastewater from the new unit's auxiliary systems, clarifier sludge, and stormwater runoff from new impervious surfaces including roof drains and surface runoff.

Wastewater discharge sources included in the current RBS LPDES permit consist of ion exchange resin backwash and regeneration, auxiliary boiler blowdown, filter backwash from service water polishing, feed and bleed from the service water system, floor washdown, equipment washing, personnel decontamination, laboratory drains, filter press effluent, standby service water reject, and maintenance wastewaters (Reference 5.5-1).

As discussed in Subsection 5.2.2, sanitary and other wastewater effluents are discharged to the Mississippi River through LPDES-permitted outfalls, subject to the constituent permitted levels summarized in Table 5.2-1. Ambient or baseline water quality conditions are discussed in Subsection 2.3.3. Additional site background information presented in other sections includes site hydrology (Subsection 2.3.1), water use in the area (Subsection 2.3.2), and ecology (Section 2.4).

Subsection 5.2.2 and Section 3.6 addressed possible water treatment chemicals and biocides that would be used for the new unit and the monitoring of the discharges based upon current usage and the LPDES permit for RBS. Ongoing monitoring of chemicals and biocides is discussed in Section 6.6. The following was discussed in Subsections 2.3.3 and 5.2.2:

- Mississippi River water has been monitored extensively for such parameters as temperature, solids, inorganic constituents, and related parameters potentially affected by the use of the water by power generation and other industrial users.
- The impact of the water discharged to the Mississippi River from the existing RBS Unit 1 has been negligible, based upon the results of ongoing monitoring programs.

- The projected impact of the discharge of water from a new RBS Unit 3 would be negligible.

- Limits included in the existing RBS LPDES permit are those determined by the LDEQ to be protective of the Mississippi River water quality and the streams receiving stormwater, based upon a detailed evaluation of facility operations, facility wastewater discharges, waterway conditions, and Louisiana and federal water quality regulations and guidance, as discussed in Subsection 2.3.3.

- An additional safeguard required by the LPDES permit is annual whole effluent toxicity testing of the RBS cooling water discharge to test for any cumulative toxic impact of the discharge water to EPA/LDEQ-specified test organisms. This testing is designed to detect any residual toxic impacts caused by the total effluent, including the effects of any biocides or other chemical additives used in the water system at RBS to control macro- and microbiological fouling and/or to inhibit corrosion in the cooling water systems. The LPDES permit requires that the samples collected for this test "are representative of any periodic episodes of chlorination, biocide usage, or other potentially toxic substances used on an intermittent basis" (Reference 5.5-1).

- RBS Unit 3 operations would not include additional or different potential impact issues beyond those evaluated and regulated for RBS Unit 1. Both are similar operations with similarities in the technologies used, chemicals used, etc.

- The assimilation ability of the Mississippi River is expected to remain the same, as demonstrated by the temperature plume modeling results for RBS Unit 3.

As discussed in earlier sections, the primary discharge of cooling water and wastewater from the RBS is released directly to the Mississippi River, and concentrations of constituents in the RBS Units 1 and 3 discharge would be negligible or undetectable in the Mississippi River, as discussed in Subsection 5.2.2. Evaluations have considered variations in flow rate, such as those shown in thermal monitoring and TDS determinations discussed in Subsection 5.2.2.2.2. Smaller volume discharges associated with plant auxiliary systems would be discharged in accordance with the applicable LDEQ water quality standards (refer to Subsection 2.3.3.1.3 for a discussion of water quality standards). Therefore, potential impacts from constituents in the cooling water and plant auxiliary system discharges from the new unit would be SMALL.

RBS would revise the existing SWPPP, which prevents or minimizes the discharge of harmful quantities of pollutants to stormwater runoff, to reflect the addition of new paved areas and facilities and changes in drainage patterns, as discussed in Subsections 4.2.2 and 5.2.2. The effects of the addition of impervious surfaces are expected to be negligible because best management practices initiated through the RBS SWPPP would be employed to control stormwater runoff. Impacts from increases in volume or pollutants in the stormwater discharge would be SMALL and would not warrant mitigation.

5.5.1.1.1 Sanitary Waste

Sanitary waste would be collected in an on-site sewage treatment plant, the design of which would meet the requirements of the current RBS LPDES permit (Reference 5.5-1) and any modifications to that permit. The wastewater treatment generated sludge would be disposed of at licensed off-site facilities, if necessary. A modified permit would be obtained from the LDEQ for any additional discharges, if necessary.

The existing discharge permit requires the sanitary discharge to meet a Louisiana sanitary weekly average limit (as a link to federal 40 CFR 133 limits) of 45 mg/l for biological oxygen demand (BOD) and total suspended solids (TSS), as well as a fecal coliform limit of 400 colonies per 100 mL prior to discharge to a combined flow outfall to the Mississippi River (Reference 5.5-1).

As discussed in Subsection 5.2.2 and in Table 5.2-1, the sanitary waste from Unit 1 discharges to the Mississippi River. The combined sanitary waste flows from Units 1 and 3 would also be discharged to the Mississippi River. The large volume of water available for mixing in the flow of the Mississippi River and compliance with effluent discharge limits would result in an insignificant buildup of sewage constituents. Therefore, based on the LDEQ effluent limit standards and past operational history, potential impacts associated with increases in sanitary waste from the operation of the new unit would be SMALL.

5.5.1.2 Impacts of Discharges to Land

Operation of the new unit would result in an increase in the total volume of solid waste generated at the RBS site. The types of solid waste generated were discussed in the Section 5.5 introduction. In addition to normal facility nonradioactive solid waste, the RBS may generate an additional 20 to 100 tons of nonradioactive solid waste per year from additional plant maintenance projects that vary annually. However, it is anticipated there would be no fundamental change in the characteristics of these wastes or the way they are currently managed at RBS Unit 1. The RBS has standard procedures in place for waste segregation, appropriate management of waste, and worker training for waste management. In addition, all applicable federal, Louisiana, and local requirements and standards would be met with regard to handling, transportation, and off-site land disposal of the solid waste at licensed commercial facilities.

Any necessary dredging activities would be addressed in the existing or modified USACE dredging permit, as discussed in Subsection 5.2.2.

The RBS has waste minimization programs in place. Nonradioactive solid waste at RBS Unit 3 would be reused or recycled to the extent practicable. Solid wastes appropriate for recycling or recovery (e.g., used oil, antifreeze, scrap metal, and paper) would be managed through the use of approved and appropriately licensed facilities. Nonradioactive solid waste destined for off-site land disposal would be disposed of at approved and licensed off-site commercial waste disposal site(s). Therefore, potential impacts from land disposal of nonradioactive solid wastes would be SMALL and would not warrant mitigation.

5.5.1.3 Impacts of Discharges to Air

Operation of the new unit would increase small amounts of gaseous emissions to the air, primarily from equipment associated with plant auxiliary systems (e.g., auxiliary boilers, standby diesel generators, and diesel-driven fire pumps). These emissions are intermittent because they are associated with auxiliary and backup systems. Projected emissions from the diesel-fueled equipment are provided in Section 3.6. Solid deposition from cooling tower emissions is addressed in Subsection 5.3.3.1.3. Deposition is anticipated to be small.

Air emission sources associated with the new unit would be managed in accordance with federal, Louisiana, and local air quality control laws and regulations. Based on the amount of potential air emissions, and the intermittent nature of the potential emissions, impacts to air quality would be SMALL and would not warrant mitigation.

5.5.2 MIXED WASTE IMPACTS

The term "mixed waste" refers specifically to waste that is regulated as both radioactive waste and hazardous waste. Radioactive materials at nuclear power plants are regulated by the NRC under the Atomic Energy Act (AEA) (AEA 1954). Hazardous wastes are regulated by the state of Louisiana, which is an EPA-authorized state (a state authorized by the EPA to regulate those portions of the federal act) under the RCRA program.

Mixed waste generated on-site is assessed according to the following laws and regulations. The radioactive component of mixed waste must satisfy the definition of LLW in the Low-Level Radioactive Waste Policy Amendments Act (LLRWPAA) of 1985. The hazardous component must exhibit at least one of the hazardous waste characteristics identified in 40 CFR 261, Subpart C, or be listed as a hazardous waste under 40 CFR 261, Subpart D. Entities that generate, treat, store, or dispose of mixed wastes are subject to the requirements of the AEA, the Solid Waste Disposal Act of 1965, as amended by the RCRA in 1976, and the federal Hazardous and Solid Waste Amendment (HWSA) to the RCRA in 1984. The federal agencies responsible for ensuring compliance with these statutes are the NRC and the EPA. However, pursuant to regulations promulgated by EPA in 2001, most low-level mixed wastes generated under a single NRC license are conditionally exempted from RCRA requirements and are regulated under NRC provisions 40 CFR 266.

5.5.2.1 Plant Systems Producing Mixed Waste

Mixed waste contains hazardous waste and a low-level radioactive source, special nuclear material, or byproduct material. A 1990 survey by the NRC identifies the following types of mixed LLW at reactor facilities (Reference 5.5-2):

- Waste oil from pumps and other equipment.
- Chlorinated fluorocarbons (CFC) resulting from cleaning, refrigeration, degreasing, and decontamination activities.
- Organic solvents, reagents, compounds, and associated materials such as rags and wipes.
- Metals such as lead from shielding applications and chromium from solutions and acids.

- Metal-contaminated organic sludge and other chemicals.
- Aqueous corrosives consisting of organic and inorganic acids.

Nuclear power plants are not large generators of mixed waste. Proper chemical control program techniques and pre-job planning ensure that only small quantities of mixed waste would be generated by RBS Unit 3. Although the specific types and quantities of mixed waste that could be generated in new operating reactors are not available, each reactor is estimated to produce potentially 0.5 m^3/year of mixed waste. However, the volume would more likely be less, based on the current waste minimization practices used at the RBS site, which have resulted in little to no mixed waste generation over the past several years. The RBS would manage the mixed wastes generated at the new unit in accordance with existing plant programs. If a licensed off-site disposal site was not available for the mixed waste, the RBS would containerize, segregate, and store (in accordance with NRC and EPA regulations) the waste at a remote monitored structure to minimize the possible exposure to employees and the public. Therefore, impacts are anticipated to be SMALL.

5.5.2.2 Mixed Waste Storage and Disposal Plans

The volume of mixed waste could be reduced or eliminated by one or more of the following treatments before disposal: decay, stabilization, neutralization, filtration, chemical decontamination, or treatment performed by an off-site vendor.

If generated, some small quantities of mixed waste could potentially be temporarily stored on-site in the event there is a lack of treatment options or disposal sites, if necessary, as noted in Subsection 5.5.2.1. For this reason, impacts resulting from occupational exposure to chemical hazards and radiological doses could be higher than otherwise expected. Occupational chemical and radiological exposures could occur during the testing of mixed wastes to determine if the constituents are chemically hazardous. In those cases, appropriate hazardous chemical and radiological control measures would be applied. Therefore, impacts are anticipated to be SMALL.

5.5.2.3 Environmental Impacts

If mixed wastes are generated, minimal environmental impacts would result from storage or shipment of the mixed wastes. In the event of a mixed waste spill, emergency operating procedures would be implemented to limit any on-site impacts, in accordance with the RBS Hazardous Materials Emergency Response Plan, which will be updated to reflect RBS Unit 3. In the event of a spill, properly trained emergency response personnel would maintain a current facility inventory of the types of waste spilled, volumes, locations, hazards, control measures, and precautionary measures to be taken.

Generation and temporary storage of mixed waste can expose workers to hazards associated with the chemical component(s) of the mixed waste from potential leaks and spills. RBS would implement appropriate procedures if it becomes necessary to store mixed wastes temporarily on-site. These procedures could include proper labeling of containers, installation of fire detection and suppression equipment (if required), use of fences and locked gates, availability of emergency shower and eyewash facilities, posting of hazard signs, and regular inspections.

The existing emergency procedures would limit any on-site impacts. Therefore, the impacts from the treatment, storage, and disposal of mixed wastes generated by the new unit would be SMALL and would not warrant mitigation.

Off-site shipment, treatment, and disposal options depend on the hazard levels and radiological characteristics of the mixed waste. Because personnel performing packaging and shipping could be exposed to radiation from the mixed waste, appropriate controls would be implemented to ensure that ALARA goals are not exceeded. The EPA mandates that waste containers in temporary storage be inspected weekly and certain aboveground portions of hazardous waste storage tanks be inspected daily. The purpose of these inspections is to detect leakage from or deterioration of containers (40 CFR 264). Waste inspection methods could include direct visual monitoring or remote monitoring for detecting leakage or deterioration. In addition, measures would be provided to promptly locate, segregate, and manage the leaking containers to mitigate the effects of mixed waste hazards.

RBS Unit 1 has produced very little mixed wastes for several years, and it is anticipated that little to no mixed waste would be produced at RBS Unit 3. Any impacts from the treatment, storage, and disposal of mixed wastes generated by RBS Unit 3 would be SMALL and would not warrant mitigation beyond what has been described in the previous paragraphs.

5.5.2.4 Waste Minimization Plan

Primary importance would be placed on source reduction efforts to prevent pollution and to eliminate or reduce the generation of hazardous waste to the maximum extent practicable. Reducing the quantity, toxicity, or mobility of the hazardous waste before accumulation or disposal would be considered when prevention or recycling is not possible or practical. The existing waste minimization plan that is currently in use at the site will be updated to apply to the new unit, with such plan goals as source reduction, source control, and recycling.

5.5.3 LOW-LEVEL RADIOACTIVE WASTE IMPACTS

A new reactor is estimated by GE-Hitachi to generate approximately 480 m^3 per year of solid LLW. In recent years, the existing RBS unit has generated approximately 100 to 1000 m^3 annually of LLW. On-site temporary storage facilities for LLW will be designed to minimize personnel exposures from waste awaiting shipment. The RBS will conform to NRC and EPA requirements and guidelines, which ensure that LLW is temporarily stored in facilities that are designed and operated properly and that public health and safety and the environment are adequately protected. These requirements and guidelines include the following:

- The amount and activity of material allowed in a storage facility and the shielding used should be controlled by the dose rate criteria for both the occupational exposures at the site boundary and any adjacent off-site areas. Direct radiation and effluent limits are restricted by 10 CFR Part 20 and 40 CFR Part 190. The exposure limits provided in 10 CFR 20.1301 apply to unrestricted areas.

- Containers and their waste forms would be compatible to prevent significant corrosion within the container. After a period of storage, the subsequent transportation and disposal should not cause a container breach.

- Gases generated from organic materials in waste packages should be evaluated periodically with respect to container breach. After a period of storage, the subsequent transportation and disposal should not cause a container breach.

- High-activity resins should not be stored more than 1 year unless they are in containers with special vents.

- A program of at least quarterly visual inspection would be expanded to include the new unit.

- A liquid drainage collection and monitoring system would be in place. Routing of the drain would be to a radwaste processing system.

Additionally, reflecting the actual upstream and downstream monitoring of the Mississippi River around the RBS, results of radioactivity sampling are mentioned in Subsections 2.3.3 and 5.2.2. Potential radioactivity release is monitored at RBS Unit 1 in compliance with the NRC license and regulations and is reported annually to the NRC. This monitoring includes the following:

- Quarterly sampling of radioactivity in upstream and downstream Mississippi River surface water.

- Annual sampling of radioactivity in Mississippi River sediment.

- Semiannual sampling of radioactivity in groundwater upgradient and downgradient from the RBS.

To date, the results of the monitoring program have indicated discharges/impacts below the limits of 10 CFR 20 and no river or sediment samples above levels that are already present from either naturally occurring background or weapons testing. Levels of radionuclides monitored in 2006 continued to remain similar to results obtained in previous operational and preoperational years (Reference 5.5-3). NRC radiation safety teams evaluate the monitoring program procedures in detail every 2 years (such as from November 1 to 4, 2005) (Reference 5.5-4). The continuation of this monitoring program will be a key measure to limit adverse water use impacts of RBS operation.

Commercial LLW disposal facilities are sited and operated consistent with 10 CFR 61 and other appropriate regulations, ensuring SMALL environmental impact. Waste generators must meet the waste acceptance criteria established for the facility and adhere to packaging requirements.

As of July 1, 2008, the LLW disposal facility in Barnwell, South Carolina is no longer accepting Class B and C waste from LLW generators in states other than Connecticut, South Carolina and New Jersey. The disposal facility in Clive, Utah, is still accepting Class A waste from all LLW generators. Class B and C waste is disposed of by one or both of the following methods:

1. Disposal at a LLW disposal facility that accepts Class B and C waste from the new unit. It is anticipated that such a disposal facility will be available well before the unit loads fuel and begins operation.

2. Conversion of Class B and C waste into Class A waste by mixing with other Class A waste and disposal at a facility that accepts Class A waste. Such mixing could be done on site or by a licensed third party at another location

A 6 month volume of LLW as packaged waste may be stored in the Radwaste Building as described in FSAR Subsection 11.4.1. LLW is stored in a manner that complies with the dose requirements in 10 CFR Part 20 and maintains dose ALARA. The applicant concludes that any impacts from the temporary on-site storage and off-site disposal of LLW generated by the unit would be SMALL and would not warrant mitigation beyond what has been described in the previous paragraphs.

5.5.4 CONCLUSIONS

As unavoidable impacts, nonradioactive wastewater discharges to surface water, the total volume of solid waste generated, gaseous emissions to the air, and potential generation of mixed waste and low-level radioactive waste all may increase as a result of RBS Unit 3 operation. In addition, some small quantities of mixed waste, if generated, would potentially be temporarily stored on-site because of the lack of treatment options or disposal sites, if necessary. For this reason, impacts resulting from occupational exposure to chemical hazards and radiological doses could be higher than otherwise expected. Occupational chemical and radiological exposures could also occur during the testing of mixed wastes to determine if the constituents are chemically hazardous. In those cases, appropriate hazardous chemical and radiological control measures would be applied.

Despite the addition of a new unit, minimal chemical constituents and/or wastes would be discharged to the water, land, or air from the operation of the new unit. Constituents discharged directly or indirectly to the Mississippi River are expected to be below LPDES permitted levels. Discharges to land would be minimal, based on the current waste discharges at RBS Unit 1 and the current waste minimization program in place. Finally, air emissions would be minimal, based on the estimated equipment emissions and the intermittent nature of these emissions.

As stated, no new/additional types of waste streams would be generated. The impacts of waste generation (e.g., nonradioactive and low-level radioactive) would be SMALL and would not warrant mitigation.

5.5.5 REFERENCES

5.5-1 Louisiana Department of Environmental Quality, "Louisiana Water Discharge Permit - River Bend Station, Permit Number LA0042731," June 2006.

5.5-2 U.S. Nuclear Regulatory Commission, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437, Final Report, Washington, D.C., 1996.

5.5-3 Entergy Operations, Inc., *River Bend Station - Annual Radiological Environmental Operating Report for 2006*, April 2007.

5.5-4 U.S. Nuclear Regulatory Commission, "River Bend Station - NRC Radiation Safety Team Inspection Report 05000458/2005015," December 16, 2005.

5.6 TRANSMISSION SYSTEM IMPACTS

This section describes the impacts of transmission system operation for the RBS. As discussed in Section 3.7, the power transmission system to which the RBS is currently connected would not support sufficient additional generation capacity to accommodate RBS Unit 3. The adequacy of the RBS area transmission and distribution system was evaluated in a study completed by the Applicant at the end of October 2007. Additional changes to the transmission and distribution system will be warranted, and the associated environmental impacts of these system expansion and upgrade activities are evaluated in Subsections 4.1.2 and 5.1.2. The impacts of operation and maintenance of the existing transmission lines and corridors to which RBS Unit 1 is currently connected were addressed in the RBS Unit 1 Environmental Report (Reference 5.6-1).

Subsection 5.6.1 addresses impacts to terrestrial ecosystems, Subsection 5.6.2 describes aquatic ecosystem impacts, and Subsection 5.6.3 discusses impacts to members of the public.

5.6.1 TERRESTRIAL ECOSYSTEMS

The effects of transmission line corridor construction are evaluated in Subsection 4.3.1. The impacts that were considered as a result of the operation of the transmission system are outlined in the Environmental Standard Review Plan (ESRP), Subsection 5.6.1 (Rev. 1 - July 2007). The ESRP considered the effects of ROW maintenance and assessed the impacts to important terrestrial species and habitats (defined in ESRP Table 2.4.1-1) other than humans. Procedures to mitigate impacts are discussed where applicable. Overall impacts to terrestrial ecology resources are expected to be SMALL and are discussed by topic in the subsections that follow.

5.6.1.1 Vegetation

Operation of the transmission system is expected to have no significant effects on vegetation, including federal and state listed threatened, endangered, or otherwise protected species. Most of the forested land crossed by the corridor is discontinuous and within privately owned land with minimal public access. The remaining lands are mostly developed or otherwise open and should not be affected by operation.

Maintenance of the ROW would be scheduled as necessary. The work would consist of mechanically removing tall growing trees to provide adequate clearance for the lines. Pesticides and herbicides will not be used to maintain the transmission system ROW. By carefully choosing the vegetative species for initial sowing upon completion of construction and selectively removing undesirable species by hand cutting and/or mowing as needed, the growth of vegetation types that provide desirable low-growing ground cover, erosion control, improved appearance, and wildlife is encouraged. Maintenance of the ROW is discussed further in Section 5.1.

The ROWs are typically inspected by plane and ground patrolled periodically to ensure that the corridor is in proper condition for safe operation of the line. Ground inspections provide an additional opportunity to assess the corridor for the presence of undesirable invasive species, pursuant to Executive Order 13112 regarding national policy on invasive species (Reference 5.6-2). The *National Invasive Species Management Plan* is currently in draft form and was undergoing public comment from December 20, 2007, to March 12, 2008 (Reference 5.6-3). Maintenance procedures currently used by the Applicant for its transmission corridors incorporate the intent of Executive Order 13112 as part of its best management practices to prevent invasive species establishment or movement.

No threatened, endangered, or otherwise protected species of plants or protected habitat are expected to be affected by operation of the transmission system. Therefore, no special maintenance practices are planned at this time. If these circumstances change, maintenance practices would be altered to protect the affected resource.

The potential impact of the project on vegetation, including important plant species and habitat, is expected to be SMALL.

5.6.1.2 Wildlife

The only wildlife issue of note concerning the operation of the transmission system is the potential for bird collisions with the towers and transmission lines. NUREG-1437, Subsection 4.5.6.2 (Reference 5.6-4) provides a thorough discussion of the topic and concludes that bird collisions associated with the operation of transmission lines would not cause long-term reductions in bird populations and, therefore, would be of SMALL significance. Available literature on transmission line collision mortality is voluminous, but the means by which studies are conducted is sometimes questioned, although alternatives are rarely offered. A more recent 2002 California Energy Commission Report (Reference 5.6-5) outlines many of the study deficiencies encountered. The most outstanding deficiencies are the problems of direct observations and dead bird counts. For example, direct observation of bird collisions requires countless hours in the field and, therefore, the results of such studies are generally not considered significant. In addition, dead bird counts in many situations cannot be considered accurate because it is probable that brush and undergrowth hide specimens that might otherwise be counted. The 2002 report summarizes 27 avian collision studies from across the United States and several from overseas. The studies observed average daily flights at or below the transmission line level. The maximum collision rate was 0.65 percent, and the majority of studies reported collisions at less than 0.1 percent. Both the NRC (NUREG-1437) and the California Energy Commission report concluded that bird mortality resulting from transmission line collisions is a small impact as related to line operation. The reports further emphasized the importance of initial routing of lines to avoid areas with high bird densities. The proposed routing has specifically avoided wildlife refuges, game management areas, and similar places where bird densities might be higher than average. Final routing preferences will be discussed with federal, state, and local agencies to avoid increasing any potential for bird collisions. Additionally, Entergy's transmission and distribution function has adopted an Avian Interaction Policy that establishes guidelines for avoidance and mitigation of avian deaths caused by power line collisions.

No threatened, endangered, or otherwise protected species of wildlife or critical habitat are expected to be affected by operation of the transmission system. Therefore, no special maintenance practices are planned at this time. If these circumstances change, maintenance practices would be altered to protect the affected resource.

The potential impact of the project on wildlife, including important species and habitat, is expected to be SMALL.

5.6.1.3 Wetlands

Impacts on wetlands from the operation of the transmission line are expected to be insignificant. Areas within the corridor that do have the potential to re-generate in forest vegetation would be periodically hand cleared and accessed by boat or matting for equipment, so as not to disturb the soil. Any maintenance activities that might be required would similarly access wetland areas by boat or matting. As noted in Subsection 5.6.1.1, no pesticide or herbicide would be used in the corridor, and, therefore, no impacts from such chemicals would result to the wetlands. The potential impact of the project on wetlands is expected to be SMALL.

5.6.1.4 Other Projects within the Area with Potential Impacts

Other projects that may be affected by the operation of the transmission line are not known to the Applicant at this time. As routing and design are formalized, a thorough investigation through agencies and public resources will be made to ensure that no impacts, or minimal impacts, would result to other ongoing or planned projects in the project vicinity.

5.6.1.5 Consultation

No direct consultation has been made with federal, state, or local agencies at this time regarding the transmission line routing and switchyard location. The Applicant will request informal consultation with natural resource agencies after final routing and design have been formalized. It is the intent of the Applicant to avoid or minimize all impacts to natural resources that may occur in the vicinity of the route upon final route approval. The transmission routing study utilized available government GIS-formatted information with regard to wetlands, important species, and other topics pertaining to terrestrial ecology.

5.6.1.6 Mitigation

Mitigation planning for the transmission line, if necessary for wetlands and potential avian collisions, will be accomplished through consultation with natural resource agencies after final routing and design have been formalized. Wetlands mitigation will be in accordance with the permit conditions. It is anticipated that there may be mitigation efforts at various areas along the line to minimize the potential for bird collisions with the lines. In 2005, the Avian Power Line Interaction Committee and the USFWS prepared the *Avian Protection Plan (APP) Guidelines* that outline suggestions to reduce avian collision potential (Reference 5.6-6). These guidelines will be utilized in part if it becomes necessary to develop mitigation measures.

5.6.2 AQUATIC ECOSYSTEMS

The effects of transmission line corridor construction on aquatic ecosystems are evaluated in Subsection 4.3.2. The impacts that were considered as a result of the operation of the transmission system are outlined in the ESRP, Subsection 5.6.2. The ESRP considered the effects of ROW maintenance and assessed the impacts to important species and habitats (defined in ESRP Table 2.4.1-1) other than humans. No important species (including threatened, endangered, or otherwise protected species) or habitats would be affected by the transmission system. Based on maintenance plans for the ROW discussed in Subsection 5.6.1.1, no impacts are expected from maintenance activities. Therefore, impacts to the aquatic ecosystem from operation of the transmission system are expected to be SMALL, and no mitigation is proposed.

5.6.3 IMPACTS TO MEMBERS OF THE PUBLIC

The effects of transmission line corridor construction on land use are evaluated in Subsection 4.1.2. Various aspects of transmission line operation (e.g., ozone production) have the potential to affect on land use through their effects on wildlife and humans. These effects are evaluated in Section 5.1. None of these potential impacts is expected to be significant to agricultural or other land uses in the area. Cultivation and grazing can continue beneath the new 500 kV off-site line as they did before construction of the new transmission corridor. Many new towers would be needed to support the new transmission line, since this is to be a new line in a completely new corridor between the RBS Fancy Point Substation and the Mount Olive to Hartburg 500 kV line in western Louisiana (near Natchitoches). The exact number of new bases will not be known until specific plans for the new transmission corridor are finalized.

The Applicant's transmission lines are designed for voltage levels of less than 765 kV to reduce adverse impacts that may result from ozone formation, as explained in NUREG-1437, Volume 1, Subsection 4.5.1. For 765 kV and higher voltage lines, consideration of potential effects of electromagnetic fields and corona discharge, including potential noise impacts to terrestrial biota, may be warranted. Additional potential adverse impacts include electric shock, electromagnetic field effects, corona discharge, and visual impacts (Reference 5.6-4). Although the RBS Unit 3 transmission lines are 500 kV, which is less than the 765 kV level of concern for the adverse impacts described in the NUREG-1437, similar potential adverse impacts are discussed in this subsection for completeness.

As described in Subsection 2.2.2 and Section 3.7, expansions of the existing on-site transmission system and a new off-site corridor would be used to transport power from RBS Unit 3 to the electric power grid. The Applicant's transmission and distribution study calls for an additional 500 kV transmission line on new towers to accommodate the additional electrical output anticipated from RBS Unit 3. Corresponding modifications and expansion work would also be done on the existing RBS Fancy Point Substation so that it could accommodate the new transmission line. This additional line would add power to the transmission system in the southwest Louisiana region and would provide an alternative power source in the event of an outage on the Mount Olive to Hartburg 500 kV line in western Louisiana and southeast Texas.

An expansion of the existing on-site corridor would be needed from its current width of about 150 ft. to an expanded total width of approximately 450 ft. for both existing and new transmission lines. New towers would be erected to support the new line and would have similar footprints and appearances as the existing towers that serve RBS Unit 1. Once the new transmission corridor is constructed, there would be no additional land disturbance during operation. Routine maintenance of the line would be the main activity during operation. It would be very unlikely that members of the public would be affected by the on-site portion of the new transmission system because members of the public are not permitted to access the RBS site.

The new off-site 500 kV transmission corridor proposed to be constructed for RBS Unit 3 would have a 200 ft. width and would be approximately 148 mi. long. New towers with approximately 45 by 45 ft. bases would be used along the new corridor approximately every 1000 to 1200 ft., depending on the features being spanned by the line. At the western terminus of the line, construction of a 1000 by 1000 ft. switchyard is proposed. The impacts to members of the public from the RBS Unit 3 new off-site transmission line would be minimal, similar to those occurring from other existing high-voltage transmission lines in the area. The proposed new transmission corridor route was selected in part to avoid populated areas and other areas that the public would be likely to access. The operation and maintenance of the new transmission system may result in visual impacts, electric shock hazards, electromagnetic field exposure, noise impacts, and radio and television interference. Interference with wireless Internet services and cellular phones is possible, but would only occur in the unlikely event that use of these devices by members of the public occurred directly under the transmission line or within the corridor area. As described below, impacts to members of the public from transmission system operation are expected to be SMALL.

5.6.3.1 Visual Impacts

Existing transmission lines for RBS Unit 1 were constructed with consideration given to minimizing impacts on environmental resources and visual values. These considerations would be continued throughout the proposed transmission system modifications described in Subsection 2.2.2. The visual impacts of the on-site transmission system would not change significantly as a result of the addition of the RBS Unit 3 transmission line because the new line would be located in an expansion of the existing transmission corridor that has been in place for more than 20 years. The majority of the transmission infrastructure on the RBS site is not visible to the public. However, the appearance of the new towers and line would be consistent with the present towers and lines and would result in a small visual change for most observers. The new off-site transmission line and towers would be visible to the public in several areas along the 148 mi. corridor, but the visual impact would be minimal because most viewers would see the lines for a relatively short time or would see only a short expanse of the lines in passing the transmission corridor on local roads. To increase visibility for aircraft, lighting on the 150-ft. transmission towers would be at a height that would be noticeable to most observers on the ground, but high enough that it should not cause annoyance or disturbance to residents living near the new transmission corridor.

The new transmission corridor from RBS to Natchitoches, Louisiana, would pass through mostly rural areas and a variety of landscapes and habitat types, as outlined in Table 2.4-5. The Applicant's routing study favored developed or otherwise open lands to the greatest extent possible and avoided parklands, wildlife areas, and similar public features to minimize visual impacts. Although forested areas would visually mask the transmission line in some areas, forest areas (except pine plantations) were avoided because of potential impacts to wildlife and habitat. Based on the proposed alignment, the visual impacts to members of the public from RBS Unit 3 transmission system operation are considered SMALL.

5.6.3.2 Electric Shock Potential

Objects located near transmission lines can become electrically charged because of their immersion in the lines' electric field. This charge results in a current that flows through the object to the ground. This is called an induced current because there is no direct connection between the line and the object. Induced current can also flow to the ground through the body of a person who touches the charged object.

Transmission line electric fields can cause an induced current in nearby grounded objects, as well as the buildup of voltage on nearby ungrounded objects such as automobiles, electric or non-electric fences, railroad tracks, and rain gutters.

Induced current can be prevented by grounding metal objects that are in the transmission line ROWs. Grounding chains can be easily installed on tractors. Metal fences can be connected to a simple ground rod with an insulated lead and wire clamp. Grounding of objects within the ROWs is in accordance with the Institute of Electrical and Electronics Engineers Recommended Practices for Grounding of Industrial and Commercial Power Systems (IEEE-142). Impacts due to electric shock as a result of induced current are potentially adverse, but can be easily mitigated; therefore, impacts are considered SMALL.

An object that is insulated from the ground can store an electrical charge, becoming capacitively charged. A person standing on the ground and touching a vehicle or a fence receives an electrical shock because of the sudden discharge of the capacitive charge through the person's body to the ground. After the initial discharge, a steady-state current can develop, the magnitude of which depends on several factors, including the following:

- The strength of the electric field, which depends on the transmission line voltage.
- The height and geometry of the individual transmission wires.
- The size of the object on the ground.
- The extent to which the object is grounded.

The *National Electrical Safety Code (NESC)* has a provision that describes how to establish minimum vertical clearances to the ground for electric lines having voltages exceeding 98 kV. The clearance must limit the induced current due to electrostatic effects to 5 milliamperes (mA) if the largest anticipated truck, vehicle, or equipment were short-circuited to ground (Reference 5.6-7). To reduce the potential for vehicle-to-ground short-circuit shock to vehicles parked beneath the lines, the existing transmission lines are currently designed to provide clearances consistent with the NESC 5 mA rule. The proposed new off-site transmission corridor described in Section 3.7 and Subsection 2.2.2 would have minimum clearance heights for the 500 kV line of 26 to 28 ft. throughout its length, with a greater minimum height of 40 ft. near road crossings. All on-site and off-site transmission lines would continue to comply with the NESC provisions.

Analysis of this area of impact, detailed in NUREG-1437, concludes that "potential electrical shock impacts are of small significance for transmission lines that are operated in adherence with the NESC" (Reference 5.6-4). The Applicant expects that electric field strength under the transmission lines would conform to the NESC guidelines (less than 7.5 kV/m maximum within the ROW, and less than 2.6 kV/m maximum at the edge of the ROW). The Applicant has not noted any problems with electric shock or electrostatic effects in maintenance records for the existing transmission lines. As a result, and because all RBS transmission lines would comply with NESC provisions to prevent electric shock, potential electric shock impacts would be SMALL for both on-site an off-site transmission lines, and no mitigation measures would be needed.

5.6.3.3 Electromagnetic Field Exposure

The existing transmission and distribution system at RBS meets NESC criteria for induced currents; any modifications to the existing system will comply with the relevant local, state, and industry standards, including the NESC. The Applicant has developed engineering and construction design control documents pertaining to transmission systems. These design control documents establish company requirements to comply with current applicable NESC criteria. All Applicant transmission lines meet these standards, which provide appropriate assurance that impacts to the public attributable to the acute effects of electromagnetic fields (EMF) will be minimized.

In 1992, Congress established a research and educational program designed to determine whether exposure to extremely low frequency electric and magnetic fields (EMF) was harmful to humans. The research and information compilation effort was conducted by the National Institute of Environmental Health Sciences (NIEHS), the National Institutes of Health, and the U.S. Department of Energy (DOE). Their findings state that, "The scientific evidence suggesting that ELF-EMF exposures pose any health risk is weak." Nevertheless, the NIEHS concluded that such exposure could not be ruled entirely safe, but that the evidence was insufficient to warrant aggressive regulatory concern (Reference 5.6-8). In a subsequent 2002 bulletin, the NIEHS provided an overview of recent scientific studies and summarized various expert review panel evaluations of the body of evidence regarding EMF (Reference 5.6-9). That bulletin reiterated and accepted the conclusions provided in the 1999 study report. The Applicant concurs with this finding, but nonetheless continues to monitor industry research on this subject through membership in industry research associations, including the Edison Electric Institute (EEI) and the EPRI, and support of ongoing research on effects of EMF.

Acute and chronic effects of transmission line operation to members of the public appear to be minimal and unknown, respectively, according to the body of scientific research on the subject. Most EMF research studies call attention to the need for further research because of the adverse effects reported in some studies. The EMF experts recommend a policy of "prudent avoidance," or reducing EMF exposure whenever possible without excessive cost or inconvenience (Reference 5.6-10). The Applicant has not encountered significant environmental problems associated with EMF from its 230 kV and 500 kV transmission lines and should be able to operate the RBS power lines without significant effect. If problems arise, it is likely that they can be eliminated by modifications of the lines or ROW (Reference 5.6-11). Accordingly, impacts to members of the public from EMF associated with the RBS Unit 3 transmission system operation are considered SMALL.

5.6.3.4 Noise

High-voltage transmission lines can emit noise when the electric field strength surrounding them is greater than the breakdown threshold of the surrounding air, creating a discharge of energy. This energy loss, known as corona discharge, is affected by ambient weather conditions such as humidity, air density, wind, and precipitation, and by irregularities on the energized surfaces. The transmission lines at the RBS site are designed with hardware and conductors that have features to eliminate corona discharge and to ensure that they are corona-free up to their maximum operating voltage. Nevertheless, during wet weather, the potential for corona loss increases, and it could occur if insulators or other hardware have any defects. NUREG-1437 (Reference 5.6-4) explains that corona discharge results in audible noise, radio and television interference, energy losses, and the production of ozone, but is generally not a problem.

Potential noise sources for power transmission systems include transformers and transmission line conductor corona discharge. No new substation transformers are planned for the site. A new on-site transmission line will be located adjacent to the existing corridor on the RBS site, whereas the off-site portion from RBS to Natchitoches, Louisiana, will be located in a new corridor. The existing on-site transmission line corridor is located approximately 900 ft. from the nearest noise sensitive receptor, as described in Section 2.5. Typical worst-case noise levels from corona discharge (i.e., during periods of heavy rain) are below 70 dBA at ground level directly below the transmission lines. Information related to the estimated noise impacts associated with the transmission system operation is included in Subsection 5.8.1.1.

Corona-induced noise along the existing transmission lines is very low, except possibly directly below the line on a quiet, humid day. The Applicant does not expect complaints on nuisance noise from the expanded on-site transmission lines. The new off-site corridor would be completely new, so it is reasonable to expect that there may be some noise complaints near the beginning of the new transmission line operating period. When the new transmission line to Natchitoches has been in operation for a length of time, it is anticipated that noise complaints would decrease as nearby members of the public become accustomed to the low-level noise from the line. Since transmission line corona noise does not have adverse effects on humans (except as a potential minor annoyance) and the noise produced is at a low level, impacts are expected to be SMALL.

5.6.3.5 Radio, Television, Cellular Phone, and Wireless Internet Interference

Generally, the cause of radio and television interference from transmission lines is a result of corona discharge from defective insulators or hardware. Corona increases with voltage, adverse weather conditions (e.g., high humidity or fog), and the number of surface irregularities (e.g., scratches, dirt particles) on the conductors. Radio interference from corona discharge is most likely to affect the amplitude modulation (AM) broadcast band (535 to 1605 kilohertz); frequency modulation (FM) radio is rarely affected. AM receivers would have to be located in proximity to transmission lines to experience potential radio interference effects. During damp or rainy weather, potential interference from corona effects is more likely (Reference 5.6-12).

There is a very small potential that the transmission lines could interfere with pacemakers or defibrillators if this kind of equipment were being used by people proximate to or directly below the lines (Reference 5.6-13). It is highly unlikely that this kind of interference would happen because the transmission corridor has been sited as far from residences as practical and because the transmission lines are suspended at a height tall enough to be distant from people on the ground. Also, people using this kind of equipment would likely be aware of possible interference effects and would thereby remain in areas away from the transmission corridor.

Although radio and television interference can occur, it is not a common or widespread phenomenon along transmission lines. The radio and television interference can vary from static sounds on AM radios to distorted TV reception, and magnetic fields can cause flickering in computer monitors. The majority of radio and television interference problems result from local, lower voltage electric distribution lines that serve residences and businesses, not high-voltage transmission lines. When radio and television interference is generated by a transmission line, it does attenuate with lateral distance from transmission lines and is typically not an issue beyond a few hundred feet out from the line. Because of this, emergency and business operations would not experience large impacts with the appropriate distance from the transmission corridor (Reference 5.6-14).

Wireless Internet services usually are not affected by high-voltage transmission lines unless the home or business attempting to use these services is directly under the lines or immediately adjacent to the corridor edge or ROW. Similarly, transmission line interference with cellular telephones would be very unlikely to occur unless phone use was attempted directly under the lines. Difficulties with Internet or cell phone interference would likely be resolved by the user moving out from under the transmission lines and out of the corridor.

Should complaints about electromagnetic interference with radio, television, cellular phone, wireless Internet reception, or other electrical devices occur, the Applicant would investigate the cause and, if necessary, replace the defective component to correct the problem. As described in Subsection 5.6.3.4, the transmission lines that provide service to the RBS site are designed to be corona-free up to their maximum operating voltage. The Applicant expects that radio, television, cellular phone, and wireless Internet interference from the proposed new transmission corridor would be SMALL.

5.6.4 REFERENCES

5.6-1 Gulf States Utilities Company, "River Bend Station Environmental Report, Operating License Stage," Volumes 1-4, Supplements 1-9, November 1984.

5.6-2 Executive Order 13112, "Invasive Species," February 3, 1999.

5.6-3 National Invasive Species Council, *2008-2012 National Invasive Species Management Plan*, Draft for Public Comment, December 20, 2007.

5.6-4 U.S. Nuclear Regulatory Commission, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437, Vol. 1, Washington, D.C., 1996.

5.6-5 California Energy Commission, *A Roadmap for PIER Research on Avian Collisions with Power Lines in California*, California Energy Commission Staff Report P500-02-071F, December 2002.

5.6-6 Avian Power Line Interaction Committee and U.S. Fish & Wildlife Service, *Avian Protection Plan (APP) Guidelines*, 2005.

5.6-7 Institute of Electrical and Electronics Engineers, *National Electrical Safety Code*, C2-2007, Part 2, Rules 232C1 and 232D3c, New York, New York, August 2006.

5.6-8 National Institute of Environmental Health Sciences, *NIEHS Report on Health Effects from Exposure to Power-Line Frequency and Electric and Magnetic Fields*, Publication No. 99-4493, National Institutes of Health, May 1999.

5.6-9 National Institute of Environmental Health Sciences, *EMF Questions & Answers, Electric and Magnetic Fields Associated with the Use of Electric Power*, Publication No. 02-4493, National Institutes of Health, June 2002.

5.6-10 Neuert Electromagnetic Services, FAQs, Website, http://www.emfcenter.com/faqs.htm, 2007, accessed November 2007.

5.6-11 U.S. Nuclear Regulatory Commission, *Final Environmental Statement Related to the Operation of River Bend Station*, NUREG-1073, Docket No. 50-458, January 1985.

5.6-12 Tucson Electric Power Company, Sahuarita-Nogales Transmission Line, "Draft Environmental Impact Statement," DOE/EIS - 0336, BLM Reference No. AZA 31746, July 2003.

5.6-13 "Medtronic Guidelines: Home and Work, Tachyrrhythmia, 2008," Website, http://www.medtronic.com/servlet/ContentServer?pagename=Medtronic/Website/StageArticle&ConditionName=Tachyarrhythmia&Stage=Treatment&Article=tachy_art_home_and_work, accessed March 27, 2008.

5.6-14 Southern California Edison, Antelope-Pardee 500 kV Transmission Line Project, "Environmental Impact Report/Environmental Impact Statement," Appendix 8, Draft EIR/EIS Comments and Responses, Comment Set C.189: Laurie De Santis-Staschik and Family, December 2006, Website, http://www.cpuc.ca.gov/environment/info/aspen/antelopepardee/EIR/Appendices/Appendix%208-Comments%20and%20Responses/C.%20Individuals/C-189_LaurieDeSantis-Staschik.pdf, accessed March 27, 2008.

5.7 URANIUM FUEL CYCLE AND TRANSPORTATION IMPACTS

This section discusses the impacts of the uranium fuel cycle (Subsection 5.7.1) and transportation of radioactive materials.

5.7.1 URANIUM FUEL CYCLE IMPACTS

This subsection discusses the environmental effects associated with the uranium fuel cycle (UFC). The UFC is defined as the total of those options and processes associated with the provision, utilization, and ultimate disposition of fuel for nuclear power reactors.

Table S-3 of 10 CFR 51.51 provides estimates of the environmental effects due to the UFC. The effects are calculated for a reference 1000 MWe light-water-cooled reactor (LWR) operating at an annual capacity factor of 80 percent for a net electric output of 800 MWe (Reference 5.7-1). This is referred to as the reference plant throughout this section. Data are calculated and presented in tables for land use, water consumption, thermal effluents, radioactive releases, waste burial, and radiation doses. The NRC regulation 10 CFR 51.51 requires that the data in Table S-3 be used as the basis for evaluation of the proposed project.

A single ESBWR is proposed for RBS Unit 3. The unit's gross electrical power is 1600 MWe. A capacity factor of 95 percent, higher than the American nuclear fleet average, is applied. The reactor operating at 1600 MWe, with an annual capacity factor of 95 percent, yields a net electric output of 1520 MWe. A ratio of the generation values of 1520 MWe and 800 MWe provides a scale factor of 1.90 to convert reference plant values to RBS Unit 3 specific values (refer to Table 5.7-1). The RBS Unit 3 values are presented in the text and tables of this subsection.

In developing the reference plant data, the NRC staff considered two UFC options: no recycle and uranium-only recycle; these differ only in the treatment of spent fuel removed from a reactor. The no recycle option treats all spent fuel as waste to be stored at a federal waste repository. The uranium-only recycle option involves reprocessing spent fuel to recover unused uranium and return it to the UFC. The reference plant values provided for reprocessing, waste management, and transportation are from the UFC option resulting in the larger environmental effect.

The Nuclear Nonproliferation Act of 1978 (Reference 5.7-2) effectively banned any reprocessing or recycling of spent fuel from U.S. commercial nuclear power. The ban on reprocessing spent fuel was lifted in 1981, but the combination of economics, uranium ore stockpiles, and nuclear industry stagnation provided little incentive for the industry to resume reprocessing. The Energy Policy Act of 2005 (Reference 5.7-3) authorized the DOE to research and develop proliferation-resistant fuel recycling and transmutation technologies that minimize environmental or public health and safety effects. Federal policy currently allows reprocessing, but additional efforts are required before commercial reprocessing and recycling of spent fuel produced in U.S. commercial nuclear power plants could commence.

The stages of the UFC include the following:

- Mining.
- Conversion.

- Enrichment of uranium.
- Fabrication of nuclear fuel.
- Use of this fuel.
- Disposal of the used (spent) fuel.

Figure 5.7-1 illustrates this process.

Natural uranium is extracted from the earth through either open-pit or underground mines or by an in situ leaching (ISL) process. ISL involves injecting a solvent solution into the underground uranium ore to dissolve uranium, and then pumping the solution to the surface for further processing. The ore or leaching solution is moved to mills, where it is processed to produce uranium oxide (U_3O_8). The uranium oxide is then converted to uranium hexafluoride (UF_6) in preparation for the enrichment process.

The UF_6 is then transported to an enrichment facility. The enrichment process increases the percentage of the more fissile isotope uranium-235 (U-235) and decreases the percentage of isotope uranium-238 (U-238). Natural uranium is approximately 0.7 percent U-235. The enrichment process exploits the slight differences in atomic weights of the two isotopes. A feature common to large-scale enrichment schemes is that they employ a number of identical stages, which use a cascading process to produce successively higher concentrations of U-235. Each stage concentrates the product of the previous stage further before being sent to the next stage. Similarly, the tailings from each stage are returned to the previous stage for further processing.

At a fuel fabrication facility, the enriched uranium is then converted from UF_6 to uranium dioxide (UO_2). The UO_2 is formed into pellets, inserted into tubes, and loaded into fuel assemblies. The fuel assemblies are placed in the reactor to produce power. After most of the U-235 has fissioned, the concentration reaches a point where the nuclear fission process becomes inefficient. The fuel assemblies are then withdrawn from the reactor. After on-site storage for sufficient time to allow for short-lived fission product decay and to reduce the heat generation rate, the fuel assemblies are transferred to a waste repository for interment. Storing the spent fuel elements in a repository constitutes the final step in the no-recycle option.

For this analysis, the environmental effects of the UFC resulting from the operation of RBS Unit 3 were assessed. This assessment was based on the RBS Unit 3 values calculated in Table 5.7-2 and an analysis of the radiological effects from radon-222 (Rn-222) and technetium-99 (Tc-99). In NUREG-1437 (Reference 5.7-4), the NRC staff provide a detailed analysis of the environmental effects from the UFC. Although NUREG-1437 is specific to license renewal, the information is relevant because the LWR design considered herein uses the same type of fuel. The analyses in Section 6.2.3 of NUREG-1437 are summarized and presented in this subsection.

Recent changes in the UFC may have some bearing on environmental effects. The Applicant concludes that the effects of the current UFC are less than those identified for the reference plant, as discussed below. The reference plant values were calculated from industry averages for each type of facility or operation within the UFC. Recognizing that this approach results in a range of values for each estimate, the NRC staff chose the assumptions or factors to be applied so that the calculated values are not underestimated. This approach was intended to ensure that the actual environmental effects are less than the quantities shown for the reference plant and envelop the widest range of operating conditions for LWRs.

Some UFC parameters and interactions were recognized by the NRC staff as being less precise than the estimates and were not considered or were considered, but had no effect on the reference plant calculations. To determine the annual fuel requirement, the NRC staff defined the model reactor as a 1000 MWe LWR. The NRC staff assumed an 80 percent capacity factor, a 12-month fuel reloading cycle, and an average fuel burnup of 33,000 megawatt-days (MWd) per metric ton (MT) of uranium. This is referred to here as a "reactor reference year" (RRY). The current expected lifetime of a new nuclear plant is 60 years (the 40-year initial licensing plus one 20-year license renewal term). The sum of the initial fuel loading and all of the expected reloads for the lifetime of the reactor are divided by the 60-year expected lifetime to obtain an average annual fuel requirement. This quantity of fuel was determined for both boiling water reactors (BWRs) and pressurized water reactors; the higher annual requirement, a BWR using 35 MT of uranium, was chosen in NUREG-1437 as the basis for the RRY.

A number of fuel management improvements have been adopted by nuclear power plants to achieve higher performance and to reduce fuel and enrichment requirements. Since the reference plant data were promulgated, these improvements have resulted in an overall reduction of the annual fuel requirement.

Another factor is the elimination of U.S. restrictions on the importation of foreign uranium. The economic conditions of the uranium market have, until recently, favored the utilization of foreign uranium rather than domestic uranium. These market conditions had led to the closing of most domestic uranium mines and mills and had substantially reduced the environmental effects in the United States from these activities. However, because of the increasing cost of uranium and the anticipated increase due to demand from new plants now involved in licensing and construction, U.S. uranium production has begun to increase and is expected to continue to do so. These changes to the UFC suggest that the environmental effects of mining and milling could temporarily drop levels below those given for the reference plant, but would probably creep upward again, making the reference numbers accurate. For the purposes of this analysis, the reference plant estimates have not been reduced.

Section 6.2 of NUREG-1437 discusses the sensitivity to recent changes in the UFC on the environmental effects in detail.

Where relevant in discussions below, a single significance level of the potential effect (i.e., SMALL, MODERATE, or LARGE) is assigned to each analysis. This is consistent with the criteria that the NRC established in 10 CFR 51, Appendix B, Table B1, Footnote 3, as follows:

- SMALL: Environmental effects are not detectable or are so minor that they neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small.

- MODERATE: Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource.

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

5.7.1.1 Land Use

The total annual land requirement for the UFC supporting RBS Unit 3 is 215 acres. This includes values for both permanently and temporarily committed land. A "temporary" land commitment is a commitment for the life of the specific UFC plant (e.g., a mill, enrichment plant, or succeeding plants). Following the 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. This is because decommissioning activities on the pertinent land cannot remove sufficient radioactive material to meet the limits in 10 CFR 20, Subpart E, for the release of the land for unrestricted use. The division of temporarily committed land into undisturbed and disturbed land is presented in Table 5.7-2. The value associated with the disturbed land is compared to the land disturbed to provide fuel for a coal-fired power plant using strip-mined coal with power generation equivalent to the RBS Unit 3 value. If the quality and opportunity cost of the land is equivalent, it is reasonable to assume that the land requirements are SMALL. Therefore, it was concluded that the impact on land use to support RBS Unit 3 would be SMALL.

5.7.1.2 Water Use

Power stations supply electrical energy to the enrichment stage of the UFC. The primary water requirement of the UFC is waste heat removal from these power stations. For the UFC supporting the RBS Unit 3, more than 97 percent of the annual water requirement is used in this manner. Values for the various water uses required are presented in Table 5.7-2.

On a thermal effluent basis, annual discharges from the UFC are equal to approximately 4 percent of the thermal effluent from the reference plant using once-through cooling. The consumptive water use is approximately 2 percent of the consumptive water use of the reference plant using cooling towers. The expected thermal effluent values for RBS Unit 3 are presented in Table 5.7-2. The amount of water withdrawn from surface and groundwater and discharged to air by RBS Unit 3 activities within the fuel cycle represents only 3.8 percent of the annual discharges to air of an LWR with cooling towers. The fuel cycle discharges are spread among facilities involved in the various stages of the fuel cycle; thus, the water discharges to air from any one of these facilities are less than 3.8 percent. The amount of water discharged to the air and discharged to water bodies and to the ground represents only 7.6 percent of the annual discharges to water bodies and the ground of the model LWR with once-through cooling. The fuel cycle discharges are spread among facilities involved in the various stages of the fuel cycle; thus, the water discharges from any one of these facilities are less than 7.6 percent. Given that the water discharged to water bodies and to the ground from other fuel cycle facilities for an RRY is only a small fraction of the discharge from an LWR, it was concluded that the impact to support RBS Unit 3 would be SMALL.

5.7.1.3 Fossil Fuel Effects

Electrical energy and process heat are required during various phases of the UFC process. The electrical energy is usually produced by the combustion of fossil fuels at power plants. The RBS Unit 3 electrical energy needs associated with the UFC represent approximately 9.5 percent of the annual electrical power production of the reference plant. Process heat is primarily generated by the combustion of natural gas. This gas consumption, if used to generate electricity, is less than 0.8 percent of the electrical output from the reference plant. The electrical energy needs for RBS Unit 3 associated with the UFC are presented in Table 5.7-2. It was concluded that the fossil fuel impacts from the consumption of electrical energy for UFC operations would be SMALL, relative to the net power production of RBS Unit 3.

5.7.1.4 Chemical Effluents

The quantities of chemical, gaseous, and particulate effluents due to UFC processes to support RBS Unit 3 are presented in Table 5.7-2. The principal effluents are oxides of sulfur (SO_x), oxides of nitrogen (NO_x), and particulates. The volume of effluent is equivalent to that of a quite small (86 MWe) coal-fired plant; thus, it is concluded that the impact to the degradation of air quality is SMALL. Based on data in *The 1997 Annual Report of the Council on Environmental Quality* (Reference 5.7-5), 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 (i.e., approximately 0.06 percent maximum of the annual national releases for each of these species).

Liquid chemical effluents produced in the UFC processes are related to the ISL process, fuel enrichment, and fabrication and may be released to receiving waters. These effluents are usually present in such small concentrations that only small amounts of dilution water are required to reach levels of concentration that are within established standards. Table 5.7-2 presents the amount of dilution water required for specific constituents. Additionally, any liquid discharges into the navigable waters of the United States from plants associated with UFC operations are subject to the requirements and limitations set in an LPDES permit issued by an appropriate federal, state, regional, local, or affected Native American tribal regulatory agency.

Tailings solutions and solids are generated during the milling process. These materials are not released in quantities sufficient to have a significant effect on the environment. It was concluded that the impact of these chemical effluents would be SMALL.

5.7.1.5 Radioactive Effluents

The estimates of radioactive effluent releases to the environment are presented in Table 5.7-2. These are from the ISL process, waste management activities, and certain other phases of the UFC process. The 100-year involuntary environmental dose commitment to the U.S. population is calculated in several parts.

As presented in Table 5.7-4, the portion of dose commitment from radioactive gaseous effluents during reactor operation is 760 person-rem per year of operation of the RBS Unit 3. This estimate excludes reactor releases and any dose commitment from Rn-222.

The portion of dose commitment from radioactive liquid effluents due to all UFC operations other than reactor operation is 380 person-rem per year of operation of the RBS Unit 3.

Thus, the total 100-year environmental dose commitment to the U.S. population from radioactive gaseous and liquid releases resulting from these portions of the UFC is 1140 person-rem per year of operation of the RBS Unit 3. Using risk estimators of 500 cancer deaths per 1 million man-rem (Reference 5.7-6), the estimated cancer risk is 0.6 cancer deaths per RRY (1140 x 500 x 10^{-6}).

Currently, the radiological effects associated with Rn-222 and Tc-99 release are not addressed in the reference plant data. Principal Rn-222 releases occur during mining and milling operations and as emissions from mill tailings, whereas principal Tc-99 releases occur from gaseous diffusion enrichment facilities.

In Section 6.2.2.1 of NUREG-1437, the NRC staff estimated the Rn-222 releases from the mining and milling operation and from mill tailings required to support each year of operations of the reference plant. Of this total, approximately 78 percent are from mining, 15 percent from milling operations, and 7 percent from inactive tailings prior to stabilization. The major risks from Rn-222 are bone and lung exposure, although there is a small risk from whole-body exposure. The organ-specific dose weighting factors from 10 CFR 20 were applied to the bone and lung doses to estimate the 100-year dose commitment from Rn-222 to the whole body. The estimated population dose commitment from mining, milling, and tailings before stabilization for each year of operation of RBS Unit 3 is presented in Table 5.7-3. From stabilized tailing piles, the estimated 100-year environmental dose commitment is presented in Table 5.7-3.

The NRC staff also considered the potential health effects associated with the release of Tc-99. It was determined release of Tc-99 per year of RBS Unit 3 operation would be from chemical reprocessing of recycled UF_6 before it enters the isotope enrichment cascade and is released into the groundwater from a federal repository. These values are presented in Table 5.7-3.

The major risks from Tc-99 are from gastrointestinal tract and kidney exposure, although there is a small risk from whole-body exposure. Using organ-specific risk estimators, these individual organ risks can be converted to a whole-body 100-year dose commitment per year of RBS Unit 3 operation. This value is presented in Table 5.7-3.

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 a lifetime dose of 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 was used to describe the relationship between radiation dose and risk, such as cancer induction. A report by the National Research Council (Reference 5.7-7) supports the linear, no-threshold dose response model. 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 NRC staff estimated the risk to the public from radiation exposure. The sum of the estimated whole-body population doses from gaseous effluents, liquid effluents, Rn-222, and Tc-99 discussed above can be used to estimate the number of fatal cancers, nonfatal cancers, and severe hereditary effects that the U.S. population would incur annually. This risk is quite small compared to the number of fatal cancers, nonfatal cancers, and severe hereditary effects that are estimated to occur in the U.S. population annually from exposure to natural sources of radiation using the same risk estimation method.

The radiation levels from Rn-222 released from tailing piles are indistinguishable from background radiation levels at a few kilometers from the tailing pile (at less than 1 km in some cases). The public dose limit specified by the EPA's regulation in 40 CFR 190 is 0.25 mSv/yr (25 mrem/yr) to the whole body from the entire UFC, but most NRC licensees have airborne effluents resulting in doses of less than 0.01 mSv/yr (1 mrem/yr) (Reference 5.7-4).

In addition, at the request of the U.S. Congress, the National Cancer Institute (NCI) conducted a study and published "Cancer in Populations Living Near Nuclear Facilities: A Survey of Mortality Nationwide and Incidence in Two States" in 1990 (Reference 5.7-8). The report concluded that if any excess cancer risk was present in U.S. counties with nuclear facilities, it was too small to be detected with the methods employed. The contribution to the annual average dose received by an individual from the UFC-related radiation and other sources is presented in Table 5.7-5.

Based on the analyses presented above, it was concluded that the environmental impact of radioactive effluents from the UFC would be SMALL.

5.7.1.6 Radioactive Wastes

The quantities of buried radioactive waste material (low-level, high-level, and transuranic wastes) are specified in Table 5.7-2. For low-level waste disposal at land burial facilities, the NRC notes in the reference plant data that there are to be no significant radioactive releases to the environment. For high-level and transuranic wastes, the NRC notes that these are expected to be buried at a repository and that no release to the environment is expected to be associated with such disposal. The gaseous and volatile radionuclides contained in the spent fuel would have been released and monitored before disposal.

On July 9, 2002, the U.S. Senate cast the final legislative vote to approve the Yucca Mountain site for the development of a repository for the geologic disposal of spent nuclear fuel and high-level nuclear waste. This was then approved by the President on July 23, 2002, allowing the DOE to continue work on this repository (Reference 5.7-9).

The EPA developed Yucca Mountain-specific repository standards, which were subsequently adopted by the NRC in 10 CFR 63. In an opinion issued on July 9, 2004, the U.S. Court of Appeals for the District of Columbia Circuit Court vacated the EPA's radiation protection standards for the candidate repository, which required compliance with certain dose limits over a 10,000-year period (Reference 5.7-10). The Court's decision also vacated the compliance period in NRC's licensing criteria for the candidate repository in 10 CFR 63. In response to the Court's decision, the EPA issued proposed revised standards on August 22, 2005. The proposed standard would revise the radiation protection standards for the candidate repository (Reference 5.7-11). As required by the Nuclear Waste Policy Act of 1982 (Reference 5.7-12), and in order to be consistent with the EPA's revised standards, the NRC proposed revisions to 10 CFR 63 on September 8, 2005. The proposed standards are 0.15 mSv/yr (15 mrem/yr) for 10,000 years following disposal and 3.5 mSv/yr (350 mrem/yr) after 10,000 years through 1 million years after disposal. It is concluded that this impact is acceptable, because the impact is not sufficiently great to require the conclusion of the National Environmental Policy Act (NEPA) analysis to be that the construction and operation of the RBS Unit 3 should be denied. For the reasons stated above, it was concluded that the environmental impact of radioactive waste disposal from the UFC would be SMALL.

5.7.1.7 Occupational Dose

In the review and evaluation of the environmental effects of the UFC, the annual occupational dose attributable to all phases of the UFC for the RBS Unit 3 is approximately 1140 person-rem (Table 5.7-4). Occupational doses are maintained to meet the dose limits in 10 CFR 20, which is 5 rem/yr. On this basis, it was concluded that environmental effects from this occupational dose would be SMALL.

5.7.1.8 Transportation

The transportation dose to workers and the public totals approximately 4.8 person-rem annually for the RBS Unit 3, according to Table 5.7-2. On this basis, it was concluded that the environmental impact of transportation would be SMALL.

5.7.1.9 Conclusion

Using an evaluation process as provided by NUREG-1437 (Reference 5.7-4), this evaluation has examined the environmental impact of the UFC, considered the impact of Rn-222 and Tc-99, and appropriately scaled the data for the RBS Unit 3. Based on this comparison, it was concluded that the environmental impact of the UFC would be SMALL, and mitigation is not warranted.

5.7.2 TRANSPORTATION OF RADIOACTIVE MATERIALS

Section 3.8 addresses the impacts of the transportation of radioactive materials. It discusses the transportation of fuel and radioactive wastes to and from the reactor and describes those design and operational parameters that meet the requirements of 10 CFR 51.52(b).

5.7.3 REFERENCES

5.7-1 U.S. Nuclear Regulatory Commission, *Environmental Survey of the Uranium Fuel Cycle*, WASH-1248, 1974.

5.7-2 U.S. Government, Nuclear Nonproliferation Act of 1978, Publication L, No. 95-242 (22 USC 3201 et seq.).

5.7-3 U.S. Government, Energy Policy Act of 2005, Publication L, No. 109-58 (119 Stat. 594 [2005]).

5.7-4 U.S. Nuclear Regulatory Commission, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437, Vol. 1, Washington, D.C., 1996.

5.7-5 U.S. Council on Environmental Quality, *The 1997 Annual Report of the Council on Environmental Quality*, Website, ceq.eh.doe.gov/NEPA/reports/1997/index.html, accessed February 2008.

5.7-6 Evans, J. S., et al., Office of Nuclear Regulatory Research, "Part I: Introduction, Integration, and Summary," *Health Effects Models for Nuclear Power Plant Accident Consequence Analysis*, NUREG/CR-4214, Rev. 2, Washington, D.C., 1993.

5.7-7 National Academy of Sciences, National Research Council, *Health Risks from Exposure to Low Levels of Ionizing Radiation: BEIR VII - Phase 2*, 2006.

5.7-8 Jablon, S., Z. Hrubec, and J. D. Boice, Jr., "Cancer in Populations Living Near Nuclear Facilities: A Survey of Mortality Nationwide and Incidence in Two States," *Journal of the American Medical Association*, Vol. 265, No. 11, March 20, 1991.

5.7-9 116 Stat. 735, Public Law 107-200, July 23, 2002.

5.7-10 U.S. Court of Appeals for the District of Columbia Circuit, No. 01-1258, Nuclear Energy Institute, Inc., Petitioner, v. Environmental Protection Agency, Respondent, January 14, 2004.

5.7-11 U.S. Environmental Protection Agency, Office of Air and Radiation, "EPA's Proposed Public Health and Environmental Radiation Protection Standards for Yucca Mountain," EPA-402-F-05-026, October 2005.

5.7-12 U.S. Department of Energy, Office of Civilian Radioactive Waste Management, Nuclear Waste Policy Act as Amended With Appropriations Acts Appended, March 2004, Website, www.ocrwm.doe.gov/documents/nwpa/css/nwpa.htm, accessed February 2008.

5.7-13 U.S. Nuclear Regulatory Commission, Reactor Concepts Manual, Natural and Man-Made Radiation Sources, Website, www.nrc.gov/reading-rm/basic-ref/teachers/06.pdf, accessed April 18, 2008.

5.7-14 U.S. Nuclear Regulatory Commission, "Stages of the Nuclear Fuel Cycle," July 3, 2007, Website, www.nrc.gov/materials/fuel-cycle-fac/stages-fuel-cycle.html, accessed February 2008.

Table 5.7-1
Scaling Factor - Reference Plant and RBS Unit 3

	10 CFR 51.51 Reference Plant (1000 MWe LWR)	RBS Unit 3 (One ESBWR)
Gross Electric Output	1000 MWe	1600 MWe
Capacity Factor	80 percent	95 percent
Net Electric Output	1000 MWe x 80 percent = 800 MWe	1600 MWe x 95 percent = 1520 MWe
Ratio of Net Electric	Output Values 1520 MWe/800 MWe = 1.90	

Note: This scale factor was used to calculate the RBS Unit 3 values in the remaining tables.

Table 5.7-2 (Sheet 1 of 8)

Table of Uranium Fuel Cycle Environmental Data - Reference Plant and RBS Unit 3

10 CFR 51.51 Table S-3[a] Normalized to Model LWR Annual Fuel Requirement (WASH-1248) or RRY (NUREG-0116)			ESBWR Data	
Environmental Considerations	**Reference Reactor Data (10 CFR 51.51)**	**Maximum Effect per Annual Fuel Requirement or RRY**	**Reference Reactor Data Multiplied by Scale Factor[d]**	**Maximum Effect per Annual Fuel Requirement or RRY Multiplied by Scale Factor[d]**
Natural Resource Use				
Land (acres)				
Temporarily committed[b]	100		190	
Undisturbed area	79		150	
Disturbed area	22	Equivalent to a 110 MWe coal-fired power plant	42	Equivalent to a 209 MWe coal-fired power plant. 209 MWe/1520 MWe = 14% This is 14% of the space requirement for a 1520 MWe coal-fired power plant.
Permanently committed	13		25	
Overburden moved (millions of MT)	2.8	Equivalent to 95 MWe coal-fired power plant	5.3	Equivalent to 181 MWe coal-fired power plant. 181 MWe/1520 MWe = 12% This is 12% of the space requirement for a 1520 MWe coal-fired power plant.

Table 5.7-2 (Sheet 2 of 8)
Table of Uranium Fuel Cycle Environmental Data - Reference Plant and RBS Unit 3

10 CFR 51.51 Table S-3[a] Normalized to Model LWR Annual Fuel Requirement (WASH-1248) or RRY (NUREG-0116)			ESBWR Data	
Environmental Considerations	**Reference Reactor Data (10 CFR 51.51)**	**Maximum Effect per Annual Fuel Requirement or RRY**	**Reference Reactor Data Multiplied by Scale Factor[d]**	**Maximum Effect per Annual Fuel Requirement or RRY Multiplied by Scale Factor[d]**
Water (millions of gallons)				
Discharged to air	160	=2 percent of model 1000 MWe LWR with cooling tower	304	This is 3.8 percent of model 1000 MWe LWR with cooling tower.
Discharged to water bodies	11,090		21,072	
Discharged to ground	127		241	
Total	11,377	<4 percent of model 1000 MWe LWR with once-through cooling	21,616	This is less than 7.6 percent of model 1000 MWe LWR with once-through cooling.
Fossil Fuel				
Electrical energy (thousands of MWh)	323	<5 percent of model 1000 MWe output	614	This is less than 9.5 percent of model 1000 MWe output.
Equivalent coal (thousands of MT)	118	Equivalent to the consumption of a 45 MWe coal-fired power plant	224	Equivalent to the consumption of a 86 MWe coal-fired power plant.
Natural gas (millions of scf)	135	<0.4 percent of model 1000 MWe energy output	257	<0.8 percent of model 1000 MWe energy output.

Table 5.7-2 (Sheet 3 of 8)

Table of Uranium Fuel Cycle Environmental Data - Reference Plant and RBS Unit 3

10 CFR 51.51 Table S-3[(a)] Normalized to Model LWR Annual Fuel Requirement (WASH-1248) or RRY (NUREG-0116)			ESBWR Data	
Environmental Considerations	**Reference Reactor Data (10 CFR 51.51)**	**Maximum Effect per Annual Fuel Requirement or RRY**	**Reference Reactor Data Multiplied by Scale Factor[(d)]**	**Maximum Effect per Annual Fuel Requirement or RRY Multiplied by Scale Factor[(d)]**
Effluents-Chemical (MT)				
Gases (including entrainment)[(c)]				
SO_x	4400		8360	
NO_x[(e)]	1190	Equivalent to emissions from 45 MWe coal-fired plant for a year	2261	Equivalent to emissions from 86 MWe coal-fired plant for a year.
Hydrocarbons	14		27	
CO	29.6		56.2	
Particulates	1154		2193	
Other gases				
F	0.67	Principally from UF_6 production, enrichment, and reprocessing. Concentration within range of state standards--below level that has effects on human health	1.27	Principally from UF_6 production, enrichment, and reprocessing. Concentration within range of state standards--below level that has effects on human health.
HCl	0.014		0.027	

Table 5.7-2 (Sheet 4 of 8)
Table of Uranium Fuel Cycle Environmental Data - Reference Plant and RBS Unit 3

10 CFR 51.51 Table S-3[(a)] Normalized to Model LWR Annual Fuel Requirement (WASH-1248) or RRY (NUREG-0116)			ESBWR Data	
Environmental Considerations	**Reference Reactor Data (10 CFR 51.51)**	**Maximum Effect per Annual Fuel Requirement or RRY**	**Reference Reactor Data Multiplied by Scale Factor[(d)]**	**Maximum Effect per Annual Fuel Requirement or RRY Multiplied by Scale Factor[(d)]**
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	18.8	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		49.0	
Fluoride	12.9		24.5	
CA^{++}	5.4		10.3	
Cl^-	8.5		16.2	
Na^+	12.1		23.0	
NH_3	10.0		19.0	
Fe	0.4		0.8	
Tailings Solutions (thousands of MT)	240	From mills only--no significant effluents to environment	456	From mills only--no significant effluents to environment
Solids	91,000	Principally from mills--no significant effluents to environment	172,900	Principally from mills--no significant effluents to environment.

Table 5.7-2 (Sheet 5 of 8)

Table of Uranium Fuel Cycle Environmental Data - Reference Plant and RBS Unit 3

10 CFR 51.51 Table S-3[a] Normalized to Model LWR Annual Fuel Requirement (WASH-1248) or RRY (NUREG-0116)			ESBWR Data	
Environmental Considerations	**Reference Reactor Data (10 CFR 51.51)**	**Maximum Effect per Annual Fuel Requirement or RRY**	**Reference Reactor Data Multiplied by Scale Factor[d]**	**Maximum Effect per Annual Fuel Requirement or RRY Multiplied by Scale Factor[d]**
Effluents--Radiological (curies) Gases (including entrainment)				
Rn-222		Presently under reconsideration by the NRC		Presently under reconsideration by the NRC.
Ra-226	0.02		0.04	
Th-230	0.02		0.04	
Uranium	0.034		0.065	
Tritium (thousands)	18.1		34.4	
C-14	24		46	
Kr-85 (thousands)	400		760	
Ru-106	0.14	Principally from fuel reprocessing plants	0.27	Principally from fuel reprocessing plants.
I-129	1.3		2.5	
I-131	0.83		1.58	
Tc-99		Presently under consideration by the NRC		Presently under consideration by the NRC.
Fission products and transuranics	0.203		0.386	

Table 5.7-2 (Sheet 6 of 8)
Table of Uranium Fuel Cycle Environmental Data - Reference Plant and RBS Unit 3

10 CFR 51.51 Table S-3[(a)] Normalized to Model LWR Annual Fuel Requirement (WASH-1248) or RRY (NUREG-0116)			ESBWR Data	
Environmental Considerations	**Reference Reactor Data (10 CFR 51.51)**	**Maximum Effect per Annual Fuel Requirement or RRY**	**Reference Reactor Data Multiplied by Scale Factor[(d)]**	**Maximum Effect per Annual Fuel Requirement or RRY Multiplied by Scale Factor[(d)]**
Liquids				
Uranium and daughters	2.1	Principally from milling--included tailings liquor and returned to ground--no effluents; therefore, no effect on the environment	4.0	Principally from milling--included tailings liquor and returned to ground--no effluents; therefore, no effect on the environment.
Ra-226	0.0034	From UF_6 production	0.0065	From UF_6 production.
Th-230	0.0015		0.0029	
Th-234	0.01	From fuel fabrication plants--concentration 10 percent of 10 CFR 20 for total processing 26 annual fuel requirements for model LWR	0.02	From fuel fabrication plants--concentration 19 percent of 10 CFR 20 for total processing 26 annual fuel requirements for model LWR.
Fission and activation products	5.9×10^{-6}		1.1×10^{-5}	

Table 5.7-2 (Sheet 7 of 8)
Table of Uranium Fuel Cycle Environmental Data - Reference Plant and RBS Unit 3

10 CFR 51.51 Table S-3[a] Normalized to Model LWR Annual Fuel Requirement (WASH-1248) or RRY (NUREG-0116)			ESBWR Data	
Environmental Considerations	**Reference Reactor Data (10 CFR 51.51)**	**Maximum Effect per Annual Fuel Requirement or RRY**	**Reference Reactor Data Multiplied by Scale Factor[d]**	**Maximum Effect per Annual Fuel Requirement or RRY Multiplied by Scale Factor[d]**
Solids (buried on-site)				
Other than high level (shallow)	11,300	9100 Ci comes from low-level reactor wastes and 1500 Ci comes from reactor decontamination and decommissioning -- buried at land burial facilities. 600 Ci comes from mills -- included in tailing returned to ground. Approximately 60 Ci comes from conversion and spent fuel storage. No significant effluent to the environment	21,470	17,290 Ci comes from low-level reactor wastes and 2850 Ci comes from reactor decontamination and decommissioning -- buried at land burial facilities. 1140 Ci comes from mills -- included in tailing returned to ground. Approximately 114 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	2.1×10^7	Buried at federal tepository.
Effluents--thermal (billions of Btus)	4063	<5 percent of model 1000 MWe LWR	7720	<9.5 percent of model 1000 MWe LWR.
Transportation (person-rem)				
Exposure of workers and general public	2.5		4.8	
Occupational exposure	22.6	From reprocessing and waste management	42.9	From reprocessing and waste management.

Table 5.7-2 (Sheet 8 of 8)

Table of Uranium Fuel Cycle Environmental Data - Reference Plant and RBS Unit 3

a) 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. This table, extracted from 10 CFR 51.51, 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 provided in *Environmental Survey of the Uranium Fuel Cycle*, WASH-1248, April 1974 (Reference 5.7-1); *Environmental Survey of Reprocessing and Waste Management Portion of the LWR Fuel Cycle*, NUREG-0116; *Public Comments and Task Force Responses Regarding the Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle*, NUREG-0216; and in the record of 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 fuel recycle). The contribution from transportation excludes the transportation of cold fuel to a reactor and 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 presented in Columns A-E of Table S-3A of WASH-1248.

b) The contributions to temporarily committed land from reprocessing are not prorated over 30 years, because the complete temporary impact accrues regardless of whether the plant services one reactor for one year or 57 reactors for 30 years.

c) Estimated effluents based upon combustion of equivalent coal for power generation.

d) Differences may exist due to rounding. All calculated values have been abbreviated to the number of significant figures present in the Reference Reactor Data.

e) 1.2 percent from natural gas use and process.

Table 5.7-3
Whole-Body 100-Year Dose Commitment Estimate of Rn-222 and Tc-99

	Release, Ci per RRY[(a)]	Percent of Total (with Stabilized Tailings)	Whole-Body 100-Year Dose Commitment, 100-Year Person-Rem per RRY[(a)]	Release, Ci per RBS Unit 3 Operation Year	Whole-Body 100-Year Dose Commitment (100-year person-rem per RBS Unit 3 year)
Values for Rn-222					
Mining	4060 Ci	77%	110 person-rem/100 years	4060 Ci * 1.90 scale factor = 7714 Ci	209 person-rem/100 years
Milling	780	15	21	1482	40
Tailings	350	7	9	665	17
Stabilized Tailings	1	<1	0.027	2	0.051
Total for Rn-222	**5191**	**100**	**140**	**9863**	**266**
Values for Tc-99					
Chemical Reprocess	0.007 Ci	58%	58 person-rem/100 years	0.013	110 person-rem/100 years
Groundwater	0.005	42	42	0.010	80
Total for Tc-99	**0.012**	**100**	**100**	**0.023**	**190**

a) Source: Reference 5.7-4.

Table 5.7-4
Whole-Body 100-Year Dose Commitment Estimate

100-Year Overall Involuntary Whole-Body Dose Commitment to the U.S. Population from the Uranium Fuel Cycle, person-rem	Reference Reactor, per RRY	RBS Unit 3, per RBS Unit 3 Operation Year
From radioactive gaseous effluents (excluding reactor releases and the dose commitment due to Rn-222)[a]	400 person-rem/ 100 years	400 x 1.90 scale factor = 760
From radioactive liquid effluents (all fuel-cycle operations excluding reactor operation)[a]	200	380
Subtotal	**600**	**1140**
Total Rn-222 (Table 5.7-3)	140	270
Total Tc-99 (Table 5.7-3)	100	190
Total with Rn-222 and Tc-99	**840**	**1600**

a) Source: Reference 5.7-4.

Table 5.7-5
Radiation Exposure to the U.S. Population

Exposure Source	Average Dose Equivalent to U.S. Population (mrem/yr)
Natural	
Radon	200
Other	100
Occupational	0.9
Nuclear Fuel Cycle[a]	0.05
Consumer Products	
Tobacco[b]	----
Other	5 - 13
Medical	
Diagnostic X-rays[c]	39
Nuclear medicine[d]	14
Approximate Total	360

a) Collective dose to regional population within 50 mi. of each facility.

b) Difficult to determine a whole-body dose equivalent. However, the dose to a portion of the lungs is estimated to be 16,000 mrem/yr.

c) Number of persons unknown. However, 180 million examinations performed, with an average dose of 50 mrem per examination.

d) Number of persons unknown. However, 7.4 million examinations performed, with an average dose of 430 mrem per examination.

Source: Reference 5.7-13.

ER 5.7 Figures

Due to the large file sizes of the figures for ER Chapter 5, they are collected in a single .pdf file, which you can navigate via the figure numbers in the Bookmark pane. When cited in the text, the links for these figures will launch the .pdf file.

5.8 SOCIOECONOMIC IMPACTS

This section addresses the socioeconomic impacts of RBS Unit 3 operation on the region and, in particular, the five-parish primary impact area consisting of West Feliciana, East Feliciana, West Baton Rouge, East Baton Rouge, and Pointe Coupee. The impacts are arranged according to physical impacts (Subsection 5.8.1), social and economic impacts (Subsection 5.8.2), and environmental justice impacts (Subsection 5.8.3).

The operational impacts of RBS Unit 3 were evaluated using the same general approach taken for evaluating construction impacts in Subsection 4.4. The impact analysis in this section was based on an assumed operating workforce of 500 workers. These workers would be divided into multiple shifts so that RBS Unit 3 would be staffed 24 hours a day, every day of the year. The day shift would contain the largest number of workers. For this analysis, it was conservatively assumed that 400 workers (or 80 percent of the workforce) would travel to the site Monday through Friday for the daytime shift.

The following analysis assumes a commercial operation date of 2017 and a settlement pattern for the RBS Unit 3 operating staff that generally reflects that of the RBS Unit 1 staff, whereby the staff predominantly resides in East Baton Rouge Parish (59 percent), West Feliciana Parish (23 percent), and East Feliciana Parish (7 percent), with at least four counties (Livingston, St. Landry, Ascension, and Tangipahoa) containing the remainder of the staff. The primary change expected to affect the location of RBS Unit 3 staff is that, because of the opening of the John James Audubon Bridge linking West Feliciana Parish with Point Coupee, establishing a residence in either Pointe Coupee or West Baton Rouge would entail a brief commute to the RBS site.

While precise estimates of the operating workforce settlement patterns are not possible, anticipating the possible impact of the John James Audubon Bridge suggests that a reasonable estimate of the RBS Unit 3 operating staff might be as follows: 40 percent in East Baton Rouge Parish, 20 percent in West Feliciana Parish, 15 percent in East Feliciana Parish, 15 percent in West Baton Rouge, and 10 percent in Pointe Coupee. Should East Baton Rouge Parish retain a higher percentage of the workforce than projected (and be more consistent with the RBS Unit 1 percentage of 59 percent), the following conclusions regarding the impacts on that parish would not materially change because of the large size of Baton Rouge.

During scheduled maintenance and forced outages, additional personnel would be required at the RBS site. Based on RBS Unit 1 experience, the temporary maintenance staff on-site during the refueling of RBS Unit 3 would be approximately 1200.

5.8.1 PHYSICAL IMPACTS OF STATION OPERATION

Physical impacts of station operation on the region and nearby communities could potentially include noise, dust, and air impacts. These categories are based on the plant layout described in Section 2.1. Transportation impacts, as well as land use and aesthetics impacts, are discussed in Subsection 5.8.2.

5.8.1.1 Noise

5.8.1.1.1 Regulations and Guidelines for Noise

The proposed RBS Unit 3 project is located in West Feliciana Parish, Louisiana, near the town of St. Francisville. There are no extant parish or state regulations regarding noise emissions. The town of St. Francisville noise regulations are outlined for reference purposes only because the project is not located within the town limits. Additionally, NRC guidelines and EPA guidelines regarding environmental noise are included.

The town of St. Francisville has established maximum permissible sound levels in the town's *Code of Ordinances* (Reference 5.8-1). While the proposed RBS Unit 3 facility would not be located within the town of St. Francisville, the established sound level limits can provide guidance. The noise ordinance limits the sound levels based on the time of day and the zoning of the property from which the sound emanates. The ordinance does not prescribe a limit for noise emanating from industrial properties, but does prescribe a limit of 65 dBA during nighttime hours (i.e., 11 p.m. to 7 a.m.) from commercial properties.

NUREG-1437 (Reference 5.8-2) provides the following guidance regarding noise impact and sound levels:

> "When noise levels are below the levels that result in hearing loss, impacts have been judged primarily in terms of adverse public reactions to the noise. Generally, power plant sites do not result in off-site levels more than 10 dB(A) above background. However, some sites have calculated impacts to critical receptors at this level and above. Noise level increases larger than 10 dB(a) would be expected to lead to interference with outdoor speech communication, particularly in rural areas or low-population areas where the day-night background noise level is in the range of 45-55 dB(A). Generally, surveys around major sources of noise such as large highways and airports have found that, when the day-night level increases beyond 60 to 65 dB(A) (FICN 1992), noise complaints increase significantly. Noise levels below 60 to 65 dB(A) are considered to be of small significance."

The EPA has identified yearly day-night average sound levels (Ldn) that are sufficient to protect public health and welfare from the effects of environmental noise (Reference 5.8-3). According to the EPA, yearly levels are sufficient to protect public health and welfare if they do not exceed an Ldn of 55 dBA outdoors in sensitive areas such as residences, schools, churches, and hospitals. The day-night sound level, Ldn, is the 24-hr. average sound level, with a penalty weighting applied to the nighttime sound levels to account for increased sensitivity to noise during nighttime hours. The EPA guideline equates to a daytime sound level (Ld) of 55 dBA and a nighttime sound level (Ln) of 45 dBA. The EPA emphasizes that since the protective sound levels were derived without concern for technical or economic feasibility, and contain a margin of safety to ensure their protective value, they must not be viewed as standards, criteria, regulations, or goals. Rather, they should be viewed as levels below which there are no reasons to suspect that the general population would be at risk from any of the identified effects of noise. Additionally, the EPA has no authority to regulate ambient noise levels.

Human response to sound is highly individualized. Annoyance is the most common issue regarding community noise. The percentage of people claiming to be annoyed by noise generally increases as environmental sound levels increase. Various references discuss the subjectivity of changes in sound level (References 5.8-4, 5.8-5, 5.8-6, and 5.8-7). Based on this information, a 3 dB change in a continuous broadband noise is generally considered "just barely perceptible" to the average listener. A 5 dB change is generally considered "clearly noticeable," and a 10 dB change is generally considered a doubling (or halving) of the apparent loudness.

5.8.1.1.2 Facility Noise Sources

Audible noise sources associated with normal station operation include the transformers (the main transformers, unit auxiliary transformers, and reserve auxiliary transformers); the cooling systems, including the natural draft cooling tower (NDCT) and mechanical draft cooling tower (MDCT); and the new transmission line.

Noise emissions from cooling systems equipment are discussed in Subsection 5.3.4.

The sound levels for the transformers are expected to be 90 dBA for the main transformers and 86 dBA for the unit and reserve auxiliary transformers (Reference 5.8-8).

Noise emissions from the transmission line are discussed in Subsection 5.6.1.

5.8.1.1.3 Operational Noise Emissions

The environmental noise emissions for normal station operation were modeled in accordance with ISO 9613, Parts 1 and 2 (References 5.8-9 and 5.8-10), using noise prediction software (Cadna/A Version 3.6.119). The model simulated the outdoor propagation of sound from each noise source and accounted for sound wave divergence; absorption from the atmosphere, the ground, and areas of dense foliage; sound directivity; and shielding due to interceding barriers and topography. A database was developed that specified the location, octave band sound levels, and sound directivity of each noise source. A receptor grid that covered the entire area of interest was specified. The model calculated the overall A-weighted sound pressure levels within the receptor grid based on the octave band sound level contribution of each noise source. Finally, a noise contour plot was produced based on the overall sound pressure levels within the receptor grid, including specific receptor locations.

The estimated sound levels from normal station operation (i.e., from RBS Unit 3 equipment only) are shown graphically in the noise contour plot in Figure 5.8-1. Sound levels at the nearest noise-sensitive receptors resulting from normal station operation (as discussed in Subsection 2.5.5) are provided in Table 5.8-1.

5.8.1.1.4 Potential Impacts

Table 5.8-1 provides the lowest ambient sound level with Unit 3 (only) in operation, based on the results of Applicant and NRC predictions (refer to Subsection 2.5.5). The expected ambient sound levels, as well as the increases in ambient sound levels, resulting from Unit 3 operation are also presented in Table 5.8-1.

The predicted noise emissions from normal station operation are not expected to exceed the St. Francisville nighttime sound level limit of 55 dBA at the nearest noise-sensitive receptors. Similarly, the predicted noise emissions from normal station operation are expected to conform to the NRC and EPA sound level guidelines for minimizing noise impact.

The maximum expected increase in ambient sound level of 3 dB is expected to occur at Receptor R8. This increase would be a barely perceptible change in ambient sound level during the quietest nighttime hours, based on the existing conditions described in Subsection 2.5.5. The potential noise impacts due to the operation of RBS Unit 3 are expected to be SMALL.

5.8.1.2 Air Quality

The RBS is located in the southern tip of West Feliciana Parish in an area that is in attainment for all EPA-listed criteria pollutants. Several of the EPA-listed criteria pollutants are routinely monitored near the RBS site. In fact, the area immediately south of the RBS facility, Baton Rouge, is heavily monitored. Monitors in the Baton Rouge area routinely monitor levels of NO_2, SO_2, CO, $PM_{2.5}$, PM_{10}, and ozone. The Baton Rouge area is considered in attainment for NO_2, SO_2, CO, PM_2.5, and PM_{10} (Reference 5.8-11). However, the Baton Rouge area is considered a nonattainment area with respect to the EPA's 8-hr. ozone standard.

The closest Class I Area is the Breton National Wildlife Refuge, which is located offshore on the Chandeleur Islands. The Breton National Wildlife Refuge is located 249 km east-southeast of the RBS (Reference 5.8-12). Given the minor nature of air emissions associated with operation of the facility, this distance is sufficiently far as to not warrant a concern. Therefore, impacts are expected to be SMALL.

5.8.1.3 Projected Air Quality

Air emissions of criteria pollutants would be minor, considering the nature of a nuclear facility and its lack of significant gaseous effluent emissions. Sources of air emissions for the proposed facility include two standby diesel generators, an auxiliary boiler, two diesel fire pumps (refer to Tables 3.6-1, 3.6-2, and 3.6-3), as well as an NDCT and a 12-cell MDCT (refer to Subsection 5.3.3.1.3). The combustion sources mentioned above would be designed for efficiency and operated with good combustion practices on a limited basis throughout the year (often only for testing). Given their small size and infrequent operation, emissions from these sources would not only have little effect on the nearby ozone nonattainment area, but would also have minimal effect on the local and regional air quality. Final emissions would depend upon the specific equipment selected for implementation, but emissions from all equipment would be within the regulatory guidelines set by federal and state agencies to be protective of air quality in the RBS region.

The proposed cooling towers would not be a source of the typical combustion-related criteria pollutants or other toxic emissions. They would, however, emit small amounts of particulate matter as drift. The towers would be equipped with drift eliminators designed to limit drift to approximately 0.002 percent or less of total water flow. Additionally, the primary normal power heat sink (NPHS) proposed for the project is an NDCT. The height of the tower would allow for good dispersion of the drift and not allow localized concentrations of particulate matter to be realized. The minor nature of the effects of the new cooling towers on visibility and air quality, including the potential for increases in ambient temperature and moisture, icing, fogging, and salt deposition, is discussed in greater detail in Subsection 5.3.3. As discussed in Subsection 5.3.3, the impacts of cooling tower operation are expected to be localized and minor in nature.

During operation, no impacts associated with dust are expected to leave the RBS site because it is relatively isolated and has a significant tree buffer between the operations area and off-site permanent populations and structures. Additional mitigation measures to limit airborne dust such as watering can be used, if necessary. Areas used for construction would be reseeded, and all permanent parking lots would be paved. Combustion sources that burn fossil fuels are not typically sources of odor emissions, because they do not process or treat effluent streams rich in odorous compounds such as hydrogen sulfide. Additionally, no open burning would occur during the operational phase. The potential air impacts due to the operation of RBS Unit 3 are expected to be SMALL.

5.8.2 SOCIAL AND ECONOMIC IMPACTS OF STATION OPERATION

The social and economic impacts during RBS Unit 3 operation would primarily be a function of the number of O&M workers and their places of residence within the primary impact area. Of the projected RBS Unit 3 operational workforce of 500, the Applicant believes that it is reasonable to expect that approximately 20 to 30 percent of the workforce, or 100 to 150 workers, would be hired from within the primary impact area. Because of the specialized nature of the jobs, it was conservatively assumed that up to 400 workers would be hired from outside the primary impact area and would relocate on a long-term basis. Table 5.8-2 indicates the assumed settlement pattern of the RBS Unit 3 workforce based on these assumptions. Thus, East Baton Rouge was assumed to be the home parish of the largest number of operating staff (200), followed by West Feliciana Parish (100). As shown in Table 5.8-2 and consistent with the overall hiring assumption, it was assumed that 80 percent of the future operating staff located in each parish would have initially relocated from beyond the primary impact area.

From a population standpoint, based on an average household size for the primary impact area of 2.7 persons (refer to Tables 2.5-9 and 2.5-16), a total of 1080 persons would be added to the primary impact area population when the relocating workers are settled in the area. This number is well within the population growth predicted for the area in year 2017 (2689 persons), based on the long-term population forecast growth rate of 0.5 percent. Table 5.8-2 indicates the projected increase in population for the primary impact area parishes.

5.8.2.1 Local Housing

Assuming that each of the 400 relocating operational staff establishes a household, the increase of 400 households in the primary impact area would represent less than a 1 percent (0.22 percent) increase in the 182,769 primary impact area households in 2000, and 2.3 percent of the 17,371 vacant housing units. Based on the projected 232,567 housing units in 2017 (shown in Table 5.8-2), if 400 new housing units were rented or purchased, it would represent only 0.17 percent of the 2017 housing stock. This small percentage increase is well within the 0.86 percent long-term historical growth in housing units in the primary impact area (refer to Table 2.5-38), and the impact on the primary impact area housing market would be SMALL.

Within the individual primary impact area parishes, the largest impact would be expected in West Feliciana Parish. If 80 new households were to locate in West Feliciana Parish, this would represent 1.1 percent of the 7211 housing units projected for 2017 in Table 5.8-2. This small percentage of impact could be somewhat misleading, given the periodic demand for temporary housing during the operational phase attributed to RBS maintenance activities, and because of the limited availability of worker and starter homes in the parish (although the relocating workforce moving into the parish would have a higher than average income and might be in a higher priced housing market). Because RBS Unit 3 operation is several years away and West Feliciana Parish is currently studying how to address housing supply issues, there is reason to be optimistic that the shortage would be addressed in the future. Operating staff have the option of constructing new homes if existing homes are unavailable in the parish. Furthermore, if a shortage of parish homes does exist when workers are relocating, the operating staff would have the option to locate in nearby areas such as Zachary and Baton Rouge, where there is greater housing availability and where the transportation network allows for a short commute to the RBS site.

During the RBS Unit 3 refueling outages an estimated 1200 temporary workers would be expected on the RBS site. Those workers not able to commute from their homes would be expected to reside in hotels, RV, parks, or short term apartments within commuting distances of the site. It is expected that there will be little demand on the existing housing market due to the short-term nature of the stay, and that there will be adequate lodging within commuting distance for the temporary workers. In addition, because RBS Unit 1 and RBS Unit 3 outages would not occur concurrently, the fact that the area has adequately accommodated the temporary outage workforce for Unit 1 is a solid indication that the area will be able to accommodate the outage workforce for RBS Unit 3. Therefore, the impact caused by RBS Unit 3 outage workers is anticipated to be SMALL.

5.8.2.2 Tax Payments

Tax payments from the operation of RBS Unit 3 would be generated from property taxes paid by the Applicant, from property taxes paid on real estate and personal property owned by operational staff, and by sales taxes on goods and services purchased by the Applicant and operational staff.

With regard to local purchases of materials and supplies, the state sales tax rate is 4 percent and the local sales tax rate for West Feliciana is also 4 percent. Effective July 1, 2008, the machinery and equipment purchased by a utility will be exempt from the state 4 percent sales tax. West Feliciana Parish has the authority to also exempt the purchase of machinery and equipment from the local sales tax. To date, West Feliciana Parish has not opted to exempt the purchase of machinery and equipment from its 4 percent local sales tax.

Related to property taxes associated with Unit 3, Louisiana has an incentive program, the Industrial Property Tax Exemption Program, to encourage capital investment in the state. The Industrial Property Tax Exemption abates, up to 10 years, local property taxes (ad valorem) on a manufacturer's new investment and annual capitalized additions. This exemption applies to all improvements to the land, building, machinery, equipment, and any other property that is part of the manufacturing process. Thus, Louisiana and West Feliciana Parish would benefit from property taxes related to the incremental increase in value to the entire RBS site from the additional unit 10 years after the unit is placed in service.

Related to state income taxes, in Louisiana, an individual's personal income is taxed at graduated rates not to exceed 6 percent. Based on assumed total labor costs of $1.13 billion (2005 dollars) over the first 30 years of operation (refer to Subsection 5.8.2.6) and assuming an average rate of 4 percent for state personal income taxes, the construction of Unit 3 could generate approximately $45 million in state income taxes.

The tax benefit to the entire primary impact area should be SMALL to MODERATE.

5.8.2.3 Local Public Services

There is the potential that the demand for a number of local public services in the primary impact area parishes would be affected by the operation of RBS Unit 3. On the positive side, an increase in the population base would increase taxes and user fees for the continued funding of facilities and services. The potential for negative impacts is also present, however, and could arise if the relocation of workers occurred rapidly and outpaced the ability of a parish or community to provide for the sudden increase in demand for these services.

The potential for a significant increase in the demand for public services is primarily a function of the number of relocating personnel and family populations as a percentage of the overall parish population. By comparing the 2017 population for each parish with the RBS Unit 3-related increase in population, it was determined that no parish is expected to realize a population increase of more than 1.3 percent of the 2017 parish population (refer to Table 5.8-2). The total primary impact area population increase (due to the relocation of RBS Unit 3 personnel and families) of 1080 is less than half of the 2687 overall annual population growth for the primary impact area in 2017, based on a forecasted 0.5 percent annual average population growth rate. This suggests that the overall impact and public services in the primary impact area due to relocating RBS Unit 3 operational staff should be SMALL. It is also important to note that the operational workforce assumed to relocate into the primary impact area is below the 788 RBS Unit 3 construction workforce assumed to relocate into the area, that the operating workforce would be dispersed among multiple shifts, and that those who relocate to the region would do so gradually before the RBS Unit 3 commercial operation date, thereby avoiding a sudden increase in demand for local public services.

5.8.2.3.1 Education

Based on the assumed settlement pattern of 400 RBS Unit 3 operating staff and an average of 0.34 student per household in the area, a net increase of 136 students would be expected in the primary impact area. This increase would only be 0.22 percent of the 2005 - 2006 enrollment in the parish school districts (refer to Table 2.5-39) and is well within the increase in student population that would result from the forecasted long-term average annual growth rate in area population (0.50 percent, as shown in Table 2.5-9).

Likewise, the largest percentage of increase in parish student population would occur in West Feliciana Parish, where 27 new students would be added under the relocation assumptions (i.e., 80 new households, 0.34 student per household), yet this would constitute only a 1.1 percent increase compared to the 2005 - 2006 parish enrollment. This would be a SMALL impact.

The conclusion that impacts on education would be SMALL is supported by the expectation that the potential students would not significantly increase the pupil-to-teacher ratios in any parish, because the maximum increase would be in West Feliciana Parish where, other things being equal, the ratio would increase from 13.5 to 13.6. As previously described in Section 4.4, discussions with personnel at each of the primary impact area parish school districts indicated that there is adequate capacity to accommodate additional students without the need for new classroom facilities in the districts; however, East Baton Rouge Parish is currently near capacity and West Baton Rouge School District is adding modular units to some schools.

5.8.2.3.2 Transportation

Transportation impacts due to RBS Unit 3 operation would include those arising from the 500-member RBS Unit 3 operational workforce, deliveries that would be dispersed throughout the day, and the periodic need for maintenance workers that, for RBS Unit 1, peaks at approximately 1200 workers during refueling. Impacts would be concentrated along U.S. Highway 61 near the RBS site in West Feliciana Parish during shift changes for both RBS units. Low-cost or no-cost measures will be used to lessen impacts; these will include the staggering of the shift start time between the normal operational workforce and the refueling workforce. Based on current Applicant practices, it is expected that the refueling workforce would work two 12 hour shifts, while the operational workforce would work 9 hour shifts. Thus, it is anticipated that the normal operating shift and refueling shift would not coincide. In the event that the refueling and the daytime operating staffs (400 for Unit 1 and 400 for Unit 3) did commute to the site at the same time, the maximum number of worker vehicles entering the site during the period would be approximately 1313 vehicles. This corresponds to the combined workforce of 800 persons for Units 1 and 3, plus the 600 day shift workers for a refueling. The total of 1400 workers is then reduced by the assumed carpooling adjustment factor of 0.9375, which reflects a 12.5 percent carpooling rate. Even this worst case scenario would constitute a workforce size less than half of the peak construction workforce. Therefore, the expected impact on traffic during operation is expected to be SMALL to MODERATE.

5.8.2.3.3 Public Safety

In addition to traffic, other safety impacts could potentially include impacts on the demand for safety and emergency services at the RBS site and by workers and families relocating to the primary impact area. This could include demands on police, fire, ambulance, and hospital services. For each of these services, the impact created in the primary impact area parishes is a function of the increase in population, as a percentage of the existing parish population. As indicated previously, the 1080 increase in population in the primary impact area attributed to the relocation of a portion of the RBS Unit 3 workforce is well within the overall annual population growth of 2689 projected for 2017, based on a 0.5 percent growth rate for the area. This relatively limited growth figure implies that the effect in the primary impact area and the individual parishes should be SMALL. Consequently, the following discussion through Subsection 5.8.2.5 focuses on the impact on West Feliciana Parish as a result of the operation of RBS Unit 3.

The on-site demand for local public safety services should be SMALL because RBS Unit 3 design and operational practices would be undertaken with the specific intent to minimize or eliminate negative impacts and to make RBS Unit 3 largely self-sufficient in these areas. An operational safety plan would be developed for the site that would conform with all industry requirements and regulations. This plan would facilitate a safe working environment for the operating workforce. The safety plan would comply with all OSHA requirements, all workers would undergo training to familiarize themselves with the safety plan, and every member of the operational workforce would be required to adhere to the requirements.

In addition, there would be limited access to the RBS site, with security guards posted on-site and a badge system to control personnel access. The site would include security lighting and fire suppression equipment. First aid stations would be established and maintained throughout the RBS. First aid training would also be provided to selected individuals in the operational workforce. Standard procedures would be adopted for spill prevention and containment, injury response, and requests for assistance from local police, fire, and ambulance services.

Should outside medical assistance be required, the nearest emergency responder to the RBS Unit 3 site would be the ambulance units from the West Feliciana Parish Hospital, located in St. Francisville, Louisiana. If necessary, hospital service could be provided by the West Feliciana Parish Hospital and the 14 hospitals in Baton Rouge. Among the hospitals in the primary impact area, virtually any specific medical expertise would be available for worker needs. Baton Rouge is approximately 30 minutes from the site, and St. Francisville is approximately 5 minutes from the site; therefore, quick transport to a hospital could occur, if required.

Should firefighting equipment be required and exceed the on-site capabilities, West Feliciana fire station personnel would be contacted and assistance would be requested. Similarly, should on-site security require assistance, the West Feliciana Sheriff's Department could be contacted. The department also has cooperative agreements with other parish departments, and the National Guard can be assigned if the security level becomes elevated.

The degree to which the Applicant has been able to minimize the need for local police, fire, and hospital services during the construction and operation of RBS Unit 1 is evident in the comments and opinions expressed by local parish safety and medical personnel. A staff member of the West Feliciana Parish Hospital stated that the hospital was not expected to encounter significant negative impacts because of the construction and operation of RBS Unit 3. This individual mentioned that the Applicant is quite self-sufficient with its own health services, and that few RBS employees have come to the West Feliciana Parish Hospital in this individual's 7-year tenure. Similarly, a member of the Parish Sheriff's Department indicated that the department anticipated hiring an additional police officer per shift to accommodate the growth associated with the expansion of U.S. Highway 61 and general parish development, and believed that this would be sufficient to accommodate any increased needs arising from RBS Unit 3 construction or operation.

5.8.2.3.4 Public Utilities

The impact on public utilities within the primary impact area would be SMALL because of the dispersed settlement pattern and considering that growth in the population and households attributed to RBS Unit 3 operation is well within the historical growth rates. At the RBS, the operation of RBS Unit 3 would require electricity, water, and waste facilities; however, the unit would be designed to be largely self-sufficient in these areas and would have a SMALL impact. On-site wells, along with potable water supplied by the West Feliciana Parish Water District, would provide the water requirements for RBS Unit 3 operation. Similarly, all sewer services would be handled on-site. RBS Unit 3 would provide a significant increase in installed electric capacity for the region.

5.8.2.4 Tourism and Recreation

The impacts on recreation and tourism due to plant operation would be SMALL, because of the relatively isolated location of the existing plant site and its distance from recreation facilities and tourist attractions. The potential for impact would primarily be limited to possible delays in traveling to recreational or tourist sights that require patrons to pass by the RBS at shift change. The degree to which such delays might occur would be reduced with the expansion of U.S. Highway 61 to four lanes, although the LOS traffic analysis would be required to predict whether any delay would be expected at times of shift change.

5.8.2.5 Land Use and Aesthetics

The operation of RBS Unit 3 would be consistent with the land use pattern set forth in the document "Land Use and Growth Management Plan: Strategies, Policies, and Guidelines" for West Feliciana Parish (the Plan) (Reference 5.8-13). The location of RBS Unit 3 at the existing RBS site is consistent with the Plan's emphasis on the encouragement of compact development patterns and the preservation of open space. The RBS site is also consistent with the Feliciana Vision 2005 land use maps in the Plan, which identify the area that includes the RBS and the proposed West Feliciana Business Park as "Industrial M-1 base zoning." The Overlay District map also designates this entire area as Industrial Park, further supporting the conclusion that RBS Unit 3 would add to controlled growth and the preservation of the rural setting of the parish.

Specific objectives established in the Plan with which RBS Unit 3 operation would conform include the following long-term goals (Reference 5.8-13):

- Goal: *Maintain the natural beauty and rural nature of the parish.* This would be met during operation because RBS Unit 3 would be located at the existing site, adjacent to RBS Unit 1.
- Goal: *Preserve agricultural, wildlife habitat, and forestry use or property.* Such areas would be preserved during operation because the existing RBS site would be used.
- Goal: *Maintain the historic character of the parish.* RBS Unit 3 operation would not affect the historic town of St. Francisville, and the historic character of the parish would be minimally affected, as discussed in Section 5.10.
- Goal: *Respect the small town character of St. Francisville.* The operation of RBS Unit 3 would not change the small town character of St. Francisville.
- Goal: *Discourage suburban sprawl and conserve land.* This goal would be met because the existing RBS site would be utilized.

- Goal: *Encourage development of land where infrastructure is already available.* Adequate infrastructure is available or would be built on-site to facilitate the operation of RBS Unit 3.

- Goal: *Expand recreational and educational opportunities for the residents.* While not directly contributing to this goal, the parish revenues associated with RBS Unit 3 operation could be used to further this goal.

- Goal: *Maintain "Greenbelts" and the rural character of roads in the parish.* Operation of RBS Unit 3 would not significantly affect the Greenbelts in the parish because the widening of U.S. Highway 61 is scheduled to occur independent of RBS Unit 3.

- Goal: *Encourage tourism development; "eco-tourism" development, and economic development.* While not directly contributing to the goals of tourism and eco-tourism development, the parish revenues associated with RBS Unit 3 could be used to further this goal. RBS Unit 3 operation would directly contribute to economic development in the parish, and to low-cost, reliable energy supply.

- Goal: *Encourage housing areas for all income groups.* Operation of RBS Unit 3 would not directly affect this goal, though operating staff may choose to construct some new housing and live locally.

- Goal: *Limit signs and visual clutter.* RBS Unit 3 operation would not significantly affect visual clutter because the site is surrounded by a significant tree buffer zone. Only the cooling tower should be visible from U.S. Highway 61 and beyond. It is possible that traffic mitigation measures could require a limited number of traffic control signs near the plant access routes off of U.S. Hwy 61 during the operating period.

As discussed in Subsection 5.1.1.10, the only ongoing aesthetic and visual impact anticipated during operation would be the visibility of the RBS Unit 3 NDCT that, along with the steam plume, would be visible from off-site locations. The visibility from off-site locations would be somewhat intermittent, however, because of the abundance of mature timber in the vicinity of the RBS, the "greenbelt" lining of the roadways by trees, and the elevation changes in the parish. Therefore, impacts are expected to be SMALL.

5.8.2.6 Local Employment

The 500 full-time operating positions for RBS Unit 3 would create direct economic benefits for the region, because these would be stable, high-paying positions that would be much sought after. In addition, the periodic maintenance staff needed to support the refueling and maintenance requirements would provide additional direct employment and wage benefits to the primary impact area. The size of this maintenance staff and the duration of their periodic employment is difficult to predict with certainty. Based on an estimated peak refueling staff of 1200 workers required every 18 months, plus the recognition that there would be additional and ongoing maintenance staff required during scheduled and forced outages, a levelized, full-time equivalent (FTE) maintenance staff of 100 workers was assumed in this subsection. Based on wage data from the U.S. Bureau of Labor Statistics, an average direct salary for the RBS Unit 3 operational and workforce staff of $62,640 in 2005 dollars was assumed (Reference 5.8-14). Thus, over the first 40 years of operation, which is consistent with half of the assumed technical operating life, the total direct payroll for the RBS Unit 3 O&M staff would exceed $1.50 billion in 2005 dollars.

In addition to the direct O&M workforce, there would be secondary, or indirect, jobs created on a long-term basis because of the economic multiplier effects of RBS Unit 3 operation. These employment and earnings impacts can be estimated through the RIMSII Input-Output model developed by the U.S. Bureau of Economic Analysis, which was simulated for the primary impact area parishes. Over a 40-year period, a total of 67,757 job-years of employment would be generated, and total income effects would be $2.62 billion (refer to Table 5.8-3). For the primary impact area, this would constitute a MODERATE to LARGE benefit.

5.8.3 ENVIRONMENTAL JUSTICE IMPACTS

The purpose of this environmental justice review is to determine if low-income or minority populations would bear a disproportionate amount of environmental impacts from the operation of RBS Unit 3. Potential areas of impact that deserve special attention include cultural, economic, and human health impacts. Logically, for there to be a significant concern that the culture, economy, or human health of low-income or minority populations might be harmed as a result of the operation of the RBS, or receive a disproportionate share of negative impacts, the following criteria must be considered:

1. Low-income or minority populations in proximity to the site would need to be present.
2. Negative cultural, economic, or health impacts on such populations would be expected.
3. The low-income areas would be expected to encounter a disproportionate share of negative impacts from the operation of RBS Unit 3.

A low-income population is defined to exist if the percentage of households within an environmental impact area or Census Block Group (CBG) living below the poverty level exceeds the percentage of low-income households within the state by 20 percentage points, or if the percentage of low-income households in the impact area or CBG is 50 percent or greater[a] (refer to Subsection 2.5.4). A "minority population" is defined to exist if the percentage of minorities within an environmental impact area (or CBG) exceeds the percentage of minorities in the state in which the impact area or CBG is located, by 20 percentage points or more, or if the percentage of minorities in the impact area or CBG is 50 percent or greater.

No parish or county in the region qualifies as a low-income area, based on the appropriate criteria for this category, although some CBGs within certain counties do qualify as low income (Subsection 2.5.4). These low-income areas were indicated in Figure 2.5-12, and the closest such area to the RBS is in Pointe Coupee Parish, southwest of the site.

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a. The poverty statistics in this subsection are presented on a family and individual basis rather than on a household basis, given the data available in LandView® 6.

U.S. Census data also indicate that three parishes and two counties (wholly or partly in the region) are minority areas, when measured according to the adopted definition of a minority area previously established. The minority areas are indicated in Figure 2.5-16 and include West Feliciana Parish. Within the parish, however, the CBGs covering the eastern half of West Feliciana are not minority areas. Table 4.4-6, Table 4.4-7, and Figure 4.4-1 illustrate that CBGs and populations within a 10-mi. radius of the RBS are not minority populations.

Combined, the low-income and minority information at the CBG level leads to the conclusion that there are no populations near the site that would create environmental justice concerns. Though there is the possibility that sub-populations even smaller than the CBG could be present and give rise to environmental justice concerns, interviews were conducted with members of the West Feliciana Police Jury, the Parish Sheriff's Department, and the West Feliciana Community Development Foundation, all of whom indicated that they believe there would be no environmental justice issues, given the beneficial aspects of the project and the population characteristics near the site. No negative subsistence living impacts are expected; this is in agreement with the Applicant's expectations because of the existing nature of the site.

The information provided by local parish officials is consistent with local church officials, who were also asked about the presence of subsistence activities by low-income and minority individuals.

Based on the above information, it is reasonable to conclude that the three conditions required for environmental justice impacts are absent for RBS Unit 3: (1) low-income or minority populations in the CBGs containing or adjacent to the site are not present, (2) during operation, only SMALL negative cultural, economic, or health impacts (in the form of increased traffic) are expected, and (3) low-income and minority populations would not encounter a disproportionate share of any negative impacts from the operation of RBS Unit 3.

5.8.4 SUMMARY

The effects of RBS Unit 3 operation on the primary impact area should be SMALL in most impact categories. The lack of significant and negative impacts is due to the dispersal of the population and housing impacts over a large and populated area that already has a well-developed infrastructure. The potential for SMALL negative impacts compares to the potential for MODERATE to LARGE earnings and employment benefits in the region over the long-term operating period.

The operation of RBS Unit 3 would create LARGE direct and indirect socioeconomic benefits in West Feliciana Parish, while maintaining consistency with the parish Plan. The potential for negative impacts arising from the demand for local facilities and services would be controlled through appropriate operating practices at the site (e.g., security, fire, safety measures), or are not a concern because of sufficient excess capacity (i.e., with regard to schools and water supply). While there is a current shortage of worker/starter housing in West Feliciana Parish that could cause negative impacts, studies are now under way to address the issue, and there is ample housing in the region to accommodate operating staff. Negative traffic impacts in West Feliciana Parish have the potential to be SMALL or possibly greater during operation, especially during the refueling of either RBS unit; however, a staggering of work times would help reduce the severity of impacts. Traffic impacts on the LOS near the RBS site will be studied in the future and in cooperation with the LDOTD, after a number of project decisions affecting traffic impacts have been made. Given the location of the RBS in a CBG that is neither low-income nor minority, there is no reason to expect that any low-income or minority areas within the parish or region would be disproportionately affected by negative impacts from the project.

5.8.5 REFERENCES

5.8-1 Town of St. Francisville, Louisiana, *Code of Ordinances,* Section 8-79, "Unnecessary Noise," April 26, 2005, Website, http://library2.municode.com:80/mcc/home.htm?view=home&doc_action=setdoc&doc_keytype=tocid&doc_key=dc8793ddcb54dbd723a7c0ff20c8628c&infobase=14277, accessed September 10, 2007.

5.8-2 U.S. Nuclear Regulatory Commission, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437, Vol. 1, Washington, D.C., 1996.

5.8-3 U.S. Environnmental Protection Agency, *Toward a National Strategy for Noise Control,* Pub. No. 550/9-77, 1977, Website, http://www.nonoise.org/epa/Roll11/roll11doc28.pdf, accessed September 18, 2007.

5.8-4 American Society for Heating, Refrigerating and Air-Conditioning Engineers, "Chapter 7, Sound and Vibration," *2001 ASHRAE Handbook - Fundamentals*, 2001.

5.8-5 Bies, D. A. and C. H. Handsen, *Engineering Noise Control,* London: Unwin Hyman, 1988.

5.8-6 Egan, M. D., *Architectural Acoustics,* McGraw-Hill Publishing Co., 1988.

5.8-7 Bolt, Beranek and Newman, Inc., *Fundamentals and Abatement of Highway Traffic Noise,* Report No. PB-222-703, prepared for the Federal Highway Administration, 1973.

5.8-8 Institute of Electrical and Electronics Engineers, "Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers," C57.12.00, Chapter 13, 2000.

5.8-9 International Organization for Standardization, "Acoustics - Attenuation of sound during propagation outdoors - Part 1: Calculation of the absorption of sound by the atmosphere," 9613-1:1993.

5.8-10 International Organization for Standardization, "Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation," 9613-2:1996.

5.8-11 U.S. Environmental Protection Agency, *US EPA Green Book*, 2007, Website, http://www.epa.gov/air/oaqps/greenbk/, accessed July 31, 2006.

5.8-12 National Park Service, "Class I Receptors, National Park Service Database," 2007, Website, http://www2.nature.nps.gov/air/Maps/Receptors/index.cfm, accessed August 1, 2007.

5.8-13 West Feliciana Parish, "Land Use and Growth Management Plan: Strategies, Policies, and Guidelines," January 1998.

5.8-14 U.S. Department of Labor, "Occupational Employment and Wages, May 2006," Website, http://www.bls.gov/oes/current/oes518012.htm, accessed March 26, 2008.

5.8-15 U.S. Bureau of Labor Statistics Data, "Labor Force data by County 2000 Annual Average," Website, ftp://ftp.bls.gov/pub/special.requests/la/laucnty00.txt, accessed July 26, 2007.

5.8-16 U.S. Bureau of Economic Analysis, RIMSII Multiplier, "Primary Impact Area of West Feliciana Parish, East Baton Rouge Parish, West Baton Rouge Parish, Pointe Coupee, and East Feliciana," March 2008.

Table 5.8-1
Estimated Facility Noise Impacts (RBS Unit 3 Cooling Systems and Transformers)

Receptor	Predicted Unit 3 Sound Level (dBA), Including Cooling Systems and Transformer Noise Contributions	Lowest Nighttime Ambient Sound Level (dBA)	Predicted Future Ambient Sound Level (dBA)	Predicted Increase in Ambient Sound Level (dB)
R1	28	47	47	0
R2	25	47	47	0
R3	33	46	46	0
R4	32	48	48	0
R5	33	49	49	0
R6	34	50	50	0
R7	36	50	50	0
R8	43	43	46	3

Table 5.8-2
2017 Population and Housing in the Primary Impact Area and the Assumed Residence of RBS Unit 3 Operating Staff[(a)]

Primary Impact Area Parish	Population, 2017	Housing Units, 2017	Staff Assumed to Reside in Each Parish	Assumed Relocating Staff to Each Parish	Population Increase from Relocating Staff
West Feliciana	16,448	7211	100	80	216
East Feliciana	23,250	11,133	75	60	162
West Baton Rouge	23,512	10,566	75	60	162
East Baton Rouge	449,384	192,251	200	160	432
Pointe Coupee	24,777	11,407	50	40	108
Total	537,371	232,567	500	400	1080

a) Parish population numbers have been rounded to yield the correct total.

Source: Reference 5.8-15.

Table 5.8-3
Projected Multiplier Impacts
Associated with RBS Unit 3 Operation

Period	Impact Category	Earnings	Employment
Operation	Direct	$1.503 billion	24,000 job-years
	RIMS II Multiplier	1.7423	2.8232
	Total Impact	$2.619 billion	67,757 job-years

Source: Reference 5.8-16.

ER 5.8 Figures

Due to the large file sizes of the figures for ER Chapter 5, they are collected in a single .pdf file, which you can navigate via the figure numbers in the Bookmark pane. When cited in the text, the links for these figures will launch the .pdf file.

5.9 DECOMMISSIONING

Decommissioning is defined as permanently removing a nuclear facility from service and reducing the radioactive materials on the licensed site to levels that would permit termination of the NRC operating license (10 CFR 50.2). The NRC evaluated the environmental impacts for the typical decommissioning methods in its *Final Generic Environmental Impact Statement (FGEIS) on Decommissioning of Nuclear Facilities* (NUREG-0586). Studies of social and environmental effects of decommissioning large commercial power generating units have not identified any significant impacts beyond those identified in the NRC FGEIS on decommissioning.

Site-specific considerations of effects related to decommissioning were discussed in Section 5.9 of the RBS Unit 1 Environmental Report (Reference 5.9-1), concluding that no significant environmental effects would be expected from the plant decommissioning. Radiation doses to the public related to the decommissioning of the existing RBS facility were considered by the NRC to be very SMALL, resulting primarily from the transportation of the decommissioned waste. Occupational doses from these activities were expected to be well within the occupational exposure limits imposed by regulatory requirements (Reference 5.9-2). Based on the NRC's FGEIS, it is expected that these conclusions would also apply to the decommissioning of the new facility proposed in this COLA.

In accordance with NRC regulations, no detailed decommissioning plans are required at this time. Such plans would not be required until the holder of the operating license decides to permanently cease operations. It is expected that technologies and guidance related to the decommissioning would continue to mature and improve to further reduce the environmental impacts related to the decommissioning.

As required by 10 CFR 50.33(k), a COLA must include the information in the form of a report, as described in 10 CFR 50.75, that certifies how reasonable assurance would be provided that funds would be available to decommission the facility. The RBS Unit 3 Decommissioning Funding Assurance Report containing the information required by 10 CFR 50.75 is provided in Part 1 of this application.

The impacts associated with the decommissioning of any light-water-cooled reactor (LWR) before or at the end of an initial or renewed license were evaluated in NUREG-0586. That report determined that the impacts associated with decommissioning under the stated decommissioning options were either SMALL or might require site-specific assessment (e.g., environmental justice, threatened and endangered [T&E] species). In accordance with 10 CFR 52.110(d)(1), a licensee is required to submit a post-shutdown decommissioning activities report (PSDAR), which must include a discussion that provides the reasons for concluding that the environmental impacts associated with site-specific decommissioning activities are bounded by appropriate previously issued environmental impact statements. If identified environmental impacts have not been considered in existing environmental assessments, the licensee is required to request a license amendment regarding the activities and submit a supplement to the ER relating to the additional impacts. Therefore, the impacts associated with decommissioning RBS Unit 3 are addressed in NUREG-0586, with the exception of site-specific impacts that are required by regulation to be assessed prior to commencement of decommissioning activities having an impact in these areas.

The DOE funded a study that compares the activities and costs required to decommission existing reactors to those required for advanced reactor designs, including the ESBWR. This study, *Study of Construction Technologies and Schedules, O&M Staffing and Cost, and Decommissioning Costs and Funding Requirements for Advanced Reactor Designs* (Reference 5.9-3), was prepared to assess the impact of these new designs' construction, operation, and decommissioning, including an assessment of the impact of these designs on decommissioning funding estimates. Four reactor types were evaluated in this report: the Toshiba and GE Advanced Boiling Water Reactor (ABWR), the GE-Hitachi ESBWR, the Westinghouse Advanced Passive Pressurized Water Reactor (AP1000), and the Atomic Energy of Canada, Limited's (AECL) Advanced CANDU Reactor (ACR-700). The cost analysis described in the study is based upon the prompt decommissioning alternative, or DECON, as defined by the NRC. The DECON alternative is also the basis for the NRC funding regulations (10 CFR 50.75), and the use of the DECON alternative for the advanced reactor designs facilitates the comparison with the NRC's own estimates and financial provisions.

Based on this study, the projected physical plant inventories associated with the advanced LWR reactor designs would generally be less than those for currently operating power reactors. This is due to advances in technology and the use of passive support systems that have significantly simplified and reduced inventories of electrical cabling, piping, pumps, motors, instrumentation and controls wiring, building size, and concrete volume typically used in contemporary power plants. This ultimately reduces the overall quantity of contaminated and noncontaminated waste required for disposal, along with transportation to and from disposal sites. The reduction is expected to have a noticeable impact on the decommissioning cost, including reduced labor costs associated with removal and radiation protection, reduced decommissioning equipment and material costs, and reduced waste processing and disposal costs. Additionally, the new facility is situated on the existing RBS site and is contained within the original site boundaries, not requiring encroachment onto additional property that is not already designated for use in power production.

Based on the above, it can be reasonably concluded that the environmental decommissioning impacts resulting from the new ESBWR facility are considered to be equal to, or less than, those evaluated in and bounded by NUREG-0586. Therefore, with respect to those impacts that can be assessed at this time, the environmental impacts of decommissioning would be SMALL.

5.9.1 REFERENCES

5.9-1 Gulf States Utilities Company, "River Bend Station Environmental Report, Operating License Stage," Volumes 1-4, Supplements 1-9, November 1984.

5.9-2 U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, *Final Environmental Statement Related to the Operation of River Bend Station*, NUREG-1073, Washington, D.C., January 1985.

5.9-3 U.S. Department of Energy, *Study of Construction Technologies and Schedules, O&M Staffing and Cost, and Decommissioning Costs and Funding Requirements for Advanced Reactor Designs*, Contract DE-AT01-020NE23476, May 27, 2004.

5.10 MEASURES AND CONTROLS TO LIMIT ADVERSE IMPACTS DURING OPERATION

The potential adverse environmental impacts to air, water, land, wildlife, and people caused by the operation of a new facility at the RBS site have been described in Sections 5.1 through 5.9. Table 5.10-1 summarizes the potential impacts identified in Sections 5.1 through 5.9 and potential measures to mitigate these impacts. The mitigation techniques presented herein represent BMPs or standard industry practices for operating nuclear plants.

Table 5.10-1 provides the cause-and-effect relationships between potential environmental disturbances from RBS Unit 3 operation activities and the corresponding affected environmental resources. The table also summarizes measures and controls that have been identified to mitigate operational impacts at RBS Unit 3. The significance indicators provided in Table 5.10-1 are designated using the following descriptors: SMALL, MODERATE, or LARGE. The significance indicators are defined in Section 1.1.

The measures and controls described in Table 5.10-1 are considered reasonable from practical, engineering, and economic viewpoints. They are based on statutes, regulatory requirements, or accepted practices within the industry. Therefore, these controls and measures are not expected to present an unreasonable or undue hardship on the Applicant during RBS Unit 3 operation. The significance level (i.e., SMALL, MODERATE, or LARGE) provided for each resource area in the table has been determined by viewing the potential impact in terms of its significance following implementation of the associated mitigation measures and controls.

The overall operational impacts of RBS Unit 3 are expected to be SMALL for the environmental resource areas evaluated in Sections 5.1 through 5.9. Most of the LARGE environmental impacts would occur during the construction of RBS Unit 3, as described in Chapter 4. Operation of RBS Unit 3 would result in LARGE, beneficial impacts to the employment and income of the West Feliciana area; MODERATE to LARGE beneficial tax benefits to the primary impact area; and SMALL impacts on traffic flows on highways and access roads to the RBS.

5.10.1 REFERENCES

None.

Table 5.10-1 (Sheet 1 of 23) Summary of Measures and Controls to Limit Adverse Operational Impacts

Impact/Impact Description		Significance	Potential Mitigation Measures	Basis of Significance
5.1	**Land Use**			
5.1.1	*The Site and Vicinity*			
5.1.1.1	Land Use Planning and Zoning	S	No impacts to land use planning in West Feliciana Parish is expected; therefore, no mitigation measures are required.	The site is on land already zoned and planned for industrial development and use.
5.1.1.2	Transportation and Rights-of-Way (a) Roads/highways (b) Barge Traffic	S-M	(a) Widening of US Highway 61 to four lanes, construction of the new Audubon Bridge, and new Highway 10 extension would serve to alleviated congestion. No land use modifications are required to support Unit 3 operations. (b) No mitigation measures required. Barge transportation no longer needed during operation.	SMALL to MODERATE increase in traffic to support increase in RBS operational personnel.
5.1.1.3	Soil and Agriculture (a) Erosion (b) Cooling Tower Drift and Salt Deposition	S	(a) Observation of erosion control measures; adherence to permits and the SWPPP will prevent erosion and enhance soil stability. (b) Drift eliminators would be incorporated into design of cooling towers to minimize the potential for salt deposition, especially to nearby agricultural fields. Mitigation beyond the proposed drift eliminators is not required.	SMALL impacts primarily associated with salt deposition. The maximum predicted annual salt deposition rate presented in Subsection 5.3.3.1.3 is 2.08 $kg/km^2/mo$. This value is well within the NUREG-1555 acceptable levels of generally not damaging to plants.
5.1.1.4	Ecological Impacts (a) Natural and Forested Areas (b) Water Courses, Wetlands, and Floodplains	S	(a) Property logging operations have not affected natural and forested areas on-site during Unit 1 operations, and no impacts are expected during Unit 3 operation. No mitigation measures are required. (b) SWPPP and SPCC Plan would be implemented to prevent adverse impacts to on-site waters. Discharges to the Mississippi River will in accordance with federal, state, and local laws and regulations and applicable permit requirements (e.g., LPDES).	SMALL due to limited disturbance to the vegetation within the site and to discharges to the environment.

Table 5.10-1 (Sheet 2 of 23)
Summary of Measures and Controls to Limit Adverse Operational Impacts

Impact/Impact Description		Significance	Potential Mitigation Measures	Basis of Significance
5.1.1	*The Site and Vicinity (Continued)*			
5.1.1.5	Recreation Areas and Viewshed	S	No mitigation measures required.	SMALL impact to recreation facilities in the region due to an increase in usage as workers and their families move to the RBS area. SMALL impact on the viewshed as a result of limited areas where the 550-ft. NDCT would now be visible where previously only a forested view was present. Forested area buffer around the rest of the site diminishes cooling tower visual impact.
5.1.1.6	Air Quality – Air Emissions	S	Air emissions would be controlled in accordance with local, state, and federal laws and regulations and applicable air permit requirements. Maintenance of unpaved roads would reduce dust emissions. Cooling tower salt deposition and drift would not significantly affect surrounding agricultural lands and vegetation. No mitigation measure required.	SMALL impact due to normal plant air emissions affecting plant air quality on the site or in the vicinity of RBS Unit 3.
5.1.1.7	Pipelines	S	New potable water pipeline would be routed to minimize impacts to the land use on-site and to areas of potential spills.	SMALL impact due to a new water pipeline being added before or during construction to provide an additional supply of potable water. No major pipeline routes cross the site or will be near RBS Unit 3.
5.1.1.8	Spills	S	The site SPCC Plan and LPDES permit contain measures to prevent and address spills. Vehicle-related activities would be conducted in an enclosed building or a bermed and lined area designated for spill containment. Materials would be stored appropriately to prevent spills, and appropriate containers, berms, barriers, and other measures would be used to prevent and mitigate spills.	SMALL impact due to staff training and observance of spill avoidance measures at the RBS Unit 3 site.
5.1.1.9	Solid Waste	S	Solid waste would be properly recycled or disposed of in closed containers. Waste would be picked up on a regular basis to avoid overflow of containers and windblown waste on the site and in surrounding areas. Contractors and employees would be notified that littering is prohibited.	SMALL impact due to implementation of mitigation procedures, RBS waste minimization plan, and responsible waste management practices.

Table 5.10-1 (Sheet 3 of 23)
Summary of Measures and Controls to Limit Adverse Operational Impacts

Impact/Impact Description		Significance	Potential Mitigation Measures	Basis of Significance
5.1.1	*The Site and Vicinity (Continued)*			
5.1.1.10	Noise	S	No mitigation measures required.	SMALL impact because Unit 1 operational noise levels have not affected land use in the plant area.
5.1.1.11	Factors Contributing to Potential Cumulative Impacts	S	No mitigation measures required.	The operation of Unit 3 to the cumulative impacts of the area involving the new Audubon Bridge, new Highway 10 extension, and widening of US Highway 61 to four lanes, as well as with RBS Unit 1 have all been found to be SMALL, including the contribution of the planned new units at Big Cajun and the new transmission corridor for RBS Unit 3 outside West Feliciana Parish. Low-level and high-level radioactive waste disposal could have a SMALL impact if temporary or long-term storage is not available at other locations.
5.1.1.12	On-Site and Vicinity Land Use Impacts Summary	S	No additional mitigation measures required from those tabulated above.	Given the topics discussed above and their potential effects on land use, impacts to land use in the site and vicinity are anticipated to be SMALL.
5.1.2	*Transmission Corridors and Off-Site Areas*			
5.1.2.1	Planning and Zoning	S	New transmission structures would continue to be in compliance with the land use plans and zoning requirements of West Feliciana, Pointe Coupee, Avoyelles, Grant, and Rapides Parishes. The area crossed by the new off-site transmission corridor would be removed from residences and development as much as possible along most of the route and primarily traverses agricultural lands.	SMALL impacts on surrounding land use, because agriculture can still be practiced in the transmission corridor under the new line.
5.1.2.2	Transportation and Rights-of-Way (ROW)	S	Maintenance activities would be carried out so as not to interfere with traffic, pipeline, or utility operations in the area.	SMALL impacts, as related to transportation and ROW, because no new transportation infrastructure crossings or ROW would be needed to support the RBS Unit 3 transmission line operation.
5.1.2.3	Agricultural and Soil Issues	S	Implementation of best management practices (BMPs), use of minimal maintenance vehicles and access roads to the extent possible, and limiting transmission line maintenance during wet weather conditions.	SMALL impacts during operation of the transmission lines as a result of new vegetative cover that would have been established, which would prevent erosion onto adjacent land, and no new excavation, grading, earthwork, or similar activities would be required.

Table 5.10-1 (Sheet 4 of 23)
Summary of Measures and Controls to Limit Adverse Operational Impacts

Impact/Impact Description		Significance	Potential Mitigation Measures	Basis of Significance
5.1.2	*Transmission Corridors and Off-Site Areas (Continued)*			
5.1.2.4	Ecological Impacts	S	Compliance with the Applicant's Avian Interaction Policy would ensure that areas of high bird densities are avoided during initial line routing. When the transmission route is finalized at a time closer to operation of the lines, bird concentrations along the new off-site transmission corridors would be investigated and measures taken to mitigate anticipated effects in areas where impacts might occur.	SMALL impacts to wildlife from expansion of the on-site corridor into forested areas and the new off-site corridor into agricultural and forested areas. SMALL impacts to wildlife from routine transmission corridor maintenance due to vegetation control, access road maintenance, and from transmission line operation. Land use restrictions or changes beyond the transmission corridor's 200-ft. boundary are not expected. SMALL impacts to birds due to collisions with the lines where the lines pass through areas of bird concentration.
5.1.2.5	Recreation and Aesthetics	S	No mitigation measures required.	SMALL impacts to recreation area users from off-site transmission lines, as they may view their experience as potentially degraded by the visual intrusion of the new transmission line structures; although, they are not likely to discontinue their use of the affected recreation area. SMALL impacts to RBS employee and observers across the Mississippi River from the on-site expanded transmission corridor's aesthetic effect. SMALL impact to observers in the area of the new off-site transmission corridor, as residents or travels driving past the area would likely notice the presence of the operating transmission line. However, the transmission line would become an aspect of the landscape that viewers would likely be accustomed to seeing during operation.
5.1.2.6	Spills	S	The RBS site SPCC Plan and LPDES permit measures would be implemented to prevent and address spills that would occur on-site. The Applicant's Transmission Group has established measures to prevent and address spills along the transmission corridor and off-site areas, primarily through preventive measures.	SMALL impact due to staff training and observance of spill avoidance measures.

Table 5.10-1 (Sheet 5 of 23)
Summary of Measures and Controls to Limit Adverse Operational Impacts

Impact/Impact Description		Significance	Potential Mitigation Measures	Basis of Significance
5.1.2	*Transmission Corridors and Off-Site Areas (Continued)*			
5.1.2.7	Noise	S	No mitigation measures required.	SMALL impact from transmission line operation because the new line would add an indiscernible level of additional noise to the noise from the existing lines. The new off-site transmission line would emit a low level of noise perceived as a low humming sound over the background noise of the mostly rural route, but it is not likely to be loud enough to cause annoyance. SMALL impact from transmission line maintenance activities as the worker activity, communication, vehicle movement, and vegetation maintenance equipment noises are of short duration and would not occur on a regular basis.
5.1.2.8	Corridor Maintenance Actions	S	ROW maintenance would be conducted similar to current RBS Unit 1 operations, but over a wider area.	SMALL impacts to land use and ROW from corridor maintenance actions because of their periodic nature and typically small areas being maintained at any one time.
5.1.2.9	Electrical Impacts	S	No mitigation measures required.	SMALL impacts because the transmission lines would produce small amounts of ozone and nitrogen oxides, electromagnetic fields, and corona noise as detailed in Subsection 5.6.3.
5.1.2.10	Factors Contributing to Potential Cumulative Impacts	S	Mitigation for avian collisions, if required, would be accomplished in consultation with the USFWS.	The main transmission line operation impact that could contribute to cumulative impacts in the area is the potential for avian collisions with the transmission lines, which is projected to be SMALL. SMALL impacts to the agricultural landscape due to the presence of new electrical tower structures where none were present before.
5.1.3	*Historic Properties*			
5.1.3.1	Historic Properties Identified Within the RBS Proposed Project Area	S	The Applicant has determined that avoidance measures would be implemented for the two historic properties identified within the RBS Unit 3 footprint, prior to construction.	Operation of the proposed RBS Unit 3 project would not have an adverse effect on historic properties, and the impact to historic resources is considered SMALL.

Table 5.10-1 (Sheet 6 of 23)
Summary of Measures and Controls to Limit Adverse Operational Impacts

Impact/Impact Description		Significance	Potential Mitigation Measures	Basis of Significance
5.1.3	*Historic Properties (Continued)*			
5.1.3.2	Historic Cemeteries	S	No mitigation measures required.	Operation of RBS Unit 3 poses no immediate impacts to these cemeteries, and no viewshed concerns are associated with these cultural resources. Therefore, the impact of operations on these resources is considered SMALL.
5.1.3.3	Traditional Cultural Properties	S	No mitigation measures required.	No traditional cultural properties were identified during the background research completed for the RBS expansion project. Therefore, no traditional cultural properties would be affected by operations, and the impact of operations is considered SMALL.
5.1.3.4	Historic Properties Identified Within the Transmission Corridor	S	No mitigation measures required.	No historic properties were identified during the 2007 archaeological inventory of the proposed on-site transmission corridor. Therefore, operational impacts to historic properties within this area are considered SMALL.
5.1.3.5	Inadvertent Discovery of Cultural Resources During Plant Operations	S	The Applicant has implemented fleet-wide procedures for activities such as trenching, excavation and ground penetration, environmental reviews and evaluations, and cultural resources protection. These procedures detail immediate Stop Work orders and notification of appropriate personnel should inadvertent discovery of cultural resources take place during operation activities.	SMALL impacts to cultural resources during operation because execution of the unanticipated discoveries plan during the construction phase would protect these resources.
5.2	**Water-Related Impacts**			
5.2.1	*Hydrological Alterations and Plant Water Supply*			
5.2.1.1	Cooling Water System	S	No mitigation measures required.	SMALL impacts based upon minimal impact from dredging discharge design and no need for dewatering during operation.
5.2.1.2	Potable Water System and Dewatering	S	No mitigation measures required.	SMALL impacts because minimal groundwater is used for the operation of the RBS, and the average surface water withdrawals are minimal compared to the total Mississippi River flow past the site.
5.2.1.3	Water Returns/ Discharges	S	No mitigation measures required.	SMALL impacts to the Mississippi River because the volume of effluent is extremely small compared to the minimum flow rate in the river.

Table 5.10-1 (Sheet 7 of 23)
Summary of Measures and Controls to Limit Adverse Operational Impacts

Impact/Impact Description		Significance	Potential Mitigation Measures	Basis of Significance
5.2.1	*Hydrological Alterations and Plant Water Supply*			
5.2.1.4	Alterations to Local Streams and Lakes	S	Combined Units 1 and 3 stormwater discharge to West Creek would be larger than current discharges because of the additional impervious area and total contributing area.	SMALL impacts to West Creek to accommodate an increase in stormwater flow from the additional Unit 3 impervious areas. Discharges would be controlled in accordance with the LPDES permit and associated stormwater management program requirements.
5.2.2	*Water Use Impacts*			
5.2.2.1	Water Use – Quantity-Related Impacts	S	No mitigation measures required.	SMALL impacts because the quantity of water withdrawals and usage of Mississippi River water by RBS Units 1 and 3 is small enough in relation to Mississippi River flow to have no anticipated effect on recreation, navigation, public water supply, or other anticipated usage of the river and its water by others.
5.2.2.2	Water Use – Quality-Related Impacts (a) Impacts from Stormwater Discharges (b) Impacts from Cooling and Process Water Discharge (c) Impacts to Groundwater Quality	S	(a) Runoff control would be managed as described in the operations phase SWPPP. (b) Measures have been established to limit adverse water-use impacts involving whole effluent toxicity testing, radioactive sampling, thermal plume size, dissolved solids from cooling, and river dredging. (c) Continued groundwater monitoring.	SMALL impacts because the limits in the LPDES permit are those determined by the LDEQ to be protective of the Mississippi River water quality and the streams receiving stormwater. (a) SMALL impacts because compliance with stormwater permit limits would provide protection of the waterways first receiving the runoff and ultimately for the Mississippi River.

Table 5.10-1 (Sheet 8 of 23)
Summary of Measures and Controls to Limit Adverse Operational Impacts

Impact/Impact Description		Significance	Potential Mitigation Measures	Basis of Significance
5.2.2	*Water Use Impacts (Continued)*			
5.2.2.2				(b) SMALL impacts to water quality because whole effluent toxicity testing is anticipated to continue for RBS Unit 3 as it has for RBS Unit 1; radioactive materials because sampling results for radioactive constituents through 2006 has shown no river or sediment samples above background levels; thermal plume modeling studies to date of the RBS site have concluded that hot water discharge plumes from cooling water discharges to the Mississippi River have minimal effect because of the large size and assimilation capacity of the Mississippi River; the highest total dissolved solids value added to the increase of 2.7 mg/l from Units 1 and 3 still results in a value (291 mg/l) that is significantly below the Louisiana water quality criteria of 400 mg/l; and river dredging would be minimized from the engineering design of the embayment. To date, river dredging for current operations has been necessary no more than one time per year. (c) SMALL impacts to groundwater quality, although monitoring at RBS for 20 years of Unit 1 operation has shown no detectable radioactivity levels of plant-related materials in the subsurface soils and water tables.
5.3	**Cooling System Impacts**			
5.3.1	*Intake System*			
5.3.1.1	Hydrodynamic Descriptions and Physical Impacts	S	A low intake velocity (≤ 0.5 fps) would be maintained, which allows most aquatic organisms to avoid the intake altogether. A zebra mussel monitoring and control program (ZMMCP) has been established under the current RBS LPDES permit to monitor relative densities of mussels in the LMR and this program will be included in future LPDES permits for the RBS site.	SMALL impacts to aquatic organisms because of a low intake velocity. Extensive hydraulic modeling has concluded that the anticipated intake flow for both units (Unit 1 and Unit 3) would be negligible when compared to the average flow of the Mississippi River. The ambient flow of the river would not be altered by Unit 3 operation.

Table 5.10-1 (Sheet 9 of 23)
Summary of Measures and Controls to Limit Adverse Operational Impacts

Impact/Impact Description		Significance	Potential Mitigation Measures	Basis of Significance
5.3.1	*Intake System (Continued)*			
5.3.1.2	Aquatic Ecosystems (a) Impingement and Entrainment (b) Commercial and Sports Fisheries (c) Threatened and Endangered Species	S	(a) Unit 3 operational environmental impacts to aquatic ecosystems would be minimized by the use of a wedgewire screen with a smaller slot opening [0.11 in. (3 mm)] than the current intake screen in operation for Unit 1. (b) No mitigation measures required. (c) No mitigation measures required.	(a) SMALL impacts to aquatic organisms due to a smaller slotted intake screen and low intake velocities. SMALL impacts to fish species inhabiting the LMR because they are heavy-bodied fishes capable of out-swimming an intake velocity of <0.5 cfs, which is the velocity planned for Units 1 and 3 operations. (b) SMALL impacts due to the similar low flow design, unchanged intake location (relative to Unit 1), and updated screen technology associated with the new Unit 3. (c) SMALL impact because there have been no documented threatened and endangered species in historic larval and adult fisheries studies conducted at the site.
5.3.2	*Discharge System*			
5.3.2.1	Thermal Description and Physical Impacts	S	No mitigation measures required.	SMALL impact because the predicted thermal modeling results performed for the RBS show that the predicted mixing zone affects a very small section of the river and is not predicted to interfere with other discharges in the area.

Table 5.10-1 (Sheet 10 of 23)
Summary of Measures and Controls to Limit Adverse Operational Impacts

Impact/Impact Description		Significance	Potential Mitigation Measures	Basis of Significance
5.3.2	*Discharge System (Continued)*			
5.3.2.2	Aquatic Ecosystems (a) Thermal Impacts (b) Chemical Impacts (c) Physical Impacts	S	(a) No mitigation measures required. (b) Chemical monitoring as required by the LPDES permit. Any chemicals that exceed permitted concentrations in the effluent would be documented immediately, and corrective measures would be taken to limit adverse environmental impacts. (c) Installation of riprap around the submerged discharge port to minimize scouring in the direct vicinity of the discharge outfall.	(a) SMALL impacts because the thermal plume modeling results show that the thermal plume from combined operation of Units 1 and 3 would be minimal when compared to the breadth of the LMR. (b) SMALL impacts because testing performed at the RBS site to date has not indicated any toxicity to designated indicator organisms. Monitoring discharges, in accordance with current and future LPDES permits, would ensure that any chemical components contained in the combined Unit 1 and Unit 3 discharge would not adversely affect aquatic resources with the LMR. (c) SMALL physical impacts to aquatic resources because of the intake design.
5.3.3	*Heat Discharge System*			
5.3.3.1	Heat Dissipation to the Atmosphere (a) Length and Frequency of Elevated Plumes (b) Frequency and Extent of Ground-Level Fogging and Icing in the Site Vicinity	S	(a) No mitigation measures required. (b) No mitigation measures required.	(a) SMALL impacts because the SACTI cooling tower model output indicates that a <5% probability exists that a visible plume would be seen by either the NDCT or MDCT. (b) SMALL impacts because the predicted operation of the MDCT would result in no increased fogging at the site. Any event that may occur is likely to be coincident with a natural fog event and transient in nature, similar to the existing MDCTs, which currently do not disrupt on-site operations. Any effect (again, the model predicted none) should only be aesthetic in nature. The SACTI cooling tower model predicted no hours of fogging from the MDCT. With no hours of fogging predicted, the SACTI model then predicted no hours of icing events from the MDCT.

Table 5.10-1 (Sheet 11 of 23)
Summary of Measures and Controls to Limit Adverse Operational Impacts

Impact/Impact Description		Significance	Potential Mitigation Measures	Basis of Significance
5.3.3	*Heat Discharge System (Continued)*			
5.3.3.1	(c) Solids Deposition (i.e., Drift Deposition) in the Site Vicinity (d) Cloud Formation, Plume Shadowing, and Additional Precipitation (e) Interaction of Vapor Plume with Existing Pollutant Sources Located within 1.25 Mi. (2 Km) of the Site (f) Ground-Level Humidity Increase in the Site Vicinity		(c) No mitigation measures required beyond the proposed drift eliminators. (d) No mitigation measures required. (e) No mitigation measures required. (f) No mitigation measures required.	(c) SMALL impacts because the SACTI cooling tower plume model assumed the maximum predicted deposition rates, which are well within the NUREG-1555 acceptable levels of generally not damaging to plants. (d) SMALL impacts because the SACTI model predicted plume shadowing to be 0.62 percent per year (daylight hours). SMALL impacts from additional precipitation because the SACTI model conservatively predicted a water deposition rate of approximately 0.001 mm per month, which is less than 0.001 percent of the average monthly rainfall of even the driest month. (e) SMALL impacts associated with vapor plume interaction due to the fact that the existing MDCTs for RBS Unit 1 and the existing RBS combustion equipment are the only two existing pollutant sources within 1.25 Mi (2 Km) of the site; the proposed MDCTs would be located approximately 0.5 mi. (800 m) on opposite sides of the central power block, and the existing and proposed combustion sources are typically low-level stack point source releases that operate infrequently and they do not typically contain the same pollutants within their exhaust streams as the cooling tower vapor plumes. (f) SMALL impacts because any increases in humidity are most likely during cold periods, but these increases would likely be localized and short-lived.

Table 5.10-1 (Sheet 12 of 23)
Summary of Measures and Controls to Limit Adverse Operational Impacts

Impact/Impact Description		Significance	Potential Mitigation Measures	Basis of Significance
5.3.3	*Heat Discharge System (Continued)*			
5.3.3.2	Terrestrial Ecosystems (a) Salt Drift (b) Vapor Plumes (c) Icing (d) Plume Shadowing (e) Precipitation (f) Noise (g) Avian Collisions	S	(a) No mitigation measures required beyond the proposed drift eliminators. (b) No mitigation measures required. (c) No mitigation measures required. (d) No mitigation measures required. (e) No mitigation measures required. (f) No mitigation measures required. (g) No mitigation measures required.	(a) SMALL impacts because the maximum predicted salt deposition rate is 2.08 kg/km^2/mo, which is well below the NUREG-1555 acceptable levels of generally not damaging plants. (b) SMALL impacts because the SACTI cooling tower model predicts that neither the medium plume lengths nor the highest probability plumes for either the NDCT or the MDCT would reach off-site. (c) SMALL impacts because cooling tower plume-induced icing events are not predicted by SACTI to occur as a result of MDCT operation at RBS. (d) SMALL impacts because SACTI model results predict the resulting hours per year of shadowing to an insignificant fraction of the total daylight hours for agricultural purposes. (e) SMALL impacts from additional precipitation because the SACTI model conservatively predicted a water deposition rate of approximately 0.001 mm per month, which is less than 0.001 percent of the average monthly rainfall of even the driest month. (f) SMALL impacts because the predicted noise emissions from normal station operation are expected to conform to the NRC and EPA sound level guidelines for minimizing noise effects. The expected noise effects due to the operation of Unit 3 are expected to be similar to background and current noise levels to which local species are adapted. (g) SMALL impacts because the MDCT is relatively low in height compared to existing and proposed on-site structures.

Table 5.10-1 (Sheet 13 of 23)
Summary of Measures and Controls to Limit Adverse Operational Impacts

Impact/Impact Description		Significance	Potential Mitigation Measures	Basis of Significance
5.3.4	*Impacts to Members of the Public*			
5.3.4.1	Etiological Agents (a) Health Effects to the Public (b) Health Effects to Workers	S	No mitigation measures required. (a) No mitigation measures required. (b) No mitigation measures required beyond those implemented during the current term license would be warranted.	SMALL impacts because thermal plume modeling predicts that the combined heated effluent for both units would result in a limited thermal discharge plume into the Mississippi River within a small mixing zone. This limited size would limit the area of conditions necessary for optimal growth of etiological agents. (a) SMALL impacts because RBS Units 1 and 3 would be discharging thermal effluents into a large river as defined by 10 CFR 51.53 and the nearest potable water intake on the LMR is located 90 mi. downstream, which is far enough away to alleviate concern for impacts to potable water supply. (b) SMALL impacts because biocides are utilized to help reduce the levels of harmful microbial populations in the cooling towers. There have been no reportable cases of Legionnaires' disease at RBS Unit 1.
5.3.4.2	Noise Impacts	S	No mitigation measures required.	SMALL impacts because the day-night noise levels that are anticipated from the plant's cooling tower would be less than 65 dBA, which is recommended in NUREG-1555, at the nearest noise-sensitive receptor.
5.4	**Radiological Impacts of Normal Operation**			
5.4.1	*Exposure Pathways*			
5.4.1.1	Liquid Pathways	S	The existing Radiological Environmental Monitoring Program (REMP) would be utilized to monitor liquid pathways and would be modified, if necessary, to accommodate RBS Unit 3 operations.	SMALL impacts because there is essentially no swimming, boating, and shoreline use that occur in the area of RBS. Irrigation using Mississippi River water is not common to the RBS area. Liquid effluent releases at RBS would result in doses to the public that are within the ALARA design objectives of 10 CFR 50, Appendix I.
5.4.1.2	Gaseous Pathways	S	The existing REMP would be utilized to monitor gaseous pathways and would be modified, if necessary, to accommodate RBS Unit 3 operations.	SMALL impacts because gaseous effluent releases at RBS would result in doses to the public that are within the ALARA design objectives of 10 CFR 50, Appendix I.

Table 5.10-1 (Sheet 14 of 23)
Summary of Measures and Controls to Limit Adverse Operational Impacts

Impact/Impact Description		Significance	Potential Mitigation Measures	Basis of Significance
5.4.1	*Exposure Pathways (Continued)*			
5.4.1.3	Direct Radiation from RBS Unit 3	S	Implementation of the existing REMP for the new facility, compliance with requirements for maintaining dose ALARA, and attention to design of plant shielding to ensure dose is ALARA would result in doses of direct radiation to the public that are maintained within limits.	SMALL impacts because measure-ments of direct dose levels at the site boundary are at background levels. In addition, the closest distance to the site boundary from the proposed location of the power block at the new facility would be approximately 2493 ft. (760 m.). Therefore, similar to that for RBS Unit 1, negligible dose from direct radiation could be expected at the site boundary from the operation of a reactor or reactors at the new facility.
5.4.2	*Radiation Doses to Members of the Public (Individuals)*			
	Liquid and Gaseous Effluents	S	Implementation of the existing REMP for the new facility, compliance with requirements for maintaining dose ALARA, and attention to design of plant shielding to ensure dose is ALARA would result in doses of direct radiation to the public that are maintained within limits.	SMALL impact because the comparison of annual MEI doses with 10 CFR 50, Appendix I limits to that calculated for RBS Unit 3 show that the total dose from all pathways for an adult and a child would be less than the annual dose limit in Appendix I.
5.4.3	*Impacts to Members of the Public*			
	Liquid and Gaseous Effluents	S	Implementation of the existing REMP for the new facility, compliance with requirements for maintaining dose ALARA, and attention to design of plant shielding to ensure dose is ALARA would result in doses of direct radiation to the public that are maintained within limits.	SMALL impacts because computer modeling results show that the total site liquid and gaseous effluent doses from RBS Units 1 and 3 would be well within the regulatory limits of 40 CFR 190. As indicated in NUREG-1555, demonstration of compliance with the limits of 40 CFR 190 is considered to be in compliance with the 0.1 rem limit of 10 CFR 20.1301.
5.4.4	*Impacts to Biota Other than Members of the Public*			
	Liquid and Gaseous Effluents	S	No mitigation measures required.	SMALL impacts to biota other than members of the public because the biota doses meet the dose guidelines by a wide margin. The annual dose to biota is much lower than the daily allowable doses to aquatic and terrestrial organisms.

Table 5.10-1 (Sheet 15 of 23)
Summary of Measures and Controls to Limit Adverse Operational Impacts

Impact/Impact Description		Significance	Potential Mitigation Measures	Basis of Significance
5.5	**Environmental Impacts of Waste**			
5.5.1	*Nonradioactive Waste System Impacts*			
5.5.1.1	Impacts of Discharges to Water (a) Nonradioactive Wastewater – Clarifier Sludge, Stormwater Runoff, Roof Drains, etc. (b) Wastewater – Ion Exchange Resin Backwash and Regeneration, Auxiliary Boiler Blowdown, etc. (c) Sanitary Waste (d) Floor Drains, Chemical Drainage, etc.	S	The RBS would revise the existing SWPPP to reflect the addition of new paved areas and facilities and changes in drainage patterns. (a) Water quality would be closely monitored and the use of biocides and chemical treatments would be minimized through process optimization. Effluents containing biocides or other chemicals would be treated to be protective of the Mississippi River and to meet future LPDES permit requirements. Water from roof drains would flow overland or via a storm drain system, combining with general site runoff. Site runoff would be regulated by the SWPPP. (b) Spent resin beds would most likely be collected by a third party vendor and disposed of in an offsite licensed landfill. (c) All liquid effluents released from the proposed facility would be treated to meet future LPDES permit requirements and to be protective of the local streams and the Mississippi River. (d) Discharges from floor drains, including chemical drainage systems, would be monitored, treated and released as permitted by the LPDES permit in place at the time.	SMALL impacts from increases in volume or pollutants in stormwater discharge because the effects of the addition of impervious surfaces are expected to be negligible. BMPs initiated through the RBS SWPPP would be employed to control stormwater runoff. (a) – (d) SMALL impacts because of past operational history and that the RBS would meet the LDEQ effluent limit standards. In addition, the large volume of water available for mixing in the flow of the Mississippi River and compliance with effluent discharge limits would result in an insignificant buildup of sewage constituents.
5.5.1.2	Impacts of Discharges to Land – Nonradio-active Solid Waste	S	Nonradioactive solid waste at RBS Unit 3 (e.g., scrap metal, lead acid batteries) would be reused or recycled to the extent practicable. Solid wastes appropriate for recycling or recovery would be managed through the use of approved and appropriately licensed facilities. Nonradioactive solid waste (e.g., chemical wastes from laboratories) destined for off-site land disposal would be disposed of at approved and licensed off-site commercial waste disposal site(s).	SMALL impacts because RBS has waste minimization programs in place.

Table 5.10-1 (Sheet 16 of 23)
Summary of Measures and Controls to Limit Adverse Operational Impacts

Impact/Impact Description		Significance	Potential Mitigation Measures	Basis of Significance
5.5.1	*Nonradioactive Waste System Impacts (Continued)*			
5.5.1.3	Impacts of Discharges to Air	S	Gaseous effluent releases would comply with federal, state, and local emissions standards and regulations that would be protective of the air quality in the region of the RBS site.	SMALL impacts because air emission sources associated with the new unit would be primarily from plant auxiliary systems equipment.
5.5.2	*Mixed Waste Impacts*			
5.5.2.1	Plant Systems Producing Mixed Waste	S	No mitigation measures required.	SMALL impacts because nuclear power plant operations are not expected to generate significant volumes of mixed waste. Nuclear power plant operations are conducted in compliance with applicable NRC and EPA regulations governing the storage and disposal of mixed wastes; therefore, exposures will be minimal.
5.5.2.2	Mixed Waste Storage and Disposal Plans	S	No mitigation measures required.	All mixed waste generated could potentially be stored on-site for the life of the new facility operating license, if adequate treatment and disposal capacities or DOE acceptance of commercial mixed waste are delayed. Accumulated volumes of mixed waste would be SMALL when compared to overall LLW volumes. Incremental effluents and doses to members of the public should be minimal and would be subject to the same regulatory limits and enforcement as LLW.
5.5.2.3	Environmental Impacts	S	Implementation of mixed waste storage and disposal plans; compliance with federal and state regulations; employee training; and implementation of appropriate hazardous chemical and radiological control measures.	SMALL impact because RBS Unit 1 has produced very little mixed wastes for several years, and it is anticipated that little to no mixed waste would be produced at RBS Unit 3.
5.5.3	*Low-Level Radioactive Waste Impacts*			
		S	On-site temporary storage facilities for low-level radioactive waste would be designed to minimize personnel exposures from waste awaiting shipment. RBS utilizes commercial low-level radioactive waste disposal facilities that are sited and operated consistent with 10 CFR 61 and other appropriate regulations. The RBS also has a contingency plan in the event that disposal capacity for low-level radioactive waste is not available.	SMALL impacts because the RBS will conform to NRC and EPA requirements and guidelines to ensure that low-level radioactive waste is temporarily stored in facilities that are designed and operated property and that public health and safety and the environment are adequately protected.

Table 5.10-1 (Sheet 17 of 23)
Summary of Measures and Controls to Limit Adverse Operational Impacts

Impact/Impact Description		Significance	Potential Mitigation Measures	Basis of Significance
5.6	**Transmission System Impacts**			
5.6.1	*Terrestrial Ecosystems*			
5.6.1.1	Vegetation	S	Maintenance of the ROW would include mechanically removing tall growing trees. Pesticides and herbicides would not be used. Careful choice of vegetative species, for initial sowing after construction, that provide desirable low-growing ground cover, erosion control, improved appearance, and wildlife is encouraged. Implement Executive Order 13112 as part of the BMPS to prevent invasive species establishment or movement.	SMALL impacts because there are no threatened, endangered, or otherwise protected species of plants or protected habitat expected to be affected by operation of the transmission system, and the implementation of BMPs for vegetation control.
5.6.1.2	Wildlife	S	Compliance with the Applicant's Avian Interaction Policy would ensure that areas of high bird densities are avoided during initial line routing. When the transmission route is finalized at a time closer to operation of the lines, bird concentrations along the new off-site transmission corridors would be investigated and measures taken to mitigate anticipated effects in areas where impacts might occur, if necessary. Although there are no species of wildlife or critical habitat along the proposed transmission route, if circumstances change, then maintenance practices would be altered to protect the affected resource.	SMALL impacts to birds due to collisions with the lines where the lines pass through areas of bird concentration. In addition, bird collisions associated with the operation of transmission lines would not cause long-term reductions in bird populations. There are no threatened, endangered, or otherwise protected species of wildlife or critical habitat expected to be affected by operation of the transmission system.
5.6.1.3	Wetlands	S	Mitigation planning for the transmission line, if necessary, through consultation with natural resource agencies after final routing and design has been formalized. Wetland mitigation would be in accordance with the permit conditions.	SMALL impacts because hand-clearing of areas within the corridor that do have the potential to regenerate and accessed by boat or matting for equipment would not disturb soil. Maintenance activities would similarly access wetland areas by boat or matting. Pesticides and herbicides would not be used.
5.6.2	*Aquatic Ecosystems*			
	Transmission Line Corridor Maintenance	S	No mitigation measures required.	SMALL impacts because there are no threatened, endangered, or otherwise protected species or habitats affected by the transmission system. Based on maintenance plans for the ROW, no impacts are expected from maintenance activities.

Table 5.10-1 (Sheet 18 of 23)
Summary of Measures and Controls to Limit Adverse Operational Impacts

Impact/Impact Description		Significance	Potential Mitigation Measures	Basis of Significance
5.6.3	*Impacts to Members of the Public*			
5.6.3.1	Visual Impacts	S	No mitigation measures required.	SMALL impacts because the proposed transmission corridor passes through mostly rural areas and a variety of landscapes and habitat types avoiding parklands, wildlife areas, and similar public features.
5.6.3.2	Electric Shock Potential	S	No mitigation measures required.	SMALL impacts because the Applicant would comply with NESC provisions to prevent electric shock and the Applicant has not noted any problems with electric shock or electrostatic effects in maintenance records for the existing transmission lines.
5.6.3.3	Electromagentic Field Exposure	S	No mitigation measures required. However, if problems do arise, it is likely that they can be eliminated by modifications of the lines or ROW.	SMALL impacts because the Applicant has not encountered significant environmental problems associated with EMF from its 230 kV or 500 kV transmission lines and should be able to operate the RBS power lines without significant effect.
5.6.3.4	Noise	S	No mitigation measures required.	SMALL impacts because the proposed transmission line route makes every effort to avoid populated areas. While there may be some noise complaints near the beginning of the new transmission line operating period, it is anticipated that noise complaints would decrease as nearby members of the public become accustomed to the low-level noise from the line.
5.6.3.5	Radio, Television, Cellular Phone, and Wireless Internet Interference	S	No mitigation measures required. However, should complaints about electromagnetic interference with radio, television, cellular phone, wireless Internet reception, or other electrical devices occur, the Applicant would investigate the cause and, if necessary, replace the defective component to correct the problem.	SMALL impacts because radio and television interference is not a common or widespread phenomenon along transmission lines. Wireless internet services and cellular phones usually are not affected by high-voltage transmission lines unless the home or business is directly under the lines or immediately adjacent to the corridor edge or ROW.

Table 5.10-1 (Sheet 19 of 23)
Summary of Measures and Controls to Limit Adverse Operational Impacts

Impact/Impact Description		Significance	Potential Mitigation Measures	Basis of Significance
5.7	**Uranium Fuel Cycle (UFC) and Transportation Impacts**			
5.7.1	*UFC Impacts*			
5.7.1.1	Land Use	S	Detailed decontamination and decommission plan needed, so that temporarily committed land can be released for unrestricted use after decommissioning. Permanent committed land would not be released after plant shutdown and/or decommissioning.	SMALL impacts to UFC-committed land uses because if the quality and opportunity cost of the land is equivalent for a UFC and coal strip mine, respectively, then it is reasonable to assume that the land requirements are SMALL. Therefore, the impact on land use to support RBS Unit 3 would also be SMALL.
5.7.1.2	Water Use	S	No mitigation measures required.	SMALL impacts to UFC to support RBS Unit 3 because the water discharged to water bodies and to the ground from other fuel cycle facilities for a reactor reference year is only a small fraction of the discharge from an LWR.
5.7.1.3	Fossil Fuel Effects	S	No mitigation measures required.	SMALL impacts to UFC because the electrical energy needs for RBS Unit 3 associated with the UFC are a small fraction of an LWR.
5.7.1.4	Chemical Effluents	S	No mitigation measures required.	SMALL impacts to UFC because the tailing solutions and solids generated during the milling process are not released in quantities sufficient to have a significant effect on the environment.
5.7.1.5	Radioactive Effluents	S	No mitigation measures required.	SMALL impacts to UFC because reference data and studies conclude that if any excess cancer risk was present in U.S. counties with nuclear facilities, it was too small to be detected with the methods employed to conduct the studies.
5.7.1.6	Radioactive Wastes	S	No mitigation measures required.	SMALL impacts to UFC because the NRC proposed revisions to 10 CFR 63 proposed standards for 10,000 years after disposal in Yucca Mountain and 1 million years after disposal.
5.7.1.7	Occupational Dose	S	As appropriate, employees are monitored and trained in radiation procedures/ regulations.	SMALL impacts to UFC because the annual occupational dose attributed to all phases of the UFC for the RBS Unit 3 is approximately 1140 person-rem. Occupational doses are maintained to meet the dose limits in 10 CFR 20, which is 5 rem/yr.

Table 5.10-1 (Sheet 20 of 23)
Summary of Measures and Controls to Limit Adverse Operational Impacts

Impact/Impact Description		Significance	Potential Mitigation Measures	Basis of Significance
5.7.1	*Uranium Fuel Cycle Impacts (Continued)*			
5.7.1.8	Transportation	S	As appropriate, employees are monitored and trained in radiation procedures/ regulations.	SMALL impacts to UFC because the transportation dose to workers and the public total approximately 4.8 person-rem annually for the RBS Unit 3, as compared to the estimated collective dose from natural background radiation to the population within 50 of 144,000 person-rem/yr as identified in the RBS OLS Table 5.4-22.
5.8	**Socioeconomic Impacts**			
5.8.1	*Physical Impacts of Station Operation*			
5.8.1.1	Noise	S	No mitigation measures required.	SMALL impacts because the predicted noise emissions from normal station operation are not expected to exceed the St. Francisville nighttime sound level limit at the nearest noise-sensitive receptors. The predicted noise emissions from normal station operation are expected to conform to the NRC and EPA sound level guidelines for minimizing noise impact. The maximum expected increase in ambient sound level of 3 dB is expected to occur at Receptor R8, which would be a barely perceptible change in ambient sound level during the quietest nighttime hours.
5.8.1.2	Air Quality	S	No mitigation measures required.	Given the minor nature of air emissions associated with operation of the facility and the distance to the nearest Class I area, this distance is sufficiently far enough as to not warrant a concern; therefore, the impact is SMALL. All air emissions would be within regulatory limits in effect at the time of operation
5.8.1.3	Projected Air Quality	S	No mitigation measures required beyond the proposed drift eliminators.	SMALL impact due to cooling tower operations as discussed in Subsection 5.3.3. Air emissions from the auxiliary plant equipment would have little effect on the nearby ozone nonattainment area, but would also have minimal effect on the local and regional air quality. In addition, no open burning would occur during the operational phase.

Table 5.10-1 (Sheet 21 of 23)
Summary of Measures and Controls to Limit Adverse Operational Impacts

Impact/Impact Description		Significance	Potential Mitigation Measures	Basis of Significance
5.8.2	*Social and Economic Impacts of Station Operation*			
5.8.2.1	Local Housing	S	No mitigation measures required.	SMALL impacts because of the small percentage increase due to the operational staff housing needs compared to the projected housing units in 2017. West Feliciana Parish is studying how to address housing supply issues. Operational staff has the option of constructing new homes or relocating outside of the primary impact area to find housing.
5.8.2.2	Tax Payments (a) Local Public Services (b) Education (c) Transportation (d) Public Safety	S - M S S S - M S	No mitigation measures required. (a) No mitigation measures required. (b) No mitigation measures required. (c) Several road improvements and construction projects are already planned for the RBS area. These projects would help ameliorate traffic problems associated with the proposed facility. In addition, flexible work hours and staggering the operational and refueling workforce for each unit could be instituted. (d) No mitigation measures required; however, West Feliciana Parish currently receives revenue from the RBS to support public safety and emergency services. This would continue and most likely be increased to support the operation of the proposed new facility.	SMALL to MODERATE beneficial impacts because the operation of Unit 3 could generate approximately $45 million in state income taxes. (a) SMALL impacts due to the relocation of Unit 3 operational staff because it was determined that the population increase of the 2017 parish population is less than half of the overall annual population growth for the primary impact area in 2017. (b) SMALL impacts because the largest percent of increase in parish student population would occur in West Feliciana Parish, where 27 new students would be added under the relocation, yet this would constitute only a 1.1 percent increase compared to the 2005-2006 parish enrolment. (c) SMALL to MODERATE impacts because the maximum commuting impact would be 1400 workers or even smaller.

Table 5.10-1 (Sheet 22 of 23)
Summary of Measures and Controls to Limit Adverse Operational Impacts

Impact/Impact Description		Significance	Potential Mitigation Measures	Basis of Significance
5.8.2	*Social and Economic Impacts of Station Operation (Continued)*			
5.8.2.2	Tax Payments (Continued)			(d) SMALL impacts because the impact created in the primary impact area parishes is a function of the increase in population, as a percent of the existing parish population. As previously indicated, the 1080 increase in population in the primary impact area attributed to the relocation of a portion of the RBS Unit 3 workforce is well within the overall annual population growth of 2680 projected for 2017. RBS Unit 3 design and operational practices would be undertaken with the specific intent to minimize or eliminate negative impacts and to make RBS Unit 3 largely self-sufficient in these areas.
5.8.2.3	Public Utilities	S	No mitigation measures required. However, increased tax revenue from the proposed facility could be used to upgrade public utilities, if necessary.	SMALL impact on public utilities within the primary impact area because of the dispersed settlement pattern and considering that growth in the population and households attributed to RBS Unit 3 operation is well within the historical growth rates. RBS Unit 3 would be designed to be largely self-sufficient in the areas of required electricity, water, and water facilities.
5.8.2.4	Recreation and Tourism	S	No mitigation measures required.	SMALL impacts on recreation and tourism due to plant operation because of the relatively isolated location of the existing plant site and its distance from recreation facilities and tourist attractions.
5.8.2.5	Land Use and Aesthetics	S	No mitigation measures required.	SMALL impacts as a result of the RBS Unit 3 NDCT, along with the steam plume, would be visible from off-site locations. The RBS site is also consistent with West Feliciana land use maps, which shows the entire RBS area as an industrial park. This allows the RBS to add to controlled growth and the preservation of the rural setting of the parish.
5.8.2.6	Local Employment	M - L	No mitigation measures required.	MODERATE to LARGE beneficial impact because RIMSII Input-Output model indicates that the total income effects over a 40-year period (67,757 job-years) would generate $2.62 billion.

Table 5.10-1 (Sheet 23 of 23)
Summary of Measures and Controls to Limit Adverse Operational Impacts

Impact/Impact Description		Significance	Potential Mitigation Measures	Basis of Significance
5.8.3	*Environmental Justice Impacts*			
	Environmental Justice Impacts	No Impact	No mitigation measures required.	There are no disproportionably high or adverse impacts identified with populations near the site that would create environmental justice concerns based on low-income and minority information at the CBG level.
5.9	**Decommissioning**			
	Decommissioning	S	No mitigation measures are proposed.	SMALL impacts based on site-specific considerations of effects related to decommissioning RBS Unit 1, as discussed in the RBS Unit 1 ER. In addition, the impacts associated with decommissioning any LWR were evaluated in NUREG-0586. That report determined that the impacts associated with decommissioning under the state decommissioning operations were either SMALL or might require site-specific assessment.

5.11 CUMULATIVE IMPACTS OF OPERATION

A cumulative impact is defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time" (40 CFR 1508.7) (Reference 5.11-1). This section examines the cumulative environmental impacts of the operation of RBS Unit 3 along with the impacts from past, current, and anticipated future activities at the RBS site and the surrounding area. This section also considers renewal of the operating licenses for RBS Units 1 and 3 and the cumulative impacts of operating both units on the affected environment.

Impacts categorized as SMALL when considered alone could result in MODERATE or LARGE impacts when considered in combination with the impacts of other actions that could affect each resource area. For resources of concern in the area, SMALL individual impacts have greater importance if they contribute to or worsen the decline of existing resources.

The potential cumulative impacts of operating an additional nuclear power unit at the RBS site were considered for this analysis. Past actions are defined as those related to the existing RBS Unit 1. Present actions are defined as major projects in progress at the time of the RBS Unit 3 COLA until the projected start of construction. Future actions are those major projects that are reasonably foreseeable through construction and operation of RBS Unit 3. The geographical area over which past, present, and future actions could contribute to cumulative impacts depends on the resource area being analyzed; these areas are considered in each subsection.

Most of the environmental impacts that have occurred at the RBS site have been associated with the construction and operation of the existing RBS Unit 1. These actions include the construction and operation of the RBS Unit 1 nuclear reactor and associated facilities, which have resulted in various positive and negative impacts to the site and surrounding area. Potential impacts from RBS Unit 3 construction and operation are detailed in Chapters 4 and 5 of this ER.

5.11.1 LAND USE

The geographic area considered for potential cumulative impacts to land use encompasses West Feliciana Parish, Louisiana.

In general, cumulative impacts to land use include possible new development and land conversion from forested and agricultural land to various intensities of development to accommodate new workers and services. Impacts from general workforce changes in this area are expected to be minor, because the operations workforce is expected to relocate from an area much wider than West Feliciana Parish, which may include the larger cities of Baton Rouge and New Orleans, Louisiana, and Jackson, Mississippi, as well as other areas of the United States. Because the workforce would be dispersed over these larger cities in the labor supply region, the induced impacts on land use (from operations of a new unit at the RBS site) could be easily absorbed within the surrounding region.

Approximately 91 ac. of the RBS site would be permanently occupied by facilities associated with Units 1 and 3. While it is possible that the operation of RBS Units 1 and 3 could encourage further development in West Feliciana Parish and the St. Francisville area, experience with operation of RBS Unit 1 demonstrates that this has not happened in the past.

Section 2.8 lists the major projects planned for the RBS area. The widening of U.S. Highway 61 north of the RBS is not likely to have significant land use impacts because much of the land is used for the existing U.S. Highway 61 and its current ROW. The development and operation of the Audubon Bridge, State Highway 10, and the fourth unit of Big Cajun Power Plant across the river in Pointe Coupee Parish are scheduled to be completed by 2010 and would have little or no impacts during operation, compared to construction activities. RBS Unit 3 has a projected operation date of 2017, which would spread the cumulative impacts of the various projects being proposed in the area over a greater length of time, making them less likely to have cumulative adverse impacts to the area.

As noted in Subsection 2.2.2.2, a new transmission line (on-site and off-site) will be added to accommodate the power output from the proposed RBS Unit 3. The proposed on-site expansion of the transmission corridor would affect an area of approximately 15 ac. of forest, while the new off-site transmission corridor would involve approximately 3334 ac. of various land uses along its 148-mi. route. However, since the impacts associated with this facility would occur almost exclusively during project construction, the operation of the transmission line should not significantly contribute to any cumulative impacts.

In prior environmental reviews, the operational impacts of the Audubon Bridge, State Highway 10, and RBS Unit 1 have been found to be SMALL. Including the Big Cajun and transmission line projects outside of the parish, all additional planned major projects (primarily new units at Big Cajun and the RBS and a new transmission corridor for the RBS) would be subject to all applicable environmental review and compliance programs. Only small individual impacts to land use in West Feliciana Parish have been identified in the past or are projected for the future, as noted in the information presented in this ER. From all individual reviews, no additional cumulative land use impacts have been identified.

5.11.2 AIR QUALITY

This subsection focuses on air impacts to the RBS and contributions to the region. Primarily, impacts to air quality would be from backup and emergency equipment (e.g., diesel generators and firefighting equipment) and the cooling towers. The RBS site is located in the southern tip of West Feliciana Parish in an area that is in attainment for all EPA-listed criteria pollutants. This includes the impacts of all industrial facilities in the region, including such major sources as Big Cajun across the river from the RBS in Point Coupee Parish, and the Tembec paper facility (or successors) downriver from the RBS.

Air emissions of criteria pollutants from RBS Units 1 and 3 would be minor, given the nature of a nuclear facility and its lack of significant gaseous exhausts of effluents to the air. Sources of air emissions for the proposed Unit 3 facility include two standby diesel generators, an auxiliary boiler, two diesel fire pumps, as well as a natural draft and a mechanical draft cooling tower. The combustion sources mentioned above would be designed for efficiency and operated with good combustion practices on a limited basis throughout the year (often only for testing). Given their small size and infrequent operation, these emissions would not only have little effect on the area of the RBS, but would have minimal impact on the local and regional air quality as well. Final emissions would depend upon the specific equipment selected for implementation, but emissions from all equipment will be within regulatory guidelines set by federal and state agencies to be protective of air quality in the RBS region. Criteria pollutant emissions impacts from RBS Unit 3 would be combined with the impacts of similar emissions for RBS Unit 1. Because such equipment is operated only intermittently, and as described above, the cumulative impacts would be SMALL.

The proposed cooling towers would not be a source of the typical combustion-related criteria pollutants or other toxic emissions. They would, however, emit small amounts of particulate matter as drift. The towers would be equipped with drift eliminators designed to limit drift to approximately 0.002 percent or less of total water flow. Additionally, the primary NPHS proposed for the project is a natural draft cooling tower (along with mechanical draft towers, particularly in hot months). The height of the natural draft tower would allow for good dispersion of the drift and not allow localized concentrations of particulate matter to be realized. The minor nature of the effects of the new cooling towers on visibility and air quality, including the potential for increases in ambient temperature and moisture, icing, fogging, and salt deposition, is discussed in further detail in Subsection 5.3.3. As discussed in Subsection 5.3.3, the impacts of cooling tower operation are expected to be localized and minor in nature. Including similar minor impacts from the existing RBS Unit 1 cooling towers, the cumulative impact of all of the cooling towers on regional air quality would be SMALL and would not warrant mitigation.

During operation, no impacts associated with dust are expected to leave the RBS site because it is relatively isolated and has a significant tree buffer between the operations area and off-site permanent populations and structures. Combustion sources that burn fossil fuels are not typically sources of odor emissions because they do not process or treat effluent streams rich in odorous compounds such as hydrogen sulfide. Additionally, no open burning would occur during the operational phase. The potential air impacts due to the operation of RBS Unit 3 are expected to be SMALL.

Likewise, the additional impact of any other pending industrial expansion in the RBS vicinity, such as the expansion of Big Cajun across the river, would be SMALL due to the restrictions provided by new facility air permitting programs under the LDEQ and the EPA, and associated control and modeling criteria.

Considering all factors together, the cumulative impacts of the operation of a new RBS Unit 3 and all other current and proposed activities in the West Feliciana Parish area would be SMALL and would not warrant additional mitigation.

5.11.3 WATER USE AND QUALITY

This subsection focuses on water usage from the Mississippi River as the surface water body supplying and receiving water for the RBS, and also as the body of water that provides potential liquid pathways for both radiological and nonradiological effluents. Groundwater impacts are also discussed.

The cumulative impact geographical area for surface water in this analysis is the Mississippi River segment from the RBS south approximately 33 river miles to Baton Rouge and the USGS monitoring station there. The impact area for groundwater is West Feliciana Parish.

5.11.3.1 Surface Water Use

As noted in Subsection 2.3.2, the predominant use of Mississippi River water in Louisiana is for power generation, with extensive use for cooling. The Mississippi River will be the primary source of water for the new RBS Unit 3, including an estimated combined makeup flow withdrawal to Units 1 and 3 of approximately 40,927 gpm or 58.9 Mgd (based on the addition of individual flow rates shown in Figure 3.3-1, which summarizes the proposed water use at RBS Units 1 and 3).

The Mississippi River has a large flow rate at the RBS, as discussed in Subsection 2.3.1, and the planned maximum daily intake of river water by RBS Unit 1 and a new RBS Unit 3 is only about 0.1 percent of the estimated minimum Mississippi River flow volume.

The neighboring and nearest downstream users of Mississippi River water are power and industrial users including Big Cajun and the Tembec paper facility (or successors). According to the USGS (Reference 5.11-2), approximately 29.8 Mgd of Mississippi River water was used for paper products in 2000 in West Feliciana Parish, and a total of 274 Mgd was withdrawn for power generation in the Point Coupee Parish (location of Big Cajun).

The sum of RBS, Tembec, and Pointe Coupee Parish usage flows is estimated at approximately 363 Mgd or only about 0.6 percent of the minimum Mississippi River flow of 100,000 cfs or 64,600 Mgd. (Even if future expansion at Big Cajun doubled that facility's withdrawal of water, the total usage by the RBS, Tembec and Big Cajun would be 637 Mgd or about 1 percent of the low flow of the Mississippi River.)

The cumulative impacts of RBS Unit 3 and other water withdrawal on the Mississippi River and downstream users would be SMALL and would not warrant mitigation.

5.11.3.2 Surface Water Quality

A comparison of water quality data collected by the USGS from the Mississippi River upstream and downstream of the RBS site (as described in Subsection 2.3.3 and in Tables 2.3-17 and 2.3-18) shows that Mississippi River water quality is substantially similar throughout the 36-mi. segment from St. Francisville, past the RBS, to Baton Rouge. The data trends demonstrate the ability of the Mississippi River to assimilate discharges and drainage to the river over that segment. This includes the impacts of all additional industrial discharges to the river in that segment, including Big Cajun and the Tembec paper facility (or successors) in the vicinity of the RBS.

In addition, with regard to actual upstream and downstream monitoring of the Mississippi River around the RBS, the results of the radioactivity sampling are discussed in Subsection 2.3.3 and Sections 5.4 and 5.5. Potential radioactivity release is monitored at RBS Unit 1 in compliance with the NRC license and NRC regulations and is reported annually to the NRC. This monitoring includes the following:

- Quarterly sampling of radioactivity in upstream and downstream Mississippi River surface water.
- Annual sampling of radioactivity in Mississippi River sediment.

Through 2006, the results of the monitoring program have indicated discharges and impacts below the limits of 10 CFR 20 and no river or sediment samples above levels that are already present from either naturally occurring background or weapons testing. Radionuclide levels that were monitored in 2006 continued to remain similar to results obtained in previous operational and preoperational years (Reference 5.11-3). This information reflects the cumulative impact of all existing nuclear power plants upstream of the RBS in the Mississippi River watershed.

An independent study of Mississippi River water quality by the National Research Council in 2007 (Reference 5.11-4) identified nutrients (such as nitrogen and phosphorous compounds) as the primary challenge to Mississippi River water quality. The RBS discharges are not a contributor to this issue, as noted in the discharge analysis results in Table 5.2-2. Nutrient compounds are not a significant concentration in the RBS effluent and have not been targeted for permit limits in past reviews by the LDEQ.

The continuing limitations on discharges from the RBS and other discharges to the Mississippi River by LPDES permits, and continuing regulation of water quality criteria in the Mississippi River by the LDEQ and EPA, provide a regulatory system to manage impacts to river water quality so as to reduce significant cumulative impacts.

Based on the above factors, the expected cumulative impacts of discharges to the Mississippi River with the addition of RBS Unit 3 are expected to be SMALL and no further mitigation measures are required.

5.11.3.3 Groundwater Use

Planned groundwater or public water usage for RBS Unit 3 is estimated at a maximum of only 315 gpm. This rate is a relatively small flow from the public system or on-site aquifer systems described in Subsection 2.3.2, and is a very small portion of the total water needs, as shown in Figure 3.3-1. Most on-site groundwater usage could be displaced by water supplied by the West Feliciana Water District. The water district has additional water available for the RBS and other users if needed. This public water usage by the RBS is not expected to compete with other future needs for the public water in the area.

Cumulative impacts to groundwater during operation would be SMALL and would not warrant mitigation.

5.11.3.4 Groundwater Quality

Existing operations of RBS Unit 1 have not resulted in significant, adverse impacts to groundwater quality. Semiannual upgradient and downgradient groundwater sampling for radioactivity has not indicated any changes in naturally occurring background levels (Reference 5.11-3). Groundwater sampling that was conducted in 2007 for a variety of physical and chemical parameters (summarized in Table 2.3-20) did not indicate apparent impacts from more than 20 years of RBS Unit 1 operations. Also, most on-site groundwater usage could be displaced by water supplied by the West Feliciana Water District, as noted above.

Potential radioactivity release is monitored at RBS Unit 1 in compliance with the terms of the NRC license and NRC regulations (10 CFR 20) and is reported annually to the NRC. Results of the monitoring program indicated that radionuclide levels monitored in 2006 continued to remain similar to results obtained in previous operational and preoperational years (Reference 5.11-3). RBS samples additional wells as part of the NEI Groundwater Protection Initiative.

The above information indicates that RBS Unit 1 has had no significant impact on groundwater quality and, likewise, no impacts are expected from the operations of RBS Unit 3. The following list presents the minimal opportunities for impact:

- Storage and use of chemicals and other potential pollutants are very limited at the RBS.
- Process operations and materials storage are in sealed buildings with monitored containment and discharge points.
- Spills, leaks, and releases of materials are prevented and managed at the site under such active programs as the SWPPP, spill prevention planning, use of appropriate chemical storage systems, and frequent inspections of material storage systems.
- Discharges from the site are controlled via the LPDES discharge permit (Reference 5.11-5).
- Semiannual groundwater monitoring for radioactivity will continue under the terms of the existing NRC license for RBS Unit 1 and expected license for RBS Unit 3.
- There are no other significant sources of radionuclides (i.e., nuclear facilities) in the area of consideration.

The impacts to groundwater at the RBS site from the operation of RBS Units 1 and 3 are expected to be SMALL, and no mitigation measures are required. Likewise, the cumulative impacts to groundwater in the West Feliciana Parish area, including operations of RBS Units 1 and 3, are expected to be SMALL.

5.11.4 ECOLOGY

After construction is complete for RBS Unit 3, Big Cajun, and the Audubon Bridge south of the RBS site, aquatic and terrestrial ecology conditions are expected to return to predominantly preconstruction conditions. There are no other past, present, or future actions in the West Feliciana Parish immediate vicinity that would significantly affect wildlife and wildlife habitat in ways similar to the operation of RBS Units 1 and 3. Therefore, the cumulative impact from the project would be SMALL.

5.11.4.1 Terrestrial Ecology

The operation of a new unit at the RBS site was evaluated to determine the magnitude of its contribution to regional cumulative adverse impacts on terrestrial ecological resources. Determinations for operation were made for resource attributes normally affected by cooling tower operation, transmission line operation, and ROW maintenance. For this analysis, the geographic region encompassing past, present, and foreseeable future actions is the area immediately surrounding the RBS. Other projects of similar magnitude include the Audubon Bridge and Big Cajun.

As described in Subsection 2.4.1, the operation of RBS Unit 3 is not expected to block existing travel corridors for wildlife movement because the plant is being developed in proximity to the existing facility, and existing corridors are being utilized (although widened in the case of the transmission line) for linear facilities. The area surrounding the existing unit is a mosaic of developed land, mowed grass, woodlots, and second generation forest that does not appear to provide significant travel corridors as might be found along water courses or entry and exit locations for desirable foraging or resting habitats. No important terrestrial species or "critical habitats," as defined by the Endangered Species Act of 1974 as amended, are currently known to occur on the RBS site or in the vicinity. As described in Subsection 2.4.1, correspondence from the USFWS and the LDWF did not list any federally protected terrestrial species, plants, or animals as occurring on or in the vicinity of the RBS site. The USFWS stated that the project "is not likely to adversely affect those resources."

Off-site transmission would include a new, 200-ft. wide, 148-mi. long corridor between the Fancy Point Substation at the RBS and a new switching station at Natchitoches, Louisiana, that is located on the existing Hartburg-Mount Olive 500 kV transmission line. The switchyard would be approximately 1000 by 1000 ft. This new 500 kV transmission system is discussed in Section 3.7 and is based on a routing study completed in January 2008. Forested and potential regulated wetland and water areas are the most significant acreages represented, with forests comprising about 468 ac. or 14 percent of the proposed route. Of the 468 ac., approximately two-thirds is pine plantation. Wetlands and other waters that would potentially be regulated account for 684 ac. or approximately 20 percent of the route.

No federal or state threatened or endangered species, or critical habitats for these species, appear to be affected by the Natchitoches route. Additionally, 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 the RBS transmission line operation and ROW maintenance (birds colliding with transmission lines; flora and fauna affected by electromagnetic fields and ROW maintenance; and floodplains and wetlands affected by ROW maintenance). In any case, most of the impacts associated with the transmission line would not significantly contribute to RBS operation cumulative impacts.

Thus, because these impacts were considered negligible for the RBS, the cumulative adverse impacts of these types of activities in the region would also be minor (SMALL). Consequently, the contribution of transmission line operation and the maintenance of the transmission line ROW to cumulative impacts on wildlife and wildlife habitat in the region would be SMALL. Additional mitigation would not be warranted.

During the development of this ER, no other past, present, or future actions in West Feliciana Parish were identified that could significantly affect wildlife and wildlife habitat in ways similar to those associated with the RBS 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 RBS, the cumulative adverse impact of these types of activities in the parish would also be considered minor. Consequently, the contribution of RBS Unit 3 cooling tower operations to cumulative impacts on wildlife and wildlife habitat in the region would be SMALL.

5.11.4.2 Aquatic Ecology

The magnitude of impacts on regional aquatic ecological resources for operation of the new RBS Unit 3 has been reviewed. 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 analysis, the geographic region encompassing past, present, and foreseeable future actions is the area immediately surrounding the RBS, including adjoining sections of the Mississippi River and the area surrounding the existing RBS Unit 1 and transmission line ROW. Other projects of similar magnitude include the Audubon Bridge and Big Cajun.

From an aquatic ecological perspective, the construction of RBS Unit 1 in the 1980s did not significantly change the Mississippi River. For example, in 2007, a comparative analysis of recent (2000 - 2001) and historic (1977 - 1979) fish samples collected near St. Francisville and the RBS site (RM 240 to RM 273) was performed, as discussed in Subsection 2.4.2.2.1. Studies examined for this analysis documented 79 species of fish as common to scarce, and no threatened or endangered species were encountered in either set of samples. Final conclusions stated that the fish communities identified in both historic and recent surveys are similar, indicating that the fish community of the Mississippi River near the RBS site is relatively stable and the speciation of common fishes has not changed significantly since historic studies (1970s) were performed prior to the RBS construction and the expansion of Big Cajun operations.

The potential RBS Unit 1 and 3 cumulative impacts related to water use and to impingement and entrainment of aquatic organisms were evaluated. Operation of the combined RBS 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. 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 withdrawn for RBS Units 1 and 3 would be approximately 0.1 percent of the flow of the river at extreme low flow conditions. The intake screens would be sized so that the average intake through the screen would have a flow velocity of less than or equal to 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 federal- or state-listed threatened and endangered species. As noted in Subsection 2.4.2, the LDWF identified the pallid sturgeon as a species of concern that could potentially inhabit the Mississippi River waters near the RBS site. Because this species is a deepwater, channel-dwelling species, the pallid sturgeon is not expected to be affected by construction and operational activities at the RBS site.

Review for this ER considered the potential cumulative impacts related to water discharge. Since the operation of RBS Unit 1 began, heated effluent has been discharged into the river. The size of the plume that would include the combined discharge from both RBS Unit 1 and the proposed

RBS Unit 3 would be small in comparison to the length and width of the Mississippi River near the RBS discharge.

Additionally, as noted in Section 6.1, thermal plume analysis of the Big Cajun outfall predicted a worst-case plume during August extreme low flow conditions. The horizontal width of the Big Cajun discharge plume extends from 367 to 1125 ft. into the channel from the west bank. That compares to a summer minimum flow plume about 5 ft. wide, modeled from RBS Units 1 and 3 on the east side of the river during the August low flow conditions. Considering that the total width of the channel during low flow conditions is estimated to be approximately 1700 ft. wide, model predictions indicate that the two plumes are not expected to come into contact with each other and that both would dissipate within a relatively short reach of the river.

Operation of the proposed discharge structure would not be expected to affect species of special interest or federal- or state-listed threatened and endangered species.

The amount of water, its temperature, and its chemical composition are regulated by the LDEQ through the LPDES permit program. The LDEQ regulates point sources discharging pollutants to ensure the protection and propagation of a balanced, indigenous population of fish, shellfish, and other aquatic organisms. The LDEQ is required to take into consideration the cumulative impacts of multiple discharges to the same body of water. Therefore, discharges from the RBS and other area facilities would be included in the review and development of permit requirements (including measures to minimize cumulative impacts) for a new RBS Unit 3 and for subsequent renewals of permits for combined RBS Unit 1 and 3 operations.

In summary, the contribution of operation (including operation of the intake structure) of the RBS to the cumulative impacts on aquatic ecological resources in the West Feliciana Parish area would be SMALL and would not warrant additional mitigation.

5.11.5 SOCIOECONOMIC, HISTORIC, AND CULTURAL RESOURCES

Much of the analyses of socioeconomic impacts presented in Section 5.8 already incorporate cumulative impacts, 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 would 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.

Operation of RBS Unit 3 would create LARGE positive direct and indirect socioeconomic benefits in the areas of employment, income, and tax revenues, while maintaining consistency with the parish plan. This implies that the project would generate substantial economic benefits to the parish and region while having a neutral or minimal impact on area culture and human health. The potential for negative impacts arising from the demand for local facilities and services would be controlled through appropriate operating practices at the site (e.g., security, fire, safety measures), or are not a concern due to sufficient excess capacity (with regard to schools and water supply). Though there is a current shortage of workers and starter housing in West Feliciana Parish, studies are under way to address the problem and ample housing exists in the region to accommodate the operating staff. The only issue identified as potentially having a negative impact greater than SMALL is the possibility of traffic impacts, which will be studied further in cooperation with the LDOTD.

With regard to historic and cultural resources, the operation of RBS Unit 3 is not expected to add any cumulative impacts beyond those impacts to the facility area identified in Chapters 4 and 5. The Applicant will develop procedures to ensure that either known or newly discovered historic and cultural sites would not be inadvertently affected during on-site activities that involve land disturbances. Operation and maintenance of the new facility would not affect land outside the bounds of the current RBS property. Therefore, the facility's contributions to cumulative impacts would be SMALL.

5.11.5.1 Environmental Justice

The cumulative impact area for environmental justice is the vicinity of RBS. As noted in Subsection 5.8.3, it is reasonable to conclude that the three conditions required for environmental justice impacts are absent in the area of the RBS. Namely, (1) low-income or minority populations (as defined by criteria previously described in Subsection 2.5.4) are not in close proximity to the RBS site, (2) during operation, only SMALL negative cultural, economic, or health impacts (in the form of increased traffic) are expected, and (3) low-income and minority populations would not encounter a disproportionate share of any negative impacts from the operation of RBS Unit 3 since such populations are not located near the site. As with the other socioeconomic factors, the metrics used for analysis are reflective of a total or cumulative context for all past and current activities in the area.

5.11.6 NONRADIOLOGICAL HEALTH

The impact analysis discussed in this subsection addresses the RBS site and on-site workers during operations. Any nonradiological health impacts are expected to be localized to the site property. (Nonradiological health impacts discussed herein do not include air quality and water quality impacts discussed above.)

Nonradioactive solid wastes will be shipped off-site and managed at licensed facilities. The volume of additional wastes would be minimized through waste minimization programs; therefore, the cumulative impacts of waste disposal, including any health impacts from this waste, are expected to be SMALL.

The cumulative health impacts of operation of the existing RBS Unit 1 and proposed RBS Unit 3 on the ambient temperature of the Mississippi River with regard to potential formation of thermophilic microorganisms were evaluated in Subsection 5.3.4. The evaluation showed that the addition of RBS Unit 3, which would use cooling towers as the source of cooling, would not have a significant impact because the discharge would be into a large river. The RBS currently uses biocides to reduce hazards from microbiological organisms in the cooling towers, and the Applicant has committed to employ appropriate industrial hygiene practices to protect the occupational workers from the effects of thermophilic microorganisms in the cooling towers for the new unit. 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 noise and dust emissions were also evaluated and found to be SMALL. In summary, the cumulative impacts on nonradiological health would be SMALL and would not warrant additional mitigation.

5.11.7 RADIOLOGICAL IMPACTS OF NORMAL OPERATION

The geographical area of the impact analysis discussed in this subsection includes the RBS site during the period of operation of RBS Units 1 and 3. The analysis uses the RBS as the only significant source of radioactivity in the immediate RBS area.

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. The public and occupational doses predicted from the proposed operation of RBS Unit 3 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 combined would be well within that of the regulatory standard 40 CFR 190 (Reference 5.11-6). For purposes of this analysis, the geographical area within 50 mi. (80 km) of the RBS site was included.

As stated in Section 2.5, the Applicant has conducted a radiological environmental monitoring program around the RBS site since prior to operations in 1985. The radiological environmental monitoring program measures radiation and radioactive materials from all sources including the RBS. The NRC and the LDEQ would regulate any reasonably foreseeable future actions that could contribute to the cumulative radiological impact.

The volumes of low-level and high-level (spent fuel) radioactive wastes would be reduced through waste minimization programs. Low-level wastes may continue to be shipped to a licensed disposal facility in the near term; however, both low- and high-level wastes may need to be stored on-site at the RBS for the long term until a national repository is available. Since high-level radioactive waste from RBS Unit 1 is currently stored at the site, storing waste from the operation of RBS Unit 3 would not add significant additional impacts at the site beyond those already discussed in this ER. Cumulative impacts from waste disposal are expected to be SMALL.

Considering all factors discussed above, the cumulative radiological impacts of operation of a new RBS Unit 3 and the existing operating RBS Unit 1 would be SMALL and would not warrant additional mitigation.

5.11.8 URANIUM FUEL CYCLE, TRANSPORTATION, AND DECOMMISSIONING

The addition of the proposed RBS Unit 3 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 hexafluoride is converted into uranium oxide fuel pellets, and disposition of the spent fuel in a proposed Yucca Mountain repository.

The environmental impacts of fuel cycle activities for the proposed unit 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-cooled reactor

(LWR) operating at 80 percent capacity with a 12-month fuel loading cycle and an average fuel burnup of 33,000 MWd/MTU. According to 10 CFR 51.51(a), the NRC typically considers the impacts in Table S-3 to be acceptable for the 1000 MW(e) reference reactor.

Advances in reactors since the development of the Table S-3 impacts would 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 RBS 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 cumulative fuel cycle impacts of operating RBS Unit 1 combined with operating RBS Unit 3 for the 1000 MW(e) LWR scaled model would be SMALL.

The addition of the proposed RBS Unit 3 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 plant. The following environmental impacts from transportation of unirradiated fuel, spent fuel, and waste were derived from the NRC staff analysis of unirradiated fuel shipments:

- 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.
- The annual dose to workers and the public would be less than the dose specified in Table S-4.
- Health impacts are projected to be small (i.e., less than 1 x 10^{-4} detriment/yr).

The following conclusions were derived for spent fuel:

- After accounting for conservative assumptions in the NRC staff's evaluation, doses to the workers and the public would be within the criteria specified in Table S-4.
- 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 normalized number of waste shipments would be within the value specified in Table S-4 for the 1100 MW(e) reference reactor. The cumulative impacts of transportation for operating both RBS Unit 1 and the proposed RBS Unit 3 would be SMALL.

5.11.9 CONCLUSION

In conclusion, the cumulative impacts of the operation of RBS Unit 3 would not be significant when considered together with the impacts of the operation of RBS Unit 1 and other existing or planned activities in the vicinity or the region.

The potential adverse short-term and long-term impacts from the operation of RBS Unit 3 have been identified and actions to mitigate those impacts proposed. Activities to be undertaken during operation of RBS Unit 3 are consistent with those currently in place for RBS Unit 1. Except for the construction footprint, available land use and the terrestrial environmental would remain largely unchanged.

Operation of the new unit would require the use of certain natural resources, including water withdrawal from the Mississippi River for cooling, and would result in the release of process gaseous, liquid and solid wastes, all in conformance with applicable local, state, and federal permit requirements and standards.

In evaluating the cumulative potential impacts resulting from operation of a new nuclear unit at the RBS for the duration of the proposed action (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 affected area, the potential cumulative impacts resulting from operation with planned mitigation are generally SMALL and would not warrant additional mitigation.

5.11.10 REFERENCES

5.11-1 40 CFR 1508.7, "Cumulative Impact."

5.11-2 U.S. Geological Survey and Louisiana Department of Transportation and Development, *Water Use in Louisiana, 2000*, 2002.

5.11-3 Entergy Operations, Inc., *River Bend Station - Annual Radiological Environmental Operating Report for 2006*, April 2007.

5.11-4 National Research Council, *Mississippi River Water Quality and Clean Water Act: Progress, Challenges and Opportunities*, ISBN:978-0-309-11408-0, 2007.

5.11-5 Louisiana Department of Environmental Quality, "Louisiana Water Discharge Permit - River Bend Station, Permit Number LA0042731," June 2006.

5.11-6 40 CFR 190, "Environmental Radiation Protection Standards for Nuclear Power Operations."

CHAPTER 6 ENVIRONMENTAL MEASUREMENT AND MONITORING PROGRAMS

This chapter presents the details of the environmental monitoring programs that are instituted for the periods prior to application submission (preapplication), during construction, prior to operation (preoperational), and during operation of RBS Unit 3. These monitoring programs establish a baseline of information that allows for the evaluation of future information and provides a method of quantifying the environmental effects of RBS Unit 3 operations.

The environmental measurement and monitoring programs are described in the following sections:

- Thermal Monitoring (Section 6.1).
- Radiological Monitoring (Section 6.2).
- Hydrological Monitoring (Section 6.3).
- Meteorological Monitoring (Section 6.4).
- Ecological Monitoring (Section 6.5).
- Chemical Monitoring (Section 6.6).
- Summary of Monitoring Programs (Section 6.7).

Monitoring details (e.g., sampling equipment, constituents, parameters, frequency, and locations) for each specific phase of the overall program are described in these sections.

The following is a brief discussion of the monitoring periods:

- **Preapplication Monitoring**--These field monitoring and data collection activities are used to support the baseline discipline-specific descriptions presented in the Environmental Report.
- **Construction Monitoring**--These monitoring activities evaluate the effects from site preparation and construction. These activities also detect any environmental impacts and allow comparison to preconstruction baseline data to assess the subsequent effects of site preparation and construction.
- **Preoperational Monitoring**--These monitoring activities establish a baseline for identifying and assessing environmental impacts resulting from RBS Unit 3 operation.
- **Operational Monitoring**--These monitoring activities establish the effects of plant operations and detect any environmental impacts.

As discussed in Section 6.6, standard sample preservation and analytical methods (in conformance with 40 CFR 136) are specified in the RBS Unit 1 Louisiana Pollutant Discharge Elimination System (LPDES) permit and are to be used when RBS Unit 3 becomes operational and the discharge of process wastewater commences. Potential radioactivity release is monitored in compliance with the U.S. Nuclear Regulatory Commission (NRC) license and NRC regulations for surface water and groundwater sampling conducted (Subsection 6.6.1).

Samples are obtained following generally accepted field sampling practices using clean sampling devices, and clean and pre-prepared sample containers. Automated systems used for sample types that require instantaneous and totalized monitoring, recorder monitoring, and composite monitoring are maintained and calibrated in accordance with the equipment manufacturer's requirements to verify and ensure accuracy. Analysis of samples for constituents that are not monitored using instantaneous and totalized automated systems may be performed by the RBS or an independent third-party laboratory. Samples submitted to an independent third-party laboratory are submitted in accordance with a chain-of-custody protocol. The RBS and the independent third-party laboratory are to comply with the necessary laboratory certification methodologies specific to data quality objectives, quality assurance procedures, quality control methods (including quality procedures/instructions for instrument maintenance and calibration), and statistical methods to interpret analytical results in accordance with 40 CFR 136.

6.1 THERMAL MONITORING

This section describes the preapplication (Subsection 6.1.1), construction (Subsection 6.1.2), preoperational (Subsection 6.1.3), and operational (Subsection 6.1.4) thermal monitoring program for RBS Unit 3. The objective of thermal monitoring during each phase is to comply with federal and state water quality criteria and to protect aquatic life within the area of influence of the facility.

6.1.1 PREAPPLICATION MONITORING

Preapplication monitoring for RBS Unit 3 consists of the use of past and present temperature monitoring activities that have been conducted for RBS Unit 1. RBS Unit 1 began commercial operation in June 1986. More than 20 years of monitoring activities have been accumulated that provide the baseline water temperature conditions and preapplication program description for RBS Unit 3. This program also includes evaluations made for the licensing and permitting of the existing RBS Unit 1.

Discharge Temperature Measurements of RBS Unit 1

The Applicant continually measures and records the temperature of the RBS Unit 1 cooling water discharge as part of compliance with the existing LPDES permit (Reference 6.1-1). The sampling location is at the blowdown control structure, west of the plant, approximately 1.1 mi. off Louisiana Highway 965 on the left side of the access road. This location is prior to discharge to the river, with additional cooling in the pipe run prior to the actual discharge point; therefore, the obtained values are a conservative measure of the actual discharge temperature. Data charts are archived (Reference 6.1-2). The hydrology of the vicinity is discussed in Subsection 2.3.1.

Mississippi River Temperature Monitoring

The RBS Mississippi River temperature monitoring primarily utilizes the data collected on an ongoing basis by the U.S. Geological Survey (USGS) near St. Francisville, Louisiana (Gage Number 07373420) (Reference 6.1-3). Temperature records at this location, roughly 3 mi. upstream of the RBS, have been collected at approximate monthly intervals that were available from January 31, 1968 through September 25, 2007 (Reference 6.1-3). The monitoring data collected adequately establish the baseline data in the Mississippi River to support the potential environmental effects discussed in this report, and the thermal discharge descriptions and evaluations provided in Section 5.3.

Past Thermal Effect Evaluations of RBS Unit 1

RBS thermal discharge plumes from cooling water discharges to the Mississippi River have had minimal effect because of the large size and assimilation capacity of the Mississippi River, as discussed in Subsection 2.3.3. As noted in Subsection 5.2.1.1, the maximum withdrawal rate of water by the proposed RBS Unit 3 and the existing RBS Unit 1 is approximately 0.1 percent of the estimated minimum Mississippi River flow. As noted in Subsection 2.3.1.1, the river channel width at the station site is approximately 1700 ft., but it increases in width downstream to more than 4000 ft. within 4 mi. Past studies have indicated that plumes do not restrict fish passage or significantly raise the river temperature (Reference 6.1-4).

The RBS Unit 1 Environmental Report developed in 1984 (Reference 6.1-4) presented plume modeling data and concluded that the heat plume was very limited in width and length. The Louisiana Department of Environmental Quality (LDEQ) last evaluated the RBS Unit 1 discharge in 2005 to develop a renewed LPDES permit (Reference 6.1-1). Using such Mississippi River data as a critical flow of 141,955 cfs, and a harmonic mean flow rate of 366,748 cfs, the LDEQ renewed the permit with a daily maximum discharge water temperature limit of 110°F and a monthly average temperature limit of 105°F. Additional permit requirements are summarized in Subsection 5.2.2.

RBS Unit 1 has demonstrated compliance with the LPDES permit by continuously measuring cooling water discharge temperature at the blowdown discharge structure.

New Thermal Modeling of RBS Units 1 and 3

The cooling system for operation of a new RBS Unit 3 is described in Section 3.4. Additional review of cooling system effects was conducted in 2007 (as described in Subsection 5.3.2.1) using the CORMIX (Cornell Mixing Zone Expert System) mixing zone model (a model supported by the EPA).

The modeling shows that the combined cooling water discharge plume from the existing RBS Unit 1 and the proposed RBS Unit 3 would have minimal effect on the Mississippi River (refer to Subsection 5.3.2.1). The model used data that reflected temperature variations from annual operation of Unit 1, including a maximum effluent temperature of 101°F (38.3°C) for the summer and 88°F (31.1°C) for the winter. The river temperature data used in the modeling are discussed in Subsection 5.3.2.1; the values were based on the annual temperature ranges from data reported in Subsection 2.3.3.

The maximum mixing zone length determined by the CORMIX model for a temperature rise of up to 2.8°C above the river ambient temperature, in accordance with Louisiana water quality regulations (Reference 6.1-5), is about 63 ft. and the maximum mixing zone width is about 8.2 ft. This plume is located in a section of the Mississippi River that is 1700 to 4000 ft. wide (refer to Subsection 2.3.1.1), with a mean river velocity of about 4.3 fps. Thus, the plume would be very small within the river before dissipation.

Additional discussion of this topic is provided in Subsection 5.3.2.

Neighboring Facility Thermal Plumes

Reference 6.1-4 mentions the planned startup of the Big Cajun Power Plant Unit 3, with a discharge location across the Mississippi River and about 400 ft. downstream of the RBS discharge point. Big Cajun Unit 3 was projected to have a 22.4°F temperature rise at its outfall associated with the discharge of once-through cooling water for the proposed coal fired power plant. Since then, the Big Cajun unit has received a discharge permit from the LDEQ and has begun operations.

As noted in Reference 6.1-4, synergistic effects from the RBS Unit 1 discharge and Big Cajun Power Plant discharges "…are likely to be undetectable due to the localized impact of each discharge…" because of the capacity of the Mississippi River.

Thermal plume analysis of the Big Cajun outfall predicted a worst-case plume during August extreme low-flow conditions (Reference 6.1-6). The horizontal width of the Big Cajun discharge plume would extend from 367 to 1125 ft. into the channel from the west bank. That value was compared to a summer minimum flow plume that would be approximately 5 ft. wide from the RBS on the east side of the river during the August low-flow conditions. Considering that the total width of the channel during low-flow conditions is estimated to be about 1700 ft. wide, model predictions indicate that the two plumes are not expected to come into contact with each other.

Summary of Preapplication Evaluations

As described above, the modeling results adequately established baseline data in the Mississippi River to support the potential environmental effects discussed in this report, and the thermal discharge descriptions and evaluations provided in Subsection 5.3.2. Construction of RBS Unit 3 and operation of RBS Unit 3 would not cause hydrological alterations of Mississippi River flow or water supplies (as discussed in Sections 4.2 and 5.2) that would affect thermal monitoring programs.

6.1.2 CONSTRUCTION MONITORING

Construction discharges are expected to consist primarily of dewatering activities to support foundation construction and drainage that collects in the sumps at the bottom of excavations, which would be pumped to a stormwater discharge point. Therefore, transmitting this water ultimately to the Mississippi River from a standard site discharge mechanism results in no expected change in thermal discharges during the preoperational monitoring program.

6.1.3 PREOPERATIONAL MONITORING

The preoperational monitoring program would be a continuation of the preapplication monitoring program, as required by the LDEQ for RBS Unit 1. The Applicant will continue to monitor and to record continuously the cooling water discharge temperature as required by the LDEQ in the LPDES permitting process. Preoperational monitoring will be conducted during RBS Unit 3 site preparation and construction.

6.1.4 OPERATIONAL MONITORING

The operational monitoring program is anticipated to be a continuation of the preapplication monitoring program and would conform to applicable LPDES permit requirements at the time of operation. The operational monitoring program is designed to detect changes in water temperature effluents resulting from new RBS Unit 3 operations. The monitoring equipment to be used for discharge temperature monitoring is determined and selected at the time of permit modification. It is expected that the monitoring equipment selected and used at the RBS site would most likely be the equipment currently being utilized at RBS Unit 1.

Required data analysis procedures are developed through consultation with the LDEQ and implemented at the time of permit modification.

For current operations of RBS Unit 1, the LDEQ requires continuous monitoring/recording of discharge water temperature from Outfall 001 (refer to Table 5.2-1), which includes the cooling water blowdown discharge (Reference 6.1-1). The Applicant expects similar monitoring requirements to continue for operation of RBS Units 1 and 3.

A description of the estimated thermal discharge and the predicted rapid dissipation of the thermal plume are presented in Subsection 5.3.2. Because of the extremely small size of the predicted thermal plume as well as the well-accepted basis for the estimation of the extent of the plume, direct monitoring of the plume dimension is not planned. In fact, given the turbulence present in the Mississippi River and the relatively small areas affected, resolution of the plume by boat-based measurement would be very challenging. It is highly likely that the plume would be small and the changes in temperature from ambient would be modest. The plume is also likely to migrate from side to side and in depth because of turbulence. River monitoring is also likely to be a logistical challenge, given the high flows and the presence of extensive shipping traffic.

Ambient water temperature data are recorded at St. Francisville, Louisiana, approximately 3 mi. upstream, by the USGS. The temperature of the effluent from both units will be monitored on a continuous basis prior to discharge in accordance with, and as required by, the facility's LPDES permit (refer to Reference 6.1-1 for the existing RBS LPDES permit). The monitoring activities of both the USGS and the LDEQ (via current and future LPDES permits) are extensive and comprehensive; additional monitoring of thermal effluents is not warranted for the RBS facility.

6.1.5 REFERENCES

6.1-1 Louisiana Department of Environmental Quality, "Louisiana Water Discharge Permit - River Bend Station, Permit Number LA0042731," June 2006.

6.1-2 Entergy Louisiana, LLC, "Conduct of Louisiana Pollutant Discharge Elimination System (LPDES) Permit Monitoring Program," *River Bend Station Support Manual*, February 5, 2007.

6.1-3 U.S. Geological Survey, National Water Information System Website, Water Quality Samples for Louisiana, USGS 07373420, Mississippi River near St. Francisville, Louisiana, accessed July 30, 2007.

6.1-4 Gulf States Utilities Company, "River Bend Station Environmental Report, Operating License Stage," Volumes 1-4, Supplements 1-9, November 1984.

6.1-5 State of Louisiana Environmental Regulatory Code, Title 33, Part IX, Section 1123, Table 3, May 2007.

6.1-6 Geo-Marine, Inc., *Section 316 Demonstration Report for Big Cajun No. 2 Power Station Unit 3*, Reference LA 0054135, Modification No. 1, 1978.

6.2 RADIOLOGICAL MONITORING

The existing RBS Radiological Environmental Monitoring Program (REMP) will be utilized to support the preapplication, construction, preoperational, and operational monitoring needs of RBS Unit 3 and to provide adequate baseline information prior to plant operation.

6.2.1 INTRODUCTION

This section describes the existing RBS Unit 1 Annual Radiological Environmental Operating Report required by RBS Unit 1 Technical Specification 5.6.2, Appendix A to RBS License Number NPF-47. The RBS Unit 1 REMP adequately characterizes the radiological environment of the biosphere in the vicinity of a new facility on the RBS site. It provides data on measurable levels of radiation and radioactive materials in the site environs and provides baseline data on the surveillance of principal pathways of exposure to the public. This subsection summarizes the findings from the 2006 Annual Radiological Environmental Operating Report for RBS Unit 1 (Reference 6.2-1).

Radioactive effluents are discussed in Section 3.5.

The following description of the RBS Unit 1 REMP includes: (1) the number and location of sample collection points and measuring devices and the pathway sampled or measured; (2) the sample size, sample collection frequency, and sampling duration; (3) the type and frequency of analysis; (4) the general types of sample collection and measuring equipment; (5) the lower limit of detection for each analysis; (6) the approximate date on which the proposed program was effective; and (7) the quality assurance programs for environmental monitoring programs.

A similar type of program would be utilized to support the preapplication, construction, preoperational, and operational monitoring needs of a new facility. Any unique characteristics required of the program for a new facility (e.g., those brought on by a new reactor design) would be incorporated into the program sufficiently in advance of the operation of a new facility to provide adequate baseline information prior to plant operation.

6.2.2 RBS UNIT 1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

The RBS Unit 1 REMP was established prior to the station becoming operational (in 1985) to provide data on background radiation and radioactivity normally present in the area. The RBS has continued to monitor the environment by sampling air, water, sediment, fish, and food products, as well as measuring radiation directly. The RBS also samples milk, if milk-producing animals are present within 5 mi. of the plant.

The REMP includes sampling indicator and control locations within a 20-mi. radius of the plant. The REMP utilizes indicator locations near the site to show any increases or buildup of radioactivity that might occur as a result of station operation and control locations farther away from the site to indicate the level of only naturally occurring radioactivity. Indicator results are compared with control and preoperational results to assess any impact that RBS operation might have had on the surrounding environment.

In 2006, environmental samples for radiological analysis were collected. The results of the indicator locations were compared with control locations and previous studies, and it was concluded that, overall, no significant relationship exists between RBS plant operation and radiological effects on the plant environs. In many instances, the 2006 data showed undetectable radiation levels in the environment and near background radiation levels in significant pathways associated with RBS Unit 1.

With respect to groundwater monitoring, the existing RBS site REMP for Unit 1 currently samples three on-site groundwater wells: one upgradient and two downgradient. By design, liquid effluent is not released to groundwater or structures that discharge to groundwater and, as such, there is no expected or intended human exposure pathway associated with groundwater for RBS Unit 3. However, recent nuclear industry initiatives by the Nuclear Energy Institute (NEI), the Electric Power Research Institute (EPRI), and NRC assessments (NRC, 2006) of existing nuclear reactors indicate that guidance documents that cover the implementation of NRC regulation 10 CFR 20.1406 (CFR, 2007c) relating to groundwater monitoring for both operating and future nuclear reactors are being developed.

Groundwater monitoring near plant facilities would provide an early indication if unexpected releases through system leaks or failures had occurred and were affecting the environment beyond expected pathways. The development of these guidance documents concerning groundwater protection is being followed, and future requirements will be addressed, as applicable, for inclusion in the RBS Unit 3 REMP.

One existing groundwater monitoring location for the Upland Terrace Aquifer (UTA) downgradient (designated "WD") is within the Unit 3 construction area. Groundwater monitoring Well MW-4 was developed for hydrological monitoring and will be evaluated for replacement of this radiological monitoring well. MW-4 is included in Table 6.2-1 and shown in Figure 6.2-2.

6.2.2.1 Pathways Monitored

The airborne, direct radiation, waterborne, and ingestion pathways (as noted in Figure 6.2-1) are monitored as required by the RBS *Off-Site Dose Calculation Manual (ODCM)*, Table 6.2-1 (Reference 6.2-2). The RBS REMP locations and descriptions are presented in Table 6.2-1 and shown in Figures 6.2-2 and 6.2-3. The radioactive effluent release points are discussed in Section 3.5.

6.2.2.2 Land Use Census

A land use census is conducted every 24 months, as required by RBS Technical Requirement Manual 3.12.2. The purpose of this census is to identify land use changes in each meteorological sector within 5 mi. of the RBS site that would require modifications to the REMP or the ODCM.

The land use census is conducted in the following manner:

- Perform field surveys in each meteorological sector out to 5 mi. in order to confirm the following:
    - Nearest permanent residence.

- Nearest garden and approximate size.[a]

- Nearest milking animal, if any.

- Identify locations on a map, measure distances to the RBS, and record results on surveillance data sheets.

- Compare current census results to previous results.

- Contact the county agents for each parish area for verification of the nearest dairy animals.

6.2.2.3 RBS Unit 1 2006 REMP Summary

Table 6.2-2 is a summary of the RBS Unit 1 REMP results for 2006.

6.2.2.4 Quality Assurance Program for REMP

The RBS Unit 1 REMP meets the quality assurance requirements of NRC Regulatory Guide 4.15, Rev. 1 (as described in Reference 6.2-3).

6.2.3 REFERENCES

6.2-1 Entergy Operations, Inc., *River Bend Station, Unit 1 - 2006 Annual Radiological Environmental Operating Report*, 2006.

6.2-2 Entergy, "River Bend Station Operating Manual - Radiation Section Procedure," *Off-Site Dose Calculation Manual (ODCM)*, Revision 13, November 2005.

6.2-3 Entergy Operations, Inc., "River Bend Station Updated Safety Analysis Report" through Revision 19, Table 1.8-1, July 2006.

a. RBS personnel do not perform a garden census because Technical Requirements Manual 3.12.2 allows the routine sampling of broadleaf vegetation in the highest D/Q sector near the site boundary in lieu of the garden census. This is consistent with the Radiological Assessment Branch Technical Position regarding Radiological Environmental Monitoring Programs, Rev. 1.

Table 6.2-1 (Sheet 1 of 7)
Radiological Environmental Sampling Program Monitoring Locations

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency of Analyses
Airborne	**Radioiodine and Particulates** Two samples from close to two SITE BOUNDARY locations, in different sectors, of the highest calculated annual average ground-level D/Q.	**AN1 (0.9 km W)--**RBS site Hwy 965; 0.4 km south of Activity Center. **AP1 (0.9 km WNW)--**Behind RBS Activity Center.	Continuous sampler operation with sample collection every 2 weeks, or more frequently if required by dust loading.	Radioiodine Canisters--I-131 analysis every 2 weeks. Air Particulate--Gross beta radioactivity analysis following filter change every 2 weeks.
	Radioiodine and Particulates One sample from the vicinity of a community having the highest calculated annual average ground-level D/Q.	**AQS2 (5.8 km NW)--**St. Francis Substation on U.S. Hwy. (Bus.) 61 in St. Francisville.		
	Radioiodine and Particulates One sample from a control location, as, for example, 15-30 km distant and in the least prevalent wind direction.	**AGC (17.0 km SE)--**Entergy Service Center compound in Zachary (Control).		
Direct Radiation	**TLDs** One ring of stations, one in each meteorological sector in the general area of the SITE BOUNDARY.	**TA1 (1.7 km N)--**RBS Training Center. **TB1 (0.5 km NNE)--**Utility pole near RBS cooling tower yard area. **TC1 (1.7 km NE)--**Utility pole at Jct. U.S. Hwy. 61 and Old Hwy. 61.	Quarterly.	mR exposure quarterly.

Table 6.2-1 (Sheet 2 of 7)
Radiological Environmental Sampling Program Monitoring Locations

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency of Analyses
Direct Radiation	**TLDs** One ring of stations, one in each meteorological sector in the general area of the SITE BOUNDARY.	**TD1 (1.6 km ENE)--**Stub pole along WF7, 150 mi. S of Jct. WF7 and U.S. Hwy. 61. **TE1 (1.3 km E)--**Stub pole along WF7, 1 km S of Jct. WF7 and U.S. Hwy. 61. **TF1 (1.3 km ESE)--**Stub pole along WF7, 2 km S of Jct. WF7 and U.S. Hwy. 61. **TG1 (1.6 km SE)--**Stub pole along WF7, 2 km S of Jct. WF7 and U.S. Hwy. 61. **TH1 (1.7 km SSE)--**Stub pole at power line crossing of WF7 (near Grants Bayou). **TJ1 (1.5 km S)--**Stub pole near RBS Gate No. 23 on Powell Station Road (LA Hwy. 965). **TK1 (0.9 km SSW)--**Utility pole on Powell Station Road (LA Hwy. 965), 20 m S of RBS River Access Road. **TL1 (1.0 km SW)--**First utility pole on Powell Station Road (LA Hwy. 965) S of former Illinois Central Gulf RR crossing.	Quarterly.	mR exposure quarterly.

Table 6.2-1 (Sheet 3 of 7)
Radiological Environmental Sampling Program Monitoring Locations

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency of Analyses
Direct Radiation	**TLDs** One ring of stations, one in each meteorological sector in the general area of the SITE BOUNDARY.	**TM1 (0.9 km WSW)--**Third utility pole on Powell Station Road (LA Hwy. 965) N of former Illinois Central Gulf RR Crossing. **TN1 (0.9 km W)--**Utility pole along Powell Station Road (LA Hwy. 965), near garden and AN1 air sampler location. **TP1 (0.9 km WNW)--**Behind RBS Activity Center at AP1 air sampler location. **TQ1 (0.6 km NW)--**Across from MA-1 on RBS North Access Road. **TR1 (0.8 km NNW)--**RBS North Access Road across from Main Plant entrance.	Quarterly.	mR exposure quarterly.

Table 6.2-1 (Sheet 4 of 7)
Radiological Environmental Sampling Program Monitoring Locations

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency of Analyses
Direct Radiation	**TLDs** The balance of the stations (8) to be placed in special interest areas such as population centers, nearby residences, schools, and in one or two areas to serve as control locations.	**TAC (15.8 km N)--**Utility pole at Jct. of U.S. Hwy. 61 and LA Hwy. 421, 7.9 km north of Bains (Control). **TCS (12.3 km NE)--**Utility pole at gate to East Louisiana State Hospital in Jackson (Special). **TEC (16.0 km E)--**Stub pole at Jct. of Hwy. 955 and Greenbriar Road, 4.8 km North of Jct. of Highways 955 and 964 (Control). **TGS (17.0 km SE)--**Entergy Service Center compound in Zachary (Special). **TNS (6.0 km W)--**Utility pole with electrical meter at west bank ferry landing (LA Hwy. 10) (Special).	Quarterly.	mR exposure quarterly.

Table 6.2-1 (Sheet 5 of 7)
Radiological Environmental Sampling Program Monitoring Locations

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency of Analyses
Direct Radiation	**TLDs** The balance of the stations (8) to be placed in special interest areas such as population centers, nearby residences, schools, and in one or two areas to serve as control locations.	**TQS1 (4.0 km NW)--**Utility pole front of Pentecostal Church (opposite West Feliciana Parish Hospital) near Jct. U.S. Hwy. 61 and Commerce Street (Special). **TQS2 (5.8 km NW)--**St. Francis Substation on business U.S. Hwy. 61 in St. Francisville (Special). **TRS (9.2 km NNW)--**Stub pole at Jct. of U.S. Hwy. 61 and WF2 near Bains (West Feliciana High School) (Special).	Quarterly.	mR exposure quarterly.
Waterborne	**Surface Water** One sample upstream and one sample downstream.	**SWU (5.0 km W)--**Mississippi River about 4 km upstream from the plant liquid discharge outfall, near LA Hwy. 10 ferry crossing. **SWD (7.75 km S)--**Mississippi River about 4 km downstream from plant liquid discharge outfall, near paper mill.	Grab samples quarterly.	Gamma isotopic analysis and tritium analysis quarterly.

Table 6.2-1 (Sheet 6 of 7)
Radiological Environmental Sampling Program Monitoring Locations

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency of Analyses
Waterborne	**Groundwater** Samples from one or two sources only if likely to be affected.	**WU (-470 m NNE)--**UTA well upgradient from plant. **WD (-470 m SW)--**UTA well downgradient from plant (displaced by Unit 3). **MW-4 (-365 m SSW)--**UTA well downgradient from plant.	Semiannually.	Gamma isotopic and tritium analysis semiannually.
	Sediment from Shoreline One sample from downstream area with existing or potential recreational value.	**SEDD (7.75 km S)--** Mississippi River about 4 km downstream from plant liquid discharge outfall, near paper mill.	Annually.	Gamma isotopic analysis annually.
Ingestion	**Milk** If commercially available, one sample from milking animals within 8 km distant where doses are calculated to be greater than 1 mrem per year. One sample from milking animals at a control location 15-30 km distant when an indicator location exists.	Currently, no available milking animals within 8 km of RBS.	Quarterly when animals are on pasture.	Gamma isotopic and I-131 analysis quarterly when animals are on pasture.

Table 6.2-1 (Sheet 7 of 7) Radiological Environmental Sampling Program Monitoring Locations

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency of Analyses
Ingestion	**Fish and Invertebrates** One sample of a commercially and/or recreationally important species in vicinity of plant discharge area. One sample of similar species in area not influenced by plant discharge.	**FD (7.75 km S)--**One sample of a commercially and/or recreationally important species from downstream area influenced by plant discharge. **FU (4.0 km WSW)--**One sample of a commercially and/or recreationally important species from upstream area not influenced by plant discharge.	Annually.	Gamma isotopic analysis on edible portions annually.
	Food Products One sample of one type of broadleaf vegetation grown near the SITE BOUNDARY location of highest predicted annual average ground-level D/Q, if milk sampling is not performed. One sample of similar broadleaf vegetation grown 15-30 km distant, if milk sampling is not performed.	**GN1 (0.9 km W)--**Sampling will be conducted on one broadleaf vegetable grown in an on-site garden, in accordance with Table 3.12.1-1, Section 4.a of the Technical Requirements Manual. **GQC (32.0 km NW)--**One sample of similar vegetables from LA State Penitentiary at Angola (Control).	Quarterly during the growing season.	Gamma isotopic and I-131 analysis quarterly.

Table 6.2-2 (Sheet 1 of 4)
Radiological Environmental Monitoring Program Summary for 2006

Sample Type (Units)	Type and Number of Analyses[a]		LLD[b]	Indicator Locations Mean (F)[c] [Range]	Location with Highest Annual Mean		Control Locations Mean (F)[c] [Range]	Number of Non-routine Results[e]
					Location[d]	Mean (F)[c] [Range]		
Air Particulates (pCi/m^3)	Gross Beta	104	0.01	0.024 (78/78) [0.013-0.048]	AN1 (0.9 km W)	0.027 (26/26) [0.013-0.048]	0.021 (26/26) [0.011-0.039]	0
Airborne Iodine (pCi/m^3)	I-131	104	0.07	<LLD	N/A	N/A	<LLD	0
Indicators TLDs (mR/Qtr)	Gamma	64	[e]	12.08 (63/64) [8.77-15.54]	TG1 (1.6 km SE)	14.42 (4/4) [14.16-14.57]	N/A	0
Special Interest TLDs (mR/Qtr)	Gamma	24	[f]	12.55 (23/24) [10.73-14.27]	TGS (17.0 km SE)	13.97 (4/4) [13.60-14.23]	N/A	0
Control TLDs (mR/Qtr)	Gamma	8	[f]	N/A	N/A	N/A	13.68 (8/8) [12.72-15.12]	0

Table 6.2-2 (Sheet 2 of 4)
Radiological Environmental Monitoring Program Summary for 2006

Sample Type (Units)	Type and Number of Analyses[a]		LLD[b]	Indicator Locations Mean (F)[c] [Range]	Location with Highest Annual Mean		Control Locations Mean (F)[c] [Range]	Number of Non-routine Results[e]
					Location[d]	Mean (F)[c] [Range]		
Surface Water (p/Ci/l)	H-3	10	3000	<LLD	N/A	N/A	<LLD	0
	Gamma	10						
	Mn-54		15	<LLD	N/A	N/A	<LLD	0
	Co-58		15	<LLD	N/A	N/A	<LLD	0
	Fe-59		30	<LLD	N/A	N/A	<LLD	0
	Co-60		15	<LLD	N/A	N/A	<LLD	0
	Zn-65		30	<LLD	N/A	N/A	<LLD	0
	Zr-95		30	<LLD	N/A	N/A	<LLD	0
	Nb-95		15	<LLD	N/A	N/A	<LLD	0
	I-131		15	<LLD	N/A	N/A	<LLD	0
	Cs-134		15	<LLD	N/A	N/A	<LLD	0
	Cs-137		18	<LLD	N/A	N/A	<LLD	0
	Ba-140		60	<LLD	N/A	N/A	<LLD	0
	La-140		15	<LLD	N/A	N/A	<LLD	0

Table 6.2-2 (Sheet 3 of 4)
Radiological Environmental Monitoring Program Summary for 2006

Sample Type (Units)	Type and Number of Analyses[a]		LLD[b]	Indicator Locations Mean (F)[c] [Range]	Location with Highest Annual Mean		Control Locations Mean (F)[c] [Range]	Number of Non-routine Results[e]
					Location[d]	Mean (F)[c] [Range]		
Groundwater (pCi/l)	H-3	6	3000	<LLD	N/A	N/A	<LLD	0
	Gamma	6						
	Mn-54		15	<LLD	N/A	N/A	<LLD	0
	Co-58		15	<LLD	N/A	N/A	<LLD	0
	Fe-59		30	<LLD	N/A	N/A	<LLD	0
	Co-60		15	<LLD	N/A	N/A	<LLD	0
	Zn-65		30	<LLD	N/A	N/A	<LLD	0
	Zr-95		30	<LLD	N/A	N/A	<LLD	0
	Nb-95		15	<LLD	N/A	N/A	<LLD	0
	I-131		15	<LLD	N/A	N/A	<LLD	0
	Cs-134		15	<LLD	N/A	N/A	<LLD	0
	Cs-137		18	<LLD	N/A	N/A	<LLD	0
	Ba-140		60	<LLD	N/A	N/A	<LLD	0
	La-140		15	<LLD	N/A	N/A	<LLD	0
Shoreline Sediment (pCi/kg)	Gamma	2						
	Cs-134		150	<LLD	N/A	N/A	<LLD[g]	0
	Cs-137		180	68.62 (2/2) [61.14 - 76.09]	SEDD (7.75 km S)	68.62 (2/2) [61.14 - 76.09]	46.25 (2/2) [26.24 - 66.27]	0

Table 6.2-2 (Sheet 4 of 4)
Radiological Environmental Monitoring Program Summary for 2006

Sample Type (Units)	Type and Number of Analyses[a]		LLD[b]	Indicator Locations Mean (F)[c] [Range]	Location with Highest Annual Mean		Control Locations Mean (F)[c] [Range]	Number of Non-routine Results[e]
					Location[d]	Mean (F)[c] [Range]		
Fish (pCi/kg)	Gamma	4						
	Mn-54		130	<LLD	N/A	N/A	<LLD	0
	Fe-59		260	<LLD	N/A	N/A	<LLD	0
	Co-58		130	<LLD	N/A	N/A	<LLD	0
	Co-60		130	<LLD	N/A	N/A	<LLD	0
	Zn-65		260	<LLD	N/A	N/A	<LLD	0
	Cs-134		130	<LLD	N/A	N/A	<LLD	0
	Cs-137		150	<LLD	N/A	N/A	<LLD	0
Food Products (pCi/kg)	I-131	8	60	<LLD	N/A	N/A	<LLD	0
	Gamma	8						
	Cs-134		60	<LLD	N/A	N/A	<LLD	0
	Cs-137		80	<LLD	N/A	N/A	<LLD	0

a) I-131 = Iodine-131; H-3 = Tritium.
b) LLD = Required lower limit of detection based on RBS Technical Requirements Manual, Table 3.12.1-3.
c) Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (F).
d) Locations are specified (1) by name and (2) direction and distance relative to reactor site.
e) Non-routine results are those that exceed 10 times the control station value. If no control station value is available, the result is considered non-routine if it exceeds 10 times the preoperational value for the location.
f) LLD is not defined in RBS Technical Requirements Manual, Table 3.12.1-3.
g) Control location for sediment is upstream surface water sample.

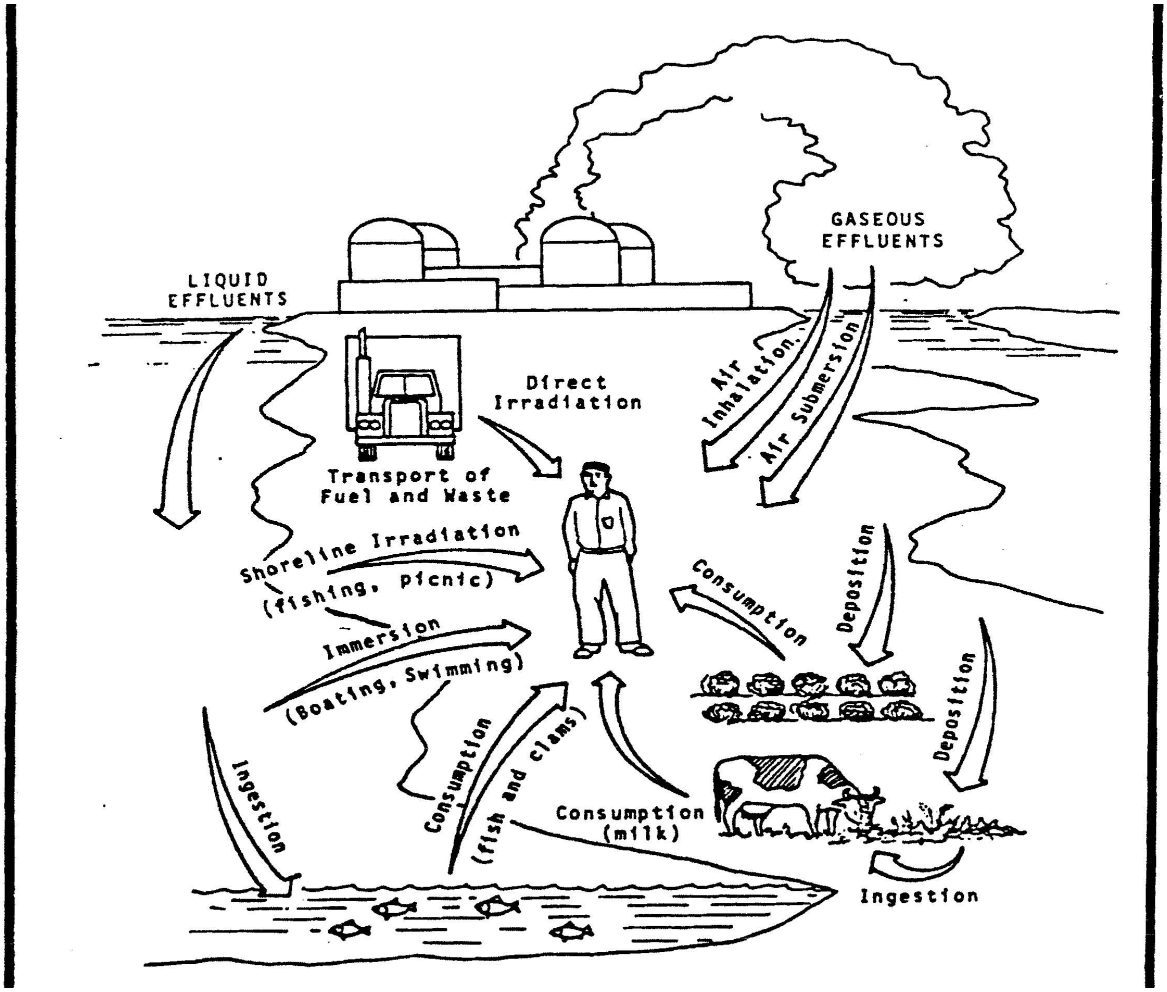
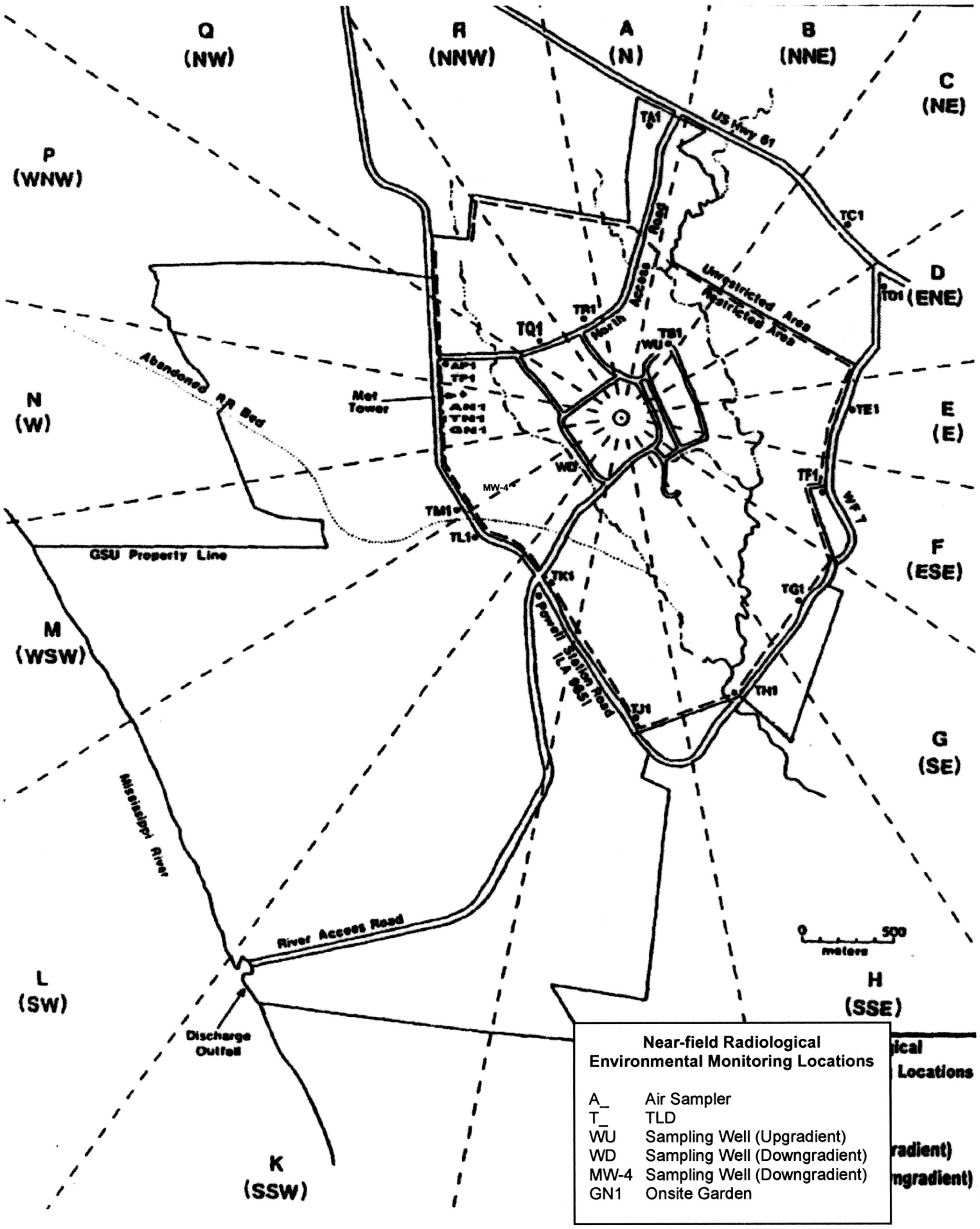


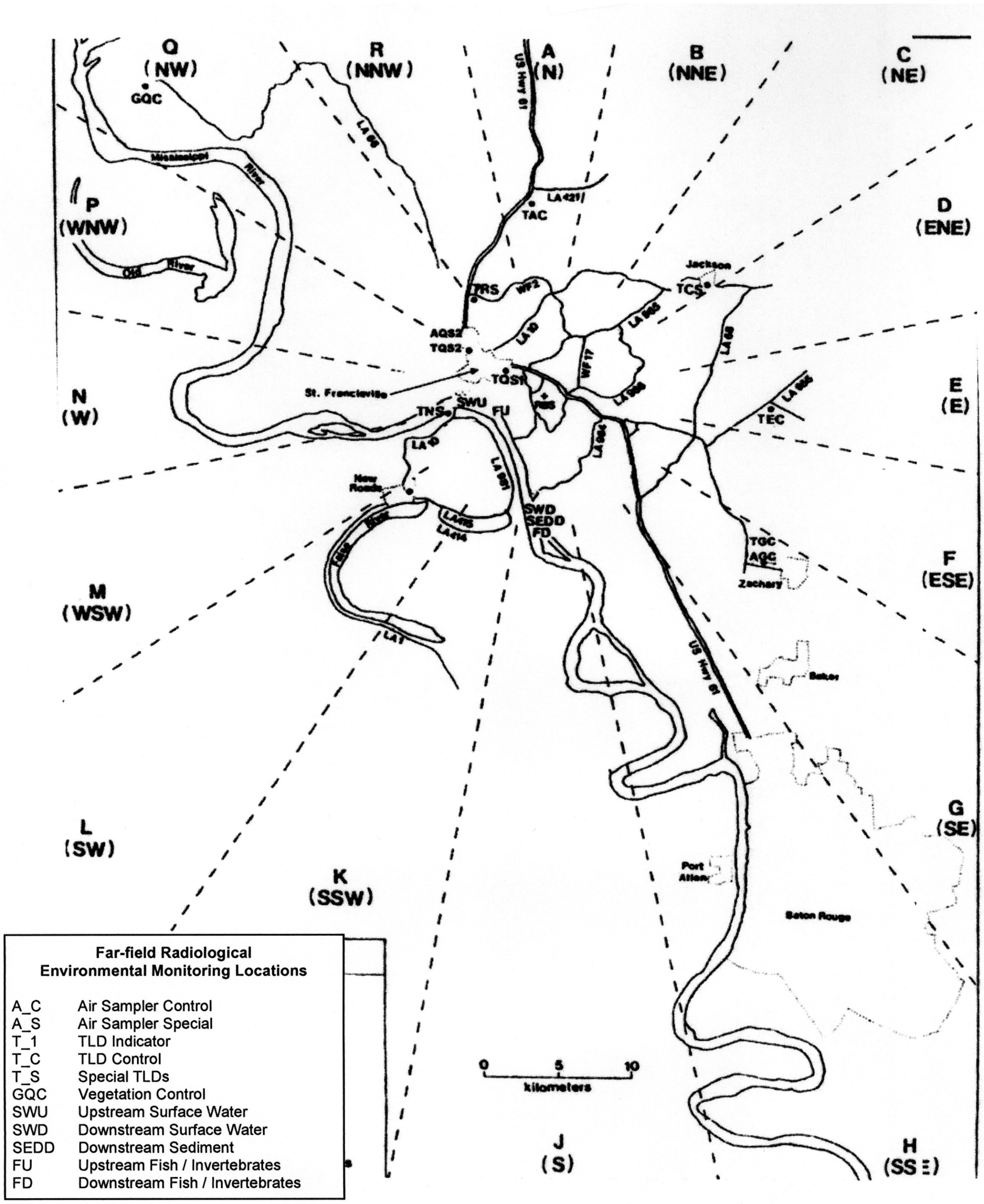
Figure 6.2-1. Exposure Pathways

Source: Reference 6.2-1.



Source: Reference 6.2-1. Figure 6.2-2. Sample Collection Sites - Near-Field(a) Revision 0

(a) WD will be affected by construction.



Source: Reference 6.2-1. **Figure 6.2-3. Sample Collection Sites - Far-Field** Revision 0

6.3 HYDROLOGICAL MONITORING

This section provides a description of the hydrological monitoring programs at the RBS, including the following:

- Preapplication monitoring used to support the descriptions of existing hydrologic conditions in Section 2.3.
- Site preparation and construction monitoring to control anticipated effects from site preparation and construction.
- Preoperational monitoring to establish a baseline for identifying and assessing environmental effects resulting from plant operation.
- Operational monitoring programs to establish the effects of plant operation and to detect any unexpected effects arising from plant operation.

Monitoring addresses the requirements of the FWPCA, including LPDES permits, and any applicable Section 401 certification requirements. Aquatic ecosystems are discussed in Subsection 4.3.2, and intake and discharge systems are discussed further in Subsections 5.3.1 and 5.3.2. Monitoring programs are summarized in Section 6.7.

6.3.1 PREAPPLICATION MONITORING

This subsection addresses information collected from the data available from ongoing monitoring programs conducted by the USGS and the U.S. Army Corps of Engineers (USACE), baseline data collected prior to construction of the existing RBS, and the ongoing RBS Unit 1 LPDES permit monitoring program. The data were used to document existing hydrologic conditions to support the hydrologic descriptions in Section 2.3.

The following describes baseline data collected at the RBS site prior to and during construction activities for RBS Unit 1.

6.3.1.1 River Monitoring

The Mississippi River is monitored and tracked extensively. The RBS is located in a highly characterized area. Hydrological information presented in Subsection 2.3.1 is based upon ongoing monitoring by the USGS and USACE about 3 mi. upstream of the RBS at St. Francisville and by the USACE at approximately the same location (Bayou Sara) (Reference 6.3-1). Additional monitoring by both organizations is about 24 mi. downstream of the site at Baton Rouge and about 44 mi. upstream of the site at Tarbert Landing.

Historic and more recent hydrological data are summarized in Subsection 2.3.1. Related water use data are presented in Subsection 2.3.2. Water quality data for the USGS stations at St. Francisville and Baton Rouge are summarized for 2004 and 2005 in Tables 2.3-17 and 2.3-18.

6.3.1.2 Discharge Monitoring

RBS Unit 1 is required to conduct discharge water sampling and flow measurements in accordance with the existing LPDES permit (Reference 6.3-2). Sampling at various outfall locations is conducted as follows (outfalls are shown in Figure 5.2-1 and discussed further in Subsection 5.2.2):

- Outfall 001 is a continuous discharge of cooling water blowdown and previously monitored effluent into the Mississippi River. Temperature and flow rate are measured continuously just prior to the discharge point.
- Outfalls 002, 003, 004, and 005 are primarily stormwater discharge flows. Such parameters as flow rate, oil and grease, total organic carbon, and pH are monitored quarterly.
- Outfall 006 is the intermittent discharge of clarifier underflow. Records are maintained on flow and quantity/types of coagulant used.
- Outfall 104 is vehicle wash water that is monitored quarterly for flow rate, pH, total suspended solids, oil and grease, soaps and detergents, and chemical oxygen demand.

Thermal monitoring associated with RBS discharges to the Mississippi River is discussed in Section 6.1.

6.3.1.3 Groundwater Data

Historic and current groundwater information is presented in Section 2.3 and in Reference 6.3-3. Ongoing groundwater monitoring of radioactivity is discussed in Subsections 2.3.3 and 5.5.2.

As noted in Subsection 5.2.2, the existing operations of RBS Unit 1 have not resulted in effects on groundwater quality. In addition, the RBS monitoring wells sampled as part of the NEI Groundwater Protection Initiative have not shown any detectable radioactivity levels of plant-related materials in the subsurface soils and water tables. Semiannual upgradient and downgradient groundwater sampling for radioactivity has not indicated any changes from background sampling (Reference 6.3-4) and groundwater sampling conducted in 2007 for a variety of physical and chemical parameters (summarized in Table 2.3-20) did not indicate apparent effects from more than 20 years of RBS Unit 1 operations.

Planned groundwater and public water usage for Units 1 and 3 is estimated at a maximum of only 315 gallons per minute (gpm), a relatively small flow as described in Subsection 2.3.2, and a very small portion of total water needs as discussed in Subsection 5.2.2. Most or all of the onsite potable groundwater usage is to be displaced by water supplied by the West Feliciana Water District, as noted in Subsection 2.3.2.

As noted in Subsection 2.3.3 and Table 2.3-20, preapplication and preconstruction groundwater monitoring is being conducted at the RBS prior to the initial construction of Unit 3 to reaffirm baseline groundwater level data that have been established since the early 1970s and continued through the Unit 3 investigations. The monitoring program includes quarterly groundwater level measurements from selected monitoring wells. During construction, groundwater level data are to be collected in existing wells and in Unit 3 monitoring wells that are unaffected by construction activities, with collected data being compared to existing information to evaluate potential effects.

6.3.2 CONSTRUCTION MONITORING

All continuing monitoring activities discussed in Subsection 6.3.1 for the preconstruction period are to continue during the construction period, including the monitoring of the Mississippi River by the USGS and USACE. The construction hydrological monitoring program is established to control anticipated effects from site preparation and construction, and to detect unexpected effects arising from these activities. It also includes preconstruction monitoring to establish a baseline for assessing subsequent effects of site preparation and construction. This monitoring is needed in circumstances where specific adverse effects are anticipated.

Additionally, during the construction period, construction effects will be reduced by development and implementation of a site-specific construction Stormwater Pollution Prevention Plan (SWPPP), as discussed in Section 4.2. The construction SWPPP will address regular inspections for erosion control measures and visual inspections for discharges that may be detrimental to water quality. Water quality sampling and flow measurements will be conducted and reported as required to meet LDEQ construction stormwater permit criteria, including construction dewatering flows as discussed in Subsection 4.2.2, and the requirements of the LPDES permit. RBS monitoring wells will also be used to characterize groundwater conditions at the site during the construction groundwater drawdown to ensure that the actual drawdown meets the predicted dewatering ranges from 22 ft. (6.7 m) to 35 ft. (10.7 m) across the RBS area (refer to FSAR Subsection 2.5.4). Construction dewatering activities are estimated to cause a potential drawdown in surficial aquifer wells within a 4-mi. radius of the RBS, as well as to cause dewatering-induced settlement at the RBS Unit 1 Reactor Building of less than 2.2 in. (55.9 mm) and differential settlement of less than 0.4 in. (10.2 mm).

6.3.3 PREOPERATIONAL MONITORING

All continuing monitoring activities discussed in Subsection 6.3.1 for the preconstruction period will continue during the preoperational period, including the monitoring of the Mississippi River by the USGS and USACE. The preoperational hydrological monitoring program is conducted to establish a baseline for identifying and assessing environmental effects resulting from station operations. The monitoring is used to verify existing hydrologic conditions and substantiate design assumptions related to site hydrology.

Although not anticipated, the Applicant will conduct additional preoperational hydrological monitoring if required by permitting or licensing agencies. Activities could potentially include reconnaissance, field sampling, laboratory analysis, and data reduction and evaluation. This monitoring could focus on physical, chemical, and microbial components of the hydrologic systems on the site, in groundwater, and in the Mississippi River as required. Data from ongoing USGS and USACE monitoring programs and monitoring programs for RBS Unit 1 would be evaluated and used as appropriate to support this program with such issues as the effect of cooling water discharges, sanitary waste management, and chemical management methods on water quality.

6.3.4 OPERATIONAL MONITORING

All continuing monitoring activities discussed in Subsection 6.3.1 for the preconstruction period will continue during the operational period, including the monitoring of the Mississippi River by the USGS and USACE. The operational monitoring program would be used to establish the effects of operating a new facility at the RBS site and to detect unexpected effects arising from plant operation. The monitoring will comply with applicable permitting agency requirements.

The Applicant will continue to monitor operations of Unit 1 and the additional Unit 3 to document compliance with applicable permitting agency requirements, including the existing LPDES permit requirements and the NRC license requirements.

RBS Unit 3 is designed and will be operated to meet the requirements of NRC Draft Regulatory Guide DG-4012 for the minimization of contamination and radioactive waste generation (Reference 6.3-5). Facility design includes the monitoring of circulating water prior to discharge and the capability to identify the unit source of an identified radioactive effluent leak.

Ongoing groundwater, surface water, and sediment monitoring for radioactivity as required by the NRC will continue. Additional groundwater monitoring, other than the current RBS sampling of monitoring wells as part of the NEI Groundwater Protection Initiative, is not proposed for Unit 3 for the following reasons:

- Groundwater elevations in the Unit 3 power block area (approximately 60 ft. msl) are well below the DCD Table 2.0-1 maximum design groundwater level requirement of 2 ft. below grade (final design grade is approximately 97.5 ft. msl); therefore, a permanent dewatering system is not required.

- RBS Unit 3 will be utilizing water from West Feliciana Water District supplies as noted earlier in this section.

The design and operations of RBS Unit 1 present minimal chance of effects on groundwater quality and, similarly, no effects are expected from the operations of RBS Unit 3. The following safeguards demonstrate the minimal opportunities for effects:

- Storage and use of chemicals and other potential pollutants are very limited at the RBS.

- Process operations and materials storage are in sealed buildings with monitored containment and discharge points.

- Spills, leaks, and releases of materials are prevented and managed under active programs such as Stormwater Pollution Prevention Planning, Spill Prevention Planning, use of appropriate chemical storage systems, and frequent inspections of material storage systems, as mentioned in Subsection 4.2.2.

- Discharges from the site are controlled via the LPDES permit (Reference 6.3-2).

- Semiannual groundwater monitoring for radioactivity will continue under terms of the existing NRC license for Unit 1 and the expected license for Unit 3.

6.3.5 REFERENCES

6.3-1 Gulf States Utilities Company, "River Bend Nuclear Station Units 1 and 2 Final Environmental Report (FER)," as Amended through Amendment No. 9.

6.3-2 Louisiana Department of Environmental Quality, "Louisiana Water Discharge Permit - River Bend Station, Permit Number LA0042731," June 2006.

6.3-3 Entergy Operations, Inc., "River Bend Station Updated Safety Analysis Report" through Revision 19, Subsection 2.4.12, July 2006.

6.3-4 Entergy Operations, Inc., *River Bend Station, Annual Radiological Environmental Operating Report for 2006*, April 2007.

6.3-5 U.S. Nuclear Regulatory Commission, "Minimization of Contamination and Radioactive Waste Generation - Life Cycle Planning," Draft Regulatory Guide DG-4012, July 2007.

6.4 METEOROLOGICAL MONITORING

The current RBS on-site meteorological monitoring program has been in place since its installation in December 1971, prior to construction and operation of RBS Unit 1. The details of the operational meteorological monitoring program for RBS Unit 1 are described in Section 6.4 of the Unit 1 Updated Safety Analysis Report (Reference 6.4-1). The on-site meteorological monitoring program has met the requirements of Safety Guide 23 (1972) and the most recent version of Regulatory Guide 1.23 (March 2007). This section describes the current state of the on-site meteorological measurement program.

The RBS Unit 1 meteorological monitoring program provides the basis for the RBS Unit 3 meteorological preapplication monitoring, site preparation and construction monitoring, preoperational monitoring, and operational monitoring programs. In addition, data from the on-site meteorological tower was used as the sole input for models that describe the atmospheric transport and diffusion characteristics of the site, as provided in NRC Regulatory Guides 1.111 and 1.21. The model used to analyze the atmospheric transport and diffusion conditions of the site is described in Subsection 2.7.5.

6.4.1 ON-SITE METEOROLOGICAL MEASUREMENT PROGRAM

The purpose of this subsection is to identify that the current on-site meteorological measurement program and other data collection programs that are to be used by RBS Unit 3 are adequate to accomplish the following: (1) describe local and regional atmospheric transport and diffusion characteristics within 50 mi. (80 km) from the plant, (2) ensure environmental protection, and (3) provide an adequate meteorological database for evaluation of the effects of plant operation. This discussion includes an analysis of the following meteorological monitoring system elements:

- The location of the meteorological tower and instrument siting.
- Meteorological parameters measured.
- Meteorological sensors.
- Data recording and transmission.
- Instrument surveillance.
- Data acquisition and reduction.
- Data validation and screening.
- Data display and archiving.
- System accuracy.
- Data recovery rate and annual and joint frequency distribution of data.

6.4.1.1 Tower and Instrument Siting

Figures showing the location of the RBS facility with respect to off-site meteorological stations and surrounding topography are provided in Figure 2.7-1 and Figures 2.7-54 through 2.7-57, respectively. The on-site meteorological tower is located approximately 2210 ft. west-northwest of the reactor containment (Figures 2.1-3 and 2.1-4) and has a height of 150 ft. above plant grade (Reference 6.4-1). This location is sufficiently close to the facility to provide representative observations and sufficiently distant to negate small-scale disturbances caused by building structures and plant construction operations. The meteorological parameters specified in Regulatory Guide 1.23 are measured by instrumentation mounted at two levels (30 and 150 ft.) of the tower. The 30- and 150-ft. elevations were selected to approximate the heights of release of activity emanating from ground level and the plant heat dissipation system, respectively. The meteorological sensors are mounted on booms that are greater than one tower width away from the tower. The booms are attached to a tower elevator system used for raising and lowering the instruments during routine calibration.

The influence of terrain near the base of the tower on temperature measurements is minimal. The tower is situated in a flat fenced-off area (100 ft. x 55 ft.) that is covered with crushed rocks and grass. A small 18-ft. x 16-ft. Instrument Building and utility shed housing a standby propane generator are located approximately 47 ft. to the west-southwest of the meteorological tower. Although recently trimmed, groves of trees located in the vicinity of the tower may affect the wind speed and direction at the 30-ft. level of the tower, as discussed in Subsection 2.7.4.2. This condition is representative of the site because the facility itself is located in a heavily wooded area of the Louisiana countryside.

6.4.1.2 Meteorological Sensors and Their Accuracies and Thresholds

The meteorological tower instrumentation consists of the following: wind speed and wind direction sensors at the 30- and 150-ft. levels, a 30-ft. ambient temperature sensor, and a 30- to 150-ft. vertical temperature difference system. A dew point temperature sensor was initially installed at the 30- and 150-ft. levels prior to operation of RBS Unit 1. The sensor suffered from constant dust contamination that caused excessive maintenance and was removed in 1998. Since then, dew point information has been obtained from Ryan Airport in Baton Rouge. In addition, a heated tipping bucket rain gauge was located approximately 15 ft. above the ground on top of the Instrument Building during the operation of RBS Unit 1. However, the rain gauge is no longer in operation, and precipitation data are currently obtained from Ryan Airport in Baton Rouge. Instrumentation on the tower also includes redundant wind speed and wind direction sensors at the 30- and 150-ft. levels, a redundant 30-ft. ambient temperature sensor, and a redundant vertical temperature difference system. A sun shield is placed on the temperature sensors to minimize solar effects for mid-day, but during morning or evening the slanting rays of the sun can result in temperature differences of ±0.5°F. The pertinent characteristics of each sensor are listed in Table 6.4-1. Subsections 6.4.1.2.1 through 6.4.1.2.4 discuss the details of each meteorological sensor, including their thresholds and accuracies.

6.4.1.2.1 Wind Sensors

Wind speed and direction for the RBS are measured on the meteorological tower at 30- and 150-ft. levels. Table 6.4-1 provides the pertinent characteristics of the wind speed and direction sensors located on the meteorological tower. Wind speed is recorded with an accuracy of ±2 degrees of azimuth and has a starting threshold of 0.93 mph. The redundant wind sensors at the 30- and 150-ft. levels contain the same accuracy and thresholds as the primary sensors. The accuracies and thresholds of wind speed and direction for the RBS are within the limits specified in Regulatory Guide 1.23.

6.4.1.2.2 Temperature Sensors

Sensors on the meteorological tower measure ambient temperature at the 30-ft. level, as well as the differential temperature between the 30- and 150-ft. level. A sun shield is located on each of the upper and lower temperature sensors to minimize solar effects. The characteristics of the 30- and 150-ft. temperature sensors are presented in Table 6.4-1. The upper-level temperature sensor, in combination with the lower-level sensor, calculates the differential temperature. The sensors' signals are entered into a temperature/delta temperature processor contained in the data acquisition system to provide output signals proportional to one ambient and one differential temperature. The ambient temperature sensors at the 30- and 150-ft. levels contain accuracies of ±0.2°F. The differential temperature is also recorded with an accuracy of ±0.2°F. The accuracies of the ambient temperature sensor and differential temperature sensor meet the required accuracies presented in Regulatory Guide 1.23.

The backup sensors for the ambient upper and lower temperature sensors are located on the meteorological tower at the same levels as the primary sensors. The accuracies of the secondary sensors are also within the limitations required in Table 2 of Regulatory Guide 1.23.

6.4.1.2.3 Dew Point Sensor

The dew point sensor on the meteorological tower suffered from constant dust contamination resulting in excessive maintenance and was removed in 1998. Currently, the RBS obtains hourly dew point data electronically from Ryan Airport. Ryan Airport is located 19 mi. southeast of the RBS and records hourly dew point temperature. Subsection 2.7.4.1.3 shows that dew point data from Ryan Airport are representative of the conditions found at the RBS.

6.4.1.2.4 Precipitation Sensor

Precipitation data for the RBS are currently obtained from Ryan Airport in Baton Rouge. Subsection 2.7.2.1.4 shows that monthly and annual precipitation at Ryan Airport is representative of conditions found at the RBS.

6.4.1.3 Meteorological Sensor Calibration and Maintenance

Procedures are in place to conduct preventive maintenance and semiannual calibrations to ensure 90 percent data recovery of all parameters and 90 percent joint data recovery of the parameters required for off-site dose assessment (e.g., wind speed, wind direction, and delta-temperature or sigma theta), as specified in Regulatory Guide 1.23 (March 2007). Table 6.4-2 provides the data recovery percentages for the period December 2004 through December 2006.

Plant staff in the Unit 1 main control room verify proper operation of the meteorological monitoring system by performing routine channel checks. Two sensors of each parameter (wind speed, wind direction, and temperature) are available to minimize loss of continuous data. Spare sensors and auxiliary equipment are maintained to ensure that all meteorological parameters can be made available to the main control room, Technical Support Center, and Emergency Off-Site Facility in the event that any portion of the system becomes totally or partially impaired. To prevent data loss from lightning strikes or loss of power, a lightning protection system and propane generator with an uninterruptible power supply are installed.

6.4.1.4 Recording of Meteorological Sensor Output

The meteorological data from the tower are collected with two digital recorders. The primary and secondary recording system utilizes an Applied Meteorology, Incorporated 80 (AMI-80) data acquisition system. The recording system hardware is located in the air-conditioned (70°F) Instrument Building situated in the southwest corner of the fenced-off tower site area. Voltages are transmitted from the sensors to the recording systems over a 1- to 5-volt dc range and are converted from an analog to a digital signal. After the AMI-80 digitally records the meteorological data, it converts it into ASCII text. The ASCII text is then sent electronically to the Unit 1 control room for display and printed every 15 minutes.

The parameters of wind speed and direction, ambient temperature, and differential temperature are sampled from the sensors every 5 seconds. Every 10 minutes, a blocked average of the past 15 minutes of data is calculated for each parameter. From the 10 minute averages, an hourly blocked average is then calculated. A minimum of 15 minutes of data is used to derive hourly averages for each of the parameters.

The data recorded by the digital and analog recorders meet the accuracy requirements listed in Table 2 of Regulatory Guide 1.23 (March 2007).

6.4.1.5 Meteorological Data Quality Assurance and Processing

After data have been collected by the meteorological sensors, the AMI-80 transmits the data to the plant computer collection system. The data are provided to the plant computer collection system to screen data for validity and quality, to perform meteorological calculations, and to update the data archive. Software in the plant computer collection system performs the channel comparison and quality checks. Data considered suspect are flagged for each parameter by a color change on the computer displays in the Unit 1 main control room. The plant staff evaluates the flagged data from the primary and secondary sensors and determines if at least one of the sensor's data can be used. After the validation process is completed, the processed data are archived and permanently stored electronically. As previously noted, a plant procedure has been established to ensure that the 90 percent recovery rate of all meteorological parameters is retained on an annual basis to assess the relative concentrations and doses resulting from accidental or routine releases. Table 6.4-2 provides the recovery rates for the meteorological parameters monitored at the on-site meteorological tower. The on-site meteorological data are considered adequate to represent on-site meteorological conditions, as required by 10 CFR 100.10 and 10 CFR 100.20, as well as to make estimates of atmospheric dispersion for design basis accident and routine releases from the reactor.

If the meteorological system is damaged, a procedure to obtain relevant meteorological information (e.g., wind speed, wind direction, cloud cover, cloud ceiling) from Ryan Airport in

Baton Rouge is in place. This procedure uses the Stability Array (STAR) technique to type atmospheric stability, which is commonly in use in most nuclear facilities. In addition, a letter of agreement between the RBS and the National Weather Service (NWS) assures meteorological data availability to the RBS on a 24-hr. per day basis. The combination of the recording of meteorological variables on-site and NWS off-site data sources essentially assures the availability of meteorological measurements for emergency preparedness use under all circumstances.

6.4.2 PREOPERATIONAL AND OPERATIONAL PROGRAM

Under the guidance of Section 6.4 of NUREG-1555, the current meteorological program establishes a baseline for identifying and assessing the environmental effects during the construction and operating stages of RBS Unit 3. Therefore, the current monitoring program is to continue and is to be used as the basis for recording the necessary meteorological observations during the preoperational/construction phase of Unit 3, as well as the operational phase of Unit 3. Should the Applicant choose to install a new meteorological monitoring program either during the preoperational or operational phases of Unit 3, the program will be sited, installed, and operated in accordance with the provisions of Regulatory Guide 1.23.

6.4.3 REFERENCES

6.4-1 Entergy Operations, Inc., "River Bend Station Updated Safety Analysis Report" through Revision 19, Section 2.3, July 2006.

Table 6.4-1
RBS On-Site Meteorological Tower Sensor Characteristics

Parameter	Teledyne Geotech Model Number	Sensor Characteristics
Wind Speed	52.1 (cup assembly) 50.1 (transmitter)	Threshold Speed--0.75 mph (transmitter) Accuracy--±1% or 0.15 mph (whichever is greater) Range--0 to 50 mph
Wind Direction	53.2 (vane assembly) 50.2 (transmitter)	Threshold Speed--0.93 mph at 10 degrees (transmitter) Accuracy--±2 degrees Range--0 to 540 degrees
Temperature	104 MB	Accuracy--±0.2°F Range--0°F to 120°F
Temperature Difference	104 MB	Accuracy--±0.2°F Range--±12°F
Dew Point	N/A	Accuracy--N/A Range--N/A
Precipitation	N/A	Accuracy--N/A

Source: Reference 6.4-1 (Table 1.8 and Table 2.3-120).

Table 6.4-2
Data Recovery Percentages for the RBS On-Site Meteorological Tower Instruments for the Period December 2004 through December 2006

Recorded Parameter	Recovery Percentages
Wind Speed	
30-ft.	94.6%
150-ft.	94.6%
Wind Direction	
30-ft.	94.5%
150-ft.	94.5%
Temperature	
30-ft.	94.8%
30-ft. to 150-ft. Difference (ΔT)	94.8%
Dew Point	
30-ft.	N/A
150-ft.	N/A
Precipitation	N/A

6.5 ECOLOGICAL MONITORING

This section provides information regarding ecological monitoring for terrestrial and aquatic resources with the potential to be affected by site preparation, construction, or operation and maintenance of the facility. The monitoring programs are designed on the basis of the anticipated environmental impacts through the various stages of project implementation. This section complies with NRC Regulatory Guides 4.7 and 4.11 regarding general site suitability studies and terrestrial environmental studies to allow reasonably certain predictions that there are no significant impacts to the terrestrial and aquatic ecology associated with the construction or operation of RBS Unit 3.

The environmental measurement and monitoring of terrestrial and aquatic ecology at the RBS site is divided into four phases:

- Preapplication monitoring.
- Construction monitoring.
- Preoperational monitoring.
- Operational monitoring.

This four-phase monitoring approach was developed to detect changes in terrestrial and aquatic ecology before application submittal, during site preparation and construction, and throughout station operation and maintenance. The monitoring programs cover elements of the ecosystem where a causal relationship between station construction and operation and adverse changes are established or strongly suspected. An evaluation of the standardization, adequacy, and accuracy of data collection and analytical methods used in the monitoring programs is also included.

The following subsections present information regarding ecological monitoring for terrestrial ecology and land use (Subsection 6.5.1) and aquatic ecology (Subsection 6.5.2) of the RBS site. The discussion centers on areas likely to be affected by site preparation, construction, and operation and maintenance of Unit 3. The programs discussed are design-based and address anticipated environmental impacts during the various stages of development.

6.5.1 TERRESTRIAL ECOLOGY AND LAND USE

Site features and land use are described in Subsection 2.2.1, and off-site transmission activities are described in Subsection 2.2.2. Subsection 2.4.1 describes the major plant communities, wildlife, and important species and habitats for the site and off-site transmission corridor. Descriptions of potential modifications that may affect the existing conditions of the project area are addressed in Subsection 4.3.1.

Most of the terrestrial acreage associated with the RBS site would remain unaffected by activities related to additional development and operation of the RBS (Section 4.3). As currently planned, the off-site transmission line would affect a large amount of land, because the line would require a new corridor (Subsection 4.3.1.2). It is too early in transmission planning to determine what monitoring may be required, but all permit conditions would be adhered to with regard to monitoring. As planning moves forward and routing is finalized, involved agencies would be consulted, including the USACE, U.S. Fish & Wildlife Service (USFWS), Louisiana Department of Wildlife & Fisheries (LDWF), and Native American tribes, to determine if monitoring activities are appropriate.

6.5.1.1 Preapplication (Existing Unit 1) Monitoring

As discussed in Subsection 2.4.1, no terrestrial protected species, important species, or associated habitats occur within the RBS impact area. As discussed in Subsection 2.4.1.1.1, wetlands that may be present on-site would be delineated prior to construction to determine the need for any type of monitoring. No other preapplication monitoring activities are planned at this time. At present, ongoing monitoring of terrestrial ecological resources is limited, as discussed below.

The Applicant cooperates with private organizations and state agencies to allow informal monitoring of selected resources at the RBS and in existing transmission corridors. The Applicant has also worked with the LDWF Natural Heritage Program to place portions of the site into the River Bend Natural Area, as noted in Subsection 2.4.1.1.1. There is, however, no regularly scheduled monitoring occurring in that area at present. The Applicant has cooperated with state agencies to investigate the potential for threatened and endangered species at the RBS and in existing transmission corridors. To date, there are no documented reports of threatened or endangered species at the RBS. The LDWF visits the RBS occasionally to do some sampling of deer for the state Deer Management Assistance Program (DMAP). Hunting privileges on the RBS property are currently held by the RBS Employee Bowhunting Club, which, according to the RBS Forest Management Plan established in 2002 and implemented in 2004 (Reference 6.5-1), resulted in further protection of the total forestland and wildlife assets present on the property. Timber harvesting on the property (outside the secure or "white line" area) occurs on a 12- to 15-year cycle, with the most recent harvest in 2005. The primary silviculture activity associated with the logging is occasional treatment to control the invasive privet shrub (*Ligustrum* sp.) that is present on the site.

6.5.1.2 Site Preparation, Construction, and Preoperational Monitoring

Site preparation, construction, and preoperational monitoring activities at this stage of the project would relate to the protection of wetland habitats, terrestrial habitats, and avian collisions associated with on-site and transmission corridor work areas. Wetland areas would be marked and flagged as "no entry" areas and, where entry would be required, appropriate measures would be taken to avoid or minimize impacts, such as using mats for vehicle access to avoid rutting the ground and damage to vegetation. Wetlands and other terrestrial habitats will be protected by compliance and monitoring activities associated with the RBS SWPPP and Spill Prevention, Control, and Countermeasure (SPCC) plan and would be inspected on at least a weekly basis by environmental compliance personnel. Such compliance is expected to diminish the potential for impacts to the terrestrial environment.

6.5.1.3 Operational Monitoring

No required continuous monitoring programs are anticipated for terrestrial ecology and land use in this phase. However, during the first 5 years of operation, the Applicant would consider the following:

- **Wildlife**. The Applicant occasionally conducts rare species surveys in its transmission corridors in cooperation with the LDWF Natural Heritage Program (Reference 6.5-2). Similar monitoring would be performed in the new transmission corridor.

- **Vegetation**. Areas re-vegetated following construction would be inspected annually to ensure that desirable vegetation is becoming reestablished.

- **Vegetation**. The existing transmission corridors are regularly managed to prevent woody growth from reaching the transmission lines. The new off-site transmission system would be monitored on at least an annual basis by air, if appropriate, or by the review of aerial video and photographs. The removal of woody species can provide grassland and wetland type habitats for some rare plant species dependent on open conditions.

- **Wetlands**. Any permanent or temporary impacts to wetlands will be mitigated according to USACE permit conditions. If wetlands enhancement is required, these areas would be inspected at a frequency recommended by the USACE to ensure that the wetlands improvements are developing successfully.

- **Transmission Corridor**. The new transmission corridor would be closely monitored for tree growth, which would be removed by the maintenance methods described in Section 5.1 or as approved by the agencies involved, such as the USACE, USFWS, and LDWF.

6.5.2 AQUATIC ECOLOGY

The following subsections provide information regarding ecological monitoring for aquatic ecology likely to be affected by site preparation, construction, or operation and maintenance of the RBS. The monitoring program is designed on the basis of anticipated environmental impacts that could be experienced by specific aquatic biota described in Subsection 2.4.2 throughout the various stages of project implementation.

Subsection 2.3.3 documents the preexisting water quality characteristics of the freshwater bodies in the vicinity of the plant and the Mississippi River. The aquatic resources at the RBS site and vicinity are described in Subsection 2.4.2. Impacts to aquatic resources from construction of RBS Unit 3 are described in Subsection 4.3.2. Impacts to aquatic resources from the operation of the cooling system are described in Subsections 5.3.1.2 and 5.3.2.2. Impacts from waste discharges are described in Section 5.5.

Construction and operational impacts directly affecting aquatic resources would be limited to areas associated with the RBS intake and discharge systems in the Mississippi River. Cooling water would be provided to the proposed Unit 3 via the existing Unit 1 intake suction lines located in the Mississippi River. Additionally, cooling tower blowdown and other wastewaters associated with Unit 3 would be discharged via existing pipelines and stormwater drains for Unit 1. Because of this arrangement, it is important that existing Unit 1 monitoring programs be considered as part of the monitoring plans for Unit 3.

Preconstruction and construction activities for other portions of the new Unit 3 at the RBS site may indirectly affect other nearby and on-site aquatic resources, such as Alligator Bayou, Grants Bayou, West Creek, and other small ponds located within RBS property boundaries. Best management practices (BMPs) and an SPCC plan would be in place to protect nearby and on-site water bodies from adverse environmental impacts, as described in Subsection 6.5.2.2.

6.5.2.1 Preapplication Monitoring

This program includes evaluations made for the licensing and permitting of the existing RBS Unit 1 and additional information presented in this document.

Current Monitoring for RBS Unit 1

Zebra mussel (*Dreissena polymorpha*) densities are currently monitored through the RBS zebra mussel monitoring and control program (ZMMCP), which was implemented in response to the requirements outlined in the current RBS LPDES permit (Reference 6.5-3). As described in previous sections, the zebra mussel is a biofouling agent commonly known to clog intake and discharge components of cooling water makeup systems. The ZMMCP monitors zebra mussel veliger density to prevent mussel buildup in the intake clarifier and clarifier components of the cooling tower makeup water system (CTMWS). It is anticipated that this program would continue to be implemented in future RBS LPDES permits, because the ZMMCP is important in ensuring the proper operation of the CTMWS.

Thermal and chemical monitoring of discharged effluents (e.g., stormwater and cooling tower blowdown) are carried out under the existing LPDES permit regulated by the LDEQ. Standards listed in this permit adhere to the water quality standards established by the state of Louisiana and aid in preventing adverse environmental impacts to aquatic resources due to the operation of RBS Unit 1. As mentioned, Unit 3 effluents would be discharged via existing Unit 1 wastewater and stormwater pipelines; therefore, the monitoring in place for RBS Unit 1 would also be applicable to RBS Unit 3.

Historic Impact Evaluations

Aquatic impact studies conducted to date at the RBS site have concluded that construction and operational activities have resulted in minimal impacts to aquatic resources. These studies include pre- and post-construction impact studies performed for the construction of RBS Unit 1, as detailed in Reference 6.5-4 and discussed in Subsections 2.4.2 and 4.3.2. Findings indicated little impact to aquatic organisms, allowing the NRC representatives to conclude that impacts to aquatic resources would be SMALL.

Literature prepared by the scientific community (including academia- and industry-generated documents) describing biota and dynamics of the Mississippi River and its associated floodplain and bayou habitats was examined to establish a thorough baseline description of the impact area in the Mississippi River. Subsection 2.4.2 includes a discussion of these documents and their descriptions of the biological systems of the Lower Mississippi River (LMR).

Historic impingement and entrainment studies performed at nearby power facilities on the Mississippi River were also reviewed. Each of these studies indicated that impingement and entrainment effects associated with cooling water intake structures were minimal, as described in Subsection 4.3.2. It is important to note that these demonstrations were performed at facilities with intake velocities greater than 0.5 foot per second (fps). Since it is understood that the RBS Units 1 and 3 intake velocity would be maintained at or below 0.5 fps, it is expected that impingement and entrainment effects would be minimal (refer to Subsection 5.3.1 for further information).

No threatened, endangered, or otherwise sensitive aquatic species were documented in the site-specific studies reviewed. Likewise, other studies conducted in the vicinity of the RBS site identified no sensitive aquatic species. Subsection 2.4.2 includes a detailed discussion of these studies and their results.

Current Impact Evaluations

Foot surveys were performed to identify aquatic resources with the potential to be affected by construction and operation of RBS Unit 3. Findings from these surveys were utilized to formulate monitoring for the future construction and operational phases at the RBS site, as detailed in Subsection 4.3.2 and 5.3.2.

During these surveys, special attention was paid to the on-site stormwater drain at its confluence with the West Creek/Grants Bayou system to document the appearance of this area prior to construction activities. It is anticipated that all construction effluent would be routed into the RBS stormwater drain and discharged into West Creek, as described in Subsection 4.2.2.

Summary of Preapplication Evaluations

The evaluations and surveys previously described adequately established the baseline data for aquatic resources located on and around the RBS to support the evaluation of potential impacts, as outlined in Subsections 4.3.2 and 5.3.2 of this report. The construction and operational impacts of the RBS Unit 3 are not anticipated to cause any adverse effects to aquatic resources; therefore, additional aquatic resource monitoring is expected to be limited.

6.5.2.2 Site Preparation and Construction Monitoring

Significant impacts to aquatic resources are not anticipated during the RBS site preparation and construction phase for Unit 3. It is expected that BMPs and associated inspections would be implemented at all construction sites to prevent construction effluent (either planned or accidental) from entering aquatic resources at or near the RBS site. These BMPs could include, but are not limited to, silt fencing and/or hay waddles around fill and soil refuse piles, tarp covers over fill and soil refuse piles when not actively in use, and silt fencing barriers along the exterior perimeters of construction projects. An SPCC plan would detail measures to protect aquatic resources from accidental spills of chemicals and oily substances. These measures could include the storage of chemicals in water-safe containers away from any on-site aquatic resources and the banning of oily substances from active work sites that utilize running water (e.g., dewatering efforts). The proper functioning of these BMPs and adherence to the SPCC plan would be monitored as appropriately outlined in the construction SWPPP for construction activities at the RBS.

Additionally, visual monitoring of the RBS stormwater drainage ditch's confluence with the West Creek/Grants Bayou system (outfall) would occur during construction dewatering activities. It is understood that construction dewatering effluent would be routed into the existing RBS stormwater drainage ditch that discharges into West Creek via an LPDES permitted outfall, as described in Sections 4.2 and 4.3. Dewatering activities are anticipated to last approximately 9 months at an average constant rate of approximately 10,000 gallons per minute (gpm), as outlined in Subsection 4.2.2.1. Visual monitoring of the stormwater drainage ditch's outfall would include a weekly inspection of the drainage ditch bed and banks at and near the outfall to monitor the integrity of West Creek topography. In the event of a significantly larger-than-average water release (due to heavy rainfall or otherwise), the frequency of the visual inspections may be increased to daily until the heavy water releases subside. Visual surveys of this outfall would cease upon the completion of construction dewatering activities.

6.5.2.3 Preoperational Monitoring

A program to monitor the aquatic ecology of the RBS site may be necessary to establish baseline information for identifying and assessing the potential environmental impacts resulting from the operation of a new facility. An evaluation would be made during the construction phase of the project, based on monitoring and evaluations conducted previously, to determine the necessity of a preoperational monitoring program. Should a preoperational monitoring program be required, full advantage would be taken of any existing environmental monitoring programs conducted on and in the vicinity of the RBS site prior to and during construction of the new facility. If possible, 2 or more consecutive years of monitoring would be conducted to provide a baseline against which future operational impacts may be judged.

Previous monitoring studies have yet to identify threatened or endangered species or other species of concern in the vicinity of the RBS site. If any aquatic threatened or endangered species or other species of concern are documented prior to the initiation of the preoperational monitoring program, the program would then be designed to obtain additional information on the spawning areas, nursery and feeding areas, wintering areas, and migration routes of these species. This information would be particularly important in assessing the potential impacts to aquatic species because of the potential for impingement and entrainment of the individuals, including larvae and juveniles, in the intake water. These organisms may also be affected by the release of heated water. Physical, chemical, and biological factors known to influence the distribution and relative abundance of these species would be investigated as part of this monitoring program.

Potential impacts to commercial and sport fishing in the vicinity from intake and discharges from a new facility would be evaluated and appropriate monitoring conducted. It is understood that the discharged effluents would continue to be monitored and the necessary parameters recorded continuously, as established in existing and future LPDES permits for the RBS cooling water intake and stormwater and wastewater discharge systems (Reference 6.5-3). These parameters conform to the Louisiana water quality standards designed to prevent adverse impacts to environmental resources and to protect important aquatic species.

As described in Subsection 6.5.2.1, permitting requirements currently include the monitoring of zebra mussel veligers, cooling water discharge effluent temperature, and concentration of pollutants in discharged effluents.

6.5.2.4 Operational Monitoring

The operational monitoring program is anticipated to be a continuation of the preoperational monitoring program and would conform to applicable LPDES permit requirements at the time of operation.

For current operations of RBS Unit 1, the LDEQ requires continuous monitoring/recording of discharge water temperature from Outfall 001 (refer to Table 5.2-1), which includes the cooling water blowdown discharge into the Mississippi River (Reference 6.5-3). Monitoring/recording of the concentration of pollutants in waters discharged at all RBS permitted outfalls is also required. It is expected that similar monitoring requirements would continue for operation of RBS Units 1 and 3.

6.5.3 REFERENCES

6.5-1 Entergy Corporation, "River Bend Site Forest Management Plan, Property Management Issues Section," pp. 18-19, 2002.

6.5-2 Louisiana Department of Wildlife & Fisheries (LDWF), "LDWF and Entergy's RBS Station Team Up to Preserve River Bend Natural Area," *LDWF Newsletter*, Volume 9, Number 2, February 17, 2005.

6.5-3 Louisiana Department of Environmental Quality, "Louisiana Water Discharge Permit - River Bend Station, Permit Number LA0042731," June 2006.

6.5-4 U.S. Nuclear Regulatory Commission, *Final Environmental Statement Related to the Operation of River Bend Station*, NUREG-1073, Docket No. 50-458, Washington, D.C., 1985.

6.6 CHEMICAL MONITORING

This section describes the chemical monitoring program of surface water and groundwater sources to control and minimize adverse effects on them as a result of operating a new RBS Unit 3 facility at the RBS site. Although application and permit issuance for wastewater discharges is not required until a time period closer to when construction of RBS Unit 3 begins, this section describes anticipated water quality monitoring activities in four phases: preapplication, construction monitoring, preoperational monitoring, and operational monitoring programs, with each program building upon the methodology and data from the previous program(s). Data collection requirements in each successive program will be based on changes in parameters from the previous, and the perceived need to continue monitoring

As described in other sections of this document, including Subsections 2.3.3, 3.6.1, and 5.2.2, the existing RBS Unit 1 uses relatively small quantities of chemicals and has demonstrated no significant effects on the Mississippi River from discharges associated with Unit 1 operation. The new Unit 3 has been designed to have similar limited use of chemicals with anticipated insignificant environmental effects. A combined Unit 1 and 3 operation will be regulated by a revised LPDES permit and NRC license requirements with limitations and environmental monitoring requirements that are expected to be similar to those of Unit 1. Potential effects discussed in Sections 4.3 and 5.3 are included in the permit monitoring considerations and requirements.

This section focuses on effects on the Mississippi River because all discharges from cooling water, process water, stormwater runoff, and drainage are directed toward the Mississippi River. Likewise, any potential chemical effects focus on the Mississippi River. Any potential spills or nonroutine releases of chemicals would be associated with the same surface discharge systems directed toward the Mississippi River.

As described in Subsection 5.2.2.2.3, existing operations of RBS Unit 1 have not resulted in effects on groundwater quality. Semiannual upgradient and downgradient groundwater sampling for radioactivity has not indicated any levels above those typically seen in previous background sampling efforts (Reference 6.6-1). Groundwater sampling conducted in 2007 for a variety of physical and chemical parameters (summarized in Table 2.3-20) did not indicate apparent effects from more than 20 years of RBS Unit 1 operations. In addition, groundwater sampling in accordance with the NEI Groundwater Protection Initiative has not detected any levels of plant-related radioactive materials in subsurface soils and water tables.

The design and operations of RBS Unit 1 present minimal chance of effects on groundwater quality and, similarly, no effects are expected from the operations of RBS Unit 3. This is due to such aspects and safeguards as limited storage and use of chemicals and other potential pollutants, process operations and materials storage in sealed buildings, and an active spill prevention/stormwater pollution prevention program.

6.6.1 PREAPPLICATION MONITORING

The purpose of the preapplication monitoring program is to generate a baseline to support the assessment of potential effects that may result from the construction and operation of RBS Unit 3. Preapplication monitoring primarily consisted of utilizing data from ongoing RBS Unit 1 monitoring programs, USGS data collected at various locations on the Mississippi River in the vicinity of the RBS site (refer to Subsection 2.3.3), and other baseline data collected prior to construction of the existing RBS. Data in Section 2.3 from these monitoring programs were used to document existing water quality conditions and to support water quality descriptions provided in Section 2.3 demonstrating site suitability for this application.

RBS Unit 1 is required to conduct discharge sampling and flow measurements in accordance with its LPDES permit (Reference 6.6-2). Sampling at external outfall locations (refer to Figure 5.2-1) is conducted as follows:

- Outfall 001 is a continuous discharge of cooling water blowdown and previously monitored effluent into the Mississippi River. Temperature and flow rate are measured continuously just prior to the discharge point. Once per week, grab samples are monitored for pH, free available chlorine, and total zinc. Total chromium is analyzed once per year. Previously monitored internal outfalls to Outfall 001 include low-level radioactive low volume wastewater, treated sanitary wastewater, intermittent metal cleaning wastewater, and various low volume resin backwash, rinse, and blowdown waters. Annual Whole Effluent Toxicity Testing (discussed in more detail below) is also performed for Outfall 001.

- Outfalls 002, 003, 004, and 005 are primarily stormwater discharge flows. Such parameters as flow rate, oil and grease, total organic carbon, and pH are monitored quarterly.

- Outfall 006 is the intermittent discharge of clarifier underflow. Records are maintained on flow and quantity/types of coagulant used.

- Outfall 104 is vehicle wash water that is monitored quarterly for flow rate, pH, total suspended solids, oil and grease, and chemical oxygen demand.

A summary table of current permit discharge requirements for RBS Unit 1 is provided in Subsection 5.2.2 (Table 5.2-1). A summary of the composition of RBS Unit 1 discharges is provided in Table 5.2-2. The composition of combined discharges from Units 1 and 3 is expected to be similar based upon design conditions.

A safeguard required by the LPDES permit is annual whole effluent toxicity testing of the RBS cooling water discharge to test for any cumulative toxic effects of the discharge water on U.S. Environmental Protection Agency (EPA)/LDEQ-specified test organisms. This testing is designed to detect any residual toxic effects caused by the total effluent, including the effects of any biocides or other chemical additives used in the water system at RBS to control macro- and microbiological fouling and/or to inhibit corrosion in the cooling water systems. The LPDES permit requires that the samples collected for this test "are representative of any periodic episodes of chlorination, biocide usage, or other potentially toxic substances used on an intermittent basis" (Reference 6.6-2).

All monitoring and analysis methods shown in Reference 6.6-2 are performed using EPA- or LDEQ-approved methods with corresponding quality assurance procedures. The decisions associated with the type of monitoring, frequency of testing, quality control, interpretation of results, and related quality/adequacy issues are based upon EPA and LDEQ environmental protection regulations, permitting policies, and watershed protection programs that have been incorporated in the LPDES program.

Potential radioactivity release is monitored at RBS Unit 1 in compliance with the NRC license and NRC regulations (Reference 6.6-1). As discussed in Subsection 5.5.2, this monitoring includes the following:

- Sampling of radioactivity in each batch of liquid effluents from low-level radioactive low volume wastewater.
- Quarterly sampling of radioactivity in upstream and downstream Mississippi River surface water.
- Annual sampling of radioactivity in Mississippi River sediment.
- Semiannual sampling of radioactivity in groundwater upgradient and downgradient from RBS.

The NRC radiation safety team evaluates the monitoring program procedures in detail every 2 years (such as on November 1 to 4, 2005) (Reference 6.6-3).

RBS Unit 1 maintains records of the use of such chemical additives as coagulants, flocculants, biocides, corrosion inhibitors, dechlorination chemicals, and related materials used in cooling and process waters in accordance with the LPDES permit (Reference 6.6-2). Similar use of these materials, with documentation of usage, is expected for a new unit. Section 3.6 provides additional information on chemical usage.

The available water quality data (as shown in Subsection 2.3.3) is adequate to describe and establish the baseline conditions in the Mississippi River surface water and on-site groundwater with respect to the chemical parameters monitored. Subsection 2.3.2 describes water use in the area, and Section 3.3 describes water use within the RBS.

6.6.2 CONSTRUCTION MONITORING

The LPDES permit may require an additional construction monitoring program to be instituted at the site for construction stormwater runoff to assess water quality changes resulting from construction of the proposed project. If requested, the water quality data collected would be analyzed and compared with historical data collected in the preapplication monitoring program. Analysis of water quality data would provide a means to control anticipated effects resulting from site preparation and construction, and would support detection of any unexpected effects arising from these activities.

Any construction effects could be reduced through development and implementation of a site-specific construction SWPPP, as discussed in Section 4.2. The SWPPP would address regular inspections for erosion control measures and visual inspections of any discharges that could be detrimental to water quality. Water quality sampling and flow measurements would be conducted as required to meet LPDES permit criteria during construction. Current permit limits and monitoring requirements for stormwater discharges from RBS Unit 1 are summarized in Subsection 5.2.2 and in Table 5.2-1.

6.6.3 PREOPERATIONAL MONITORING

Additional preoperational water quality monitoring is not anticipated, but if requested by the NRC or LDEQ, the Applicant will conduct additional monitoring to establish a baseline for identifying and assessing environmental effects resulting from plant operation. Data from ongoing monitoring programs for RBS Unit 1, and data collected during any preapplication and construction monitoring, would be evaluated and used as appropriate. The preoperational monitoring program would be an extension of the existing, continuing water quality and discharge monitoring programs.

If required, a program could consist of such actions as reconnaissance, field sampling, laboratory analysis, and data reduction and evaluation. Monitoring would focus on selected physical, chemical, and microbial components of the hydrologic systems on and adjacent to the site as required.

6.6.4 OPERATIONAL MONITORING

Operational monitoring would be used to establish the effects of plant operation and detect any unexpected effects arising from plant operation. This monitoring would be utilized to evaluate the effects of sanitary and chemical waste retention methods on water quality, and to assess the effects associated with alteration of chemical and sediment transport during operation of a new facility. The effectiveness of effluent treatment and control systems would be assessed as part of the monitoring program, providing the ability to predict failures in or reductions of the effectiveness of these systems.

Sampling locations, frequency, and parameter analysis would meet LPDES permit criteria applicable at the time of operation; these items may be similar to the monitoring conducted for Unit 1 as described above and as summarized in Table 5.2-1, and for potential radioactivity release as discussed above and in Sections 5.4 and 5.5.

Whole effluent toxicity testing is anticipated to continue in a similar way for the testing of a combined discharge from Units 1 and 3 under a combined facility LPDES permit. This testing process will continue to test for the toxic effects of the total content of the discharge to the Mississippi River. As noted in Subsections 2.3.3 and 3.6.1, biocides and other additive chemicals are used under the terms of the LPDES permit. The continuation of whole effluent toxicity testing will be a key measure to limit adverse water use effects.

6.6.5 REFERENCES

6.6-1 Entergy Operations, Inc., *River Bend Station, Annual Radiological Environmental Operating Report for 2006*, April 2007.

6.6-2 Louisiana Department of Environmental Quality, "Louisiana Water Discharge Permit - River Bend Station, Permit Number LA0042731," June 2006.

6.6-3 U.S. Nuclear Regulatory Commission, "River Bend Station - NRC Radiation Safety Team Inspection Report 05000458/2005015," December 16, 2005.

6.7 SUMMARY OF MONITORING PROGRAMS

This section reviews and summarizes the requirements of the various RBS site monitoring programs. Six specific areas of monitoring were discussed previously in these sections:

- Thermal Monitoring (Section 6.1).
- Radiological Monitoring (Section 6.2).
- Hydrological Monitoring (Section 6.3).
- Meteorological Monitoring (Section 6.4).
- Ecological Monitoring (Section 6.5).
- Chemical Monitoring (Section 6.6).

In addition to the monitoring programs discussed in Sections 6.1 through 6.6, noise monitoring was discussed in Section 5.8 and is addressed in this summary as Table 6.7-8. Tables 6.7-1 through 6.7-8 summarize the monitoring programs for RBS Unit 3.

6.7.1 PREAPPLICATION MONITORING

This program provides baseline data for the RBS site to support environmental descriptions and assessments of site environmental suitability throughout this COL. RBS Unit 3 preapplication monitoring includes several years of monitoring at the site for various environmental areas in preparation for RBS Unit 1 construction and since RBS Unit 1 has been in operation.

6.7.2 CONSTRUCTION MONITORING

Construction monitoring is used when specific adverse impacts from construction are predicted. The purpose of this monitoring program is to provide the data necessary to assess impacts resulting from the construction of the proposed project. This monitoring would include additional preapplication monitoring when necessary to establish a baseline. The time frame for sampling each parameter would be appropriate for the period of expected change, and data would be collected at defined locations, times, and frequencies so that subsequent data collected during construction could be compared, and construction impacts assessed and mitigated as required.

6.7.3 PREOPERATIONAL MONITORING

The purpose of this monitoring program is to provide baseline data so that the operational monitoring program can detect impacts resulting from the continued operation of a new facility. It is anticipated that this monitoring would be consistent with existing RBS Unit 1 monitoring programs and would include a logical extension of the preapplication and site preparation and construction monitoring programs, as appropriate.

6.7.4 OPERATIONAL MONITORING

The purpose of the operational monitoring program would be to identify and assess the magnitude of impacts from continued plant operation. This information would also be used to assess the effectiveness of waste treatment systems and the quality of plant effluents, and to provide real-time warnings of any failures in effluent treatment systems. Operational monitoring programs would be prescribed primarily by the requirements of the various permits required for operation of a new facility, such as the air permit and the LPDES permit.

Future regulatory requirements or agency consultations could cause revisions to existing RBS Unit 1 and potential RBS Unit 3 operational monitoring programs. Similar to the process for RBS Unit 1, specifications for RBS Unit 3 monitoring would be established before RBS Unit 3 operation and would be refined based on operational experience with the new unit.

Table 6.7-1
Thermal Monitoring

Phase	Monitoring Actions	Monitoring Frequency	Corresponding Agency and Permit or Requirement
Preapplication	**Discharge Temperature Measurements** The Applicant will continue to monitor and continuously record the RBS Unit 1 cooling water discharge temperature.	Continuous.	LDEQ Requirement of existing LPDES permits
	Mississippi River Temperature Monitoring RBS Mississippi River temperature monitoring primarily uses the data collected on an ongoing basis by the USGS near St. Francisville, Louisiana. Ambient water temperature data are recorded by the USGS. The temperature of the effluent from RBS Unit 1 will be monitored on a continuous basis prior to discharge in accordance with, and as required by, the facility's LPDES permit. The monitoring activities of both the USGS and the LDEQ (via current and future LPDES permits) are extensive and complete; additional monitoring of thermal effluents is not warranted for the RBS.	Continuous.	LDEQ Requirement of existing LPDES permits
Construction Monitoring	The construction monitoring program would be a continuation of the existing monitoring program, as required by the LDEQ for RBS Unit 1.	Continuous.	LDEQ Requirement of existing LPDES permits
Preoperational	The preoperational monitoring program would be a continuation of the existing monitoring program, as required by the LDEQ for RBS Unit 1.	Continuous.	LDEQ Requirement of existing LPDES permits
Operational	The operational monitoring program is anticipated to be a continuation of the preoperational monitoring program, and would conform to applicable LPDES permit requirements at the time of operation. For current operations of RBS Unit 1, the LDEQ requires continuous monitoring/ recording of discharge water temperature from Outfall 001, which includes the cooling water blowdown discharge. The Applicant expects similar monitoring requirements to continue for the operation of RBS Units 1 and 3.	Continuous.	LDEQ Requirement of existing LPDES permits

Table 6.7-2 (Sheet 1 of 3)[(a)] Radiological Monitoring

Phase	Monitoring Actions	Monitoring Frequency	Corresponding Agency and Permit or Requirement
Preapplication	A Land Use Census is conducted to identify land use in each meteorological sector within 5 mi. of the RBS site that would require modifications to the REMP or the ODCM.	Every 24 months.	NRC
	The airborne, direct radiation, waterborne, and ingestion pathways are monitored as required by the RBS ODCM.		Requirement of existing RBS Unit 1 license
	Airborne 1. Radioiodine and Particulates	1. Sampled continuously; sample collection every 2 weeks or more frequently.	NRC Requirement of existing RBS Unit 1 license
	2. Radioiodine Canisters--I-131	2. Analysis every 2 weeks.	
	3. Air Particulate--Gross beta radioactivity analysis	3. Following filter change every 2 weeks.	
	Direct Radiation 1. Thermoluminescent Dosimeter (TLD)	1. Sampled quarterly; mR exposure analysis quarterly.	NRC Requirement of existing RBS Unit 1 license
	Waterborne 1. Surface water grab samples and gamma isotopic and tritium analysis 2. Groundwater sampling and gamma isotopic and tritium analysis 3. Shoreline sediment sampling and gamma isotopic analysis	1. Quarterly. 2. Semiannually. 3. Annually.	NRC Requirement of existing RBS Unit 1 license

Table 6.7-2 (Sheet 2 of 3)[a]
Radiological Monitoring

Phase	Monitoring Actions	Monitoring Frequency	Corresponding Agency and Permit or Requirement
Preapplication (Continued)			
	Ingestion 1. Milk sampling and gamma isotopic and I-131 analysis 2. Fish and invertebrates sampling and gamma isotopic analysis on edible portions 3. Broadleaf vegetation sampling and gamma isotopic and I-131 analysis	1. Quarterly, when animals are on pasture. 2. Annually. 3. Quarterly, during the growing season if milk sampling is not completed.	NRC Requirement of existing RBS Unit 1 license
Construction Monitoring	The RBS Unit 3 site preparation and construction monitoring program would be a continuation of the existing RBS Unit 1 REMP.	Same as existing program.	NRC Requirement of existing RBS Unit 1 license
Preoperational	The RBS Unit 3 preoperational monitoring program would be a continuation of the existing RBS Unit 1 REMP. Any unique characteristics required of the program for a new facility (e.g., those brought on by a new reactor design) would be incorporated into the program sufficiently in advance of operation of a new facility to provide adequate baseline information prior to plant operation.	Same as existing program.	NRC Ongoing requirement of existing RBS Unit 1 license
Operational	The RBS Unit 3 operational monitoring program would be a continuation of the existing RBS Unit 1 REMP. Any unique characteristics required of the program for a new facility (e.g., those brought on by a new reactor design) would be incorporated into the program sufficiently in advance of operation of a new facility to provide adequate baseline information prior to plant operation.	Same as existing program.	NRC Ongoing requirement of existing RBS Unit 1 license

Table 6.7-2 (Sheet 3 of 3)[a]
Radiological Monitoring

a) The current RBS radiological environmental monitoring program (REMP) is used to support the preoperational and operational monitoring needs of RBS Unit 3, and to provide adequate baseline information prior to plant operation. The RBS Unit 1 REMP was established prior to the station becoming operational (in 1985) to provide data on background radiation and radioactivity normally present in the area. The RBS has continued to monitor the environment by sampling air, water, sediment, fish, and food products, as well as measuring radiation directly. The RBS also samples milk if milk-producing animals are present within 5 mi. of the plant.

The REMP includes sampling indicator and control locations within a 20-mi. radius of the plant. The REMP uses indicator locations near the site to show any increases or buildup of radioactivity that might occur due to station operation, and uses control locations farther away from the site to indicate the level of only naturally occurring radioactivity. Indicator results are compared with control and preoperational results to assess any effect that RBS operation might have had on the surrounding environment. Monitoring at RBS Unit 3 would be achieved using the existing RBS Unit 1 monitoring approach, with only slight modifications to one of the existing groundwater well locations.

Table 6.7-3 (Sheet 1 of 2)
Hydrological Monitoring

Phase	Monitoring Actions	Monitoring Frequency	Corresponding Agency and Permit or Requirement
Preapplication	**River Monitoring (Unit 1)** Continuation of ongoing monitoring by the USACE and USGS.	Ongoing.	USACE, USGS, LDEQ
	Discharge Monitoring (Unit 1) 1. Discharge of cooling water blowdown and previously monitored effluent into the Mississippi River (temperature and flow rate). 2. Stormwater discharge flows (flow rate, oil and grease, total organic carbon, and pH). 3. Flow and quantity/types of coagulant used for the intermittent discharge of clarifier underflow. 4. Vehicle wash water (flow rate, pH, total suspended solids, oil and grease, and chemical oxygen demand).	1. Continuous. 2. Quarterly. 3. Records maintained. 4. Quarterly.	LDEQ
	Groundwater Monitoring (Unit 1) 1. Collection of groundwater level measurements from selected monitoring wells.	1. Quarterly.	
Construction Monitoring	1. All preapplication monitoring activities would continue during the construction period, including the Mississippi River monitoring by the USGS and USACE. The construction SWPPP would address regular inspections for erosion control measures and visual inspections for discharges that may be detrimental to water quality. Water quality sampling and flow measurements will be conducted and reported as required to meet construction stormwater permit criteria and the requirements of the LDEQ discharge permit.	1. At the frequencies specified in preapplication phase above.	LDEQ, USGS, USACE

**Table 6.7-3 (Sheet 2 of 2)
Hydrological Monitoring**

Phase	Monitoring Actions	Monitoring Frequency	Corresponding Agency and Permit or Requirement
Construction Monitoring	2. Groundwater monitoring during construction dewatering.	2. In accordance with LPDES permit conditions.	LDEQ, USGS, USACE
Preoperational	All preapplication monitoring activities would continue during the preoperational period, including the Mississippi River monitoring by the USGS and the USACE. It has been determined that existing groundwater wells would most likely be used to support monitoring. Gamma radionuclides and tritium would be monitored through grab samples taken quarterly. Additional groundwater monitoring is not proposed for RBS Unit 3.		USGS, USACE Existing RBS Unit 1 REMP
Operational	All preapplication monitoring activities would continue during the operation period, including Mississippi River monitoring by the USGS and the USACE. The Applicant will continue to monitor operations of RBS Unit 1 and the additional RBS Unit 3 to document compliance with applicable permitting agency requirements, including the existing LPDES permit requirements and NRC license requirements. Ongoing groundwater monitoring for radioactivity (as required by the NRC) would continue. It has been determined that existing groundwater wells can be used to support monitoring. Gamma radionuclides and tritium would be monitored through grab samples taken quarterly. Additional groundwater monitoring is not proposed for RBS Unit 3.		USGS, USACE, LDEQ, NRC

Table 6.7-4
Meteorological Monitoring[a]

Phase	Monitoring Actions	Monitoring Frequency	Corresponding Agency and Permit or Requirement
Preapplication	Wind direction, wind speed, and temperature difference are measured as part of the existing RBS Unit 1 operational meteorological monitoring system and would continue as the monitoring program for RBS Unit 3.	Continuous.	NRC Existing license requirement
Construction Monitoring	Wind direction, wind speed, and temperature difference are measured as part of the existing RBS Unit 1 operational meteorological monitoring system and would continue as the monitoring program for RBS Unit 3.	Continuous.	NRC Existing license requirement
Preoperational	Wind direction, wind speed, and temperature difference are measured as part of the existing RBS Unit 1 operational meteorological monitoring system and would continue as the monitoring program for RBS Unit 3.	Continuous.	NRC Existing license requirement
Operational	Wind direction, wind speed, and temperature difference are measured as part of the existing RBS Unit 1 operational meteorological monitoring system and would continue as the monitoring program for RBS Unit 3.	Continuous.	NRC Existing license requirement

a) The current monitoring program would continue and be used as the basis for recording the necessary meteorological observations during the preoperation/construction phase of RBS Unit 3, as well as the operation phase of RBS Unit 3. Should the Applicant choose to install a new meteorological monitoring program either during the preoperational or operational phases of RBS Unit 3, then the program will be sited, installed, and operated in accordance with the provisions of Regulatory Guide 1.23.

Table 6.7-5
Terrestrial Ecological Monitoring

Phase	Monitoring Actions	Monitoring Frequency	Corresponding Agency and Permit or Plan
Preapplication	None.	NA	NA
Construction Monitoring	**<u>Wetlands</u>** 1. Wetland areas would be delineated and marked “no entry,” except where activities are approved by permit.	1. Weekly, at a minimum, during construction.	USACE Proposed
	2. Wetland areas would be protected by SWPPP standards to avoid stormwater runoff and erosion from construction site and SPCC plan measures to minimize the potential for impacts to wetlands.	2. Weekly, at a minimum.	USACE, LDEQ Proposed
	<u>Habitat and Wildlife</u> 1. Area habitats would be protected by SWPPP standards to avoid stormwater runoff and erosion from construction site and SPCC plan measures to minimize the potential for impacts to habitats and wildlife in the area.	1. Weekly, at a minimum, during construction.	LDEQ, SWPPP (LPDES permit)
	2. Access to nonconstruction areas would be prohibited to protect existing vegetation.	2. Weekly, at a minimum, during construction.	Proposed
Preoperational	None.	NA	NA
Operational	**<u>Wildlife</u>** 1. Occasional surveys of transmission corridors for protected species.	1. Irregular.	LDWF
	<u>Vegetation</u> 1. Visual survey of vegetation in vicinity of cooling tower drift for evidence of effects from salt deposition in drift.	1. Annual (first 1-3 years).	Proposed
	2. Reestablishment of vegetation in planted areas following construction.	2. Annual (first 1-3 years).	Proposed
	3. Inspection of transmission ROW for undesirable tree growth.	3. Annual.	Transmission ROW Maintenance Plan
	<u>Wetlands</u> 1. Monitoring to be established after wetland delineation is performed and only if the need for mitigation is established.	1. Annual (5 years, if needed).	USACE Section 404 Permit

Table 6.7-6 (Sheet 1 of 2)
Aquatic Ecological Monitoring

Phase	Monitoring Actions	Monitoring Frequency	Corresponding Agency and Permit or Requirement
Preapplication	Zebra mussel (*Dreissena polymorpha*) densities are currently monitored through the RBS zebra mussel monitoring and control program (ZMMCP), as outlined and implemented in the current RBS LPDES permit.	If zebra mussel infestation is suspected, sampling is to occur once weekly; April through October, and once monthly; November through March.	LDEQ LPDES Permit
	Thermal and chemical monitoring of discharged effluents (stormwater and Unit 1 cooling tower blowdown) are carried out under the existing LPDES permit regulated by the LDEQ.	Continuous effluent temperature and flow monitoring (as indicated under Discharge Monitoring in Table 6.7-7, Chemical Monitoring).	LDEQ LPDES Permit
Construction Monitoring	It is expected that BMPs and BMP inspections would be implemented at all construction sites to prevent construction effluent from entering aquatic resources at and near the RBS site. Proper functioning of these BMPs would be monitored as outlined in the construction SWPPP for construction activities at the RBS.	BMPs monitored weekly, at a minimum, during construction.	LDEQ SWPPP (LPDES permit)
	It is anticipated that the current preapplication program would continue to be implemented in future RBS LPDES permits, as the ZMMCP is important to ensure the proper operation of the station water system (SWS).	For zebra mussels, if zebra mussel infestation is suspected, zebra mussel sampling is to occur once weekly; April through October, and once monthly; November through March. Continuous effluent temperature and flow monitoring (as indicated under Discharge Monitoring in Table 6.7-7, Chemical Monitoring).	
	Visual monitoring of the RBS stormwater drainage ditch's confluence with the West Creek/Grants Bayou system (outfall) would occur during construction dewatering activities. Visual monitoring of the stormwater drainage ditch's West Creek outfall would include a once-weekly inspection of the drainage ditch bed and banks at and near the outfall to monitor the	Visual monitoring of stormwater drainage ditch outfall once weekly during construction. Monitoring would be increased to daily inspections during heavy water releases.	

Table 6.7-6 (Sheet 2 of 2)
Aquatic Ecological Monitoring

Phase	Monitoring Actions	Monitoring Frequency	Corresponding Agency and Permit or Requirement
	integrity of West Creek topography. In the event of a significantly larger-than-average water release (due to heavy rainfall or otherwise), the frequency of visual inspections may be increased to once daily until the heavy water releases subside. Visual surveys of this outfall would cease upon completion of construction dewatering activities.		
Preoperational	The preoperational monitoring program would be a continuation of the existing monitoring program, as required by the LDEQ for RBS Unit 1.	For zebra mussels, if zebra mussel infestation is suspected, zebra mussel sampling is to occur once weekly; April through October, and once monthly; November through March.	LDEQ LPDES Permit
	Discharged effluents would continue to be monitored and necessary parameters recorded continuously, as established in existing and future LPDES permits for the RBS cooling water intake and stormwater and wastewater discharge systems.	Continuous effluent temperature and flow monitoring (as indicated under Discharge Monitoring in Table 6.7-7, Chemical Monitoring).	
Operational	The operational monitoring program is anticipated to be a continuation of the preoperational monitoring program, and would conform to applicable LPDES permit requirements at the time of operation.	For zebra mussels, if zebra mussel infestation is suspected, zebra mussel sampling is to occur once weekly; April through October, and once monthly; November through March.	LDEQ LPDES Permit
	For current operations of RBS Unit 1, the LDEQ requires continuous monitoring/ recording of discharge water temperature from Outfall 001, which includes the cooling water blowdown discharge into the Mississippi River. Monitoring/recording of the concentration of pollutants in waters discharged at all RBS permitted outfalls is also required. It is expected that similar monitoring requirements would continue for operation of RBS Units 1 and 3.	Continuous effluent temperature and flow monitoring (as indicated under Discharge Monitoring in Table 6.7-7, Chemical Monitoring).	

Table 6.7-7 (Sheet 1 of 2) Chemical Monitoring

Phase	Monitoring Actions	Monitoring Frequency	Corresponding Agency and Permit or Requirement
Preapplication	Preapplication monitoring consists of data from ongoing RBS Unit 1 monitoring programs, USGS data collected in the Mississippi River near RBS Unit 1, and other baseline data collected prior to construction of the existing RBS Unit 1.	Variable frequency by parameter (daily to annual).	USEPA, LDEQ, NRC license LPDES Permit
	Unit 1 Discharge Monitoring		USEPA, LDEQ, NRC license LPDES Permit
	1. Discharge of cooling water blowdown and previously monitored effluent into the Mississippi River (temperature and flow rate).	1. Continuous.	
	2. Stormwater discharge flows (flow rate, total suspended solids, oil and grease, total organic carbon, and pH).	2. Quarterly.	
	3. Flow and quantity/types of coagulant used for the intermittent discharge of clarifier underflow.	3. Records maintained.	
	4. Vehicle wash water (flow rate, pH, total suspended solids, oil and grease, and chemical oxygen demand).	4. Quarterly.	
Construction Monitoring	1. RBS Unit 1 maintains records of the use of such chemical additives as coagulants, flocculants, biocides, corrosion inhibitors, dechlorination chemicals, and related materials used in cooling and process waters in accordance with the LPDES permit.	1. Maintain current records.	USEPA, LDEQ, NRC license LPDES Permit
	2. Whole effluent toxicity testing of the cooling water discharge to test for any cumulative toxic impact of the discharge water to EPA/LDEQ specified test organisms.	2. Annually.	

Table 6.7-7 (Sheet 2 of 2)
Chemical Monitoring

Phase	Monitoring Actions	Monitoring Frequency	Corresponding Agency and Permit or Requirement
Preoperational	Additional preoperational hydrological monitoring is not anticipated. If requested by the NRC or LDEQ, the Applicant would monitor to establish a baseline for identifying and assessing environmental impacts resulting from plant operation. The preoperational monitoring program would be an extension of the existing, continuing water quality and discharge monitoring programs.	Variable frequency by parameter (daily to annual).	USEPA, LDEQ, NRC license LPDES Permit
Operational	It is anticipated that the effects of sanitary and chemical waste retention methods on water quality would be evaluated, and the impact associated with alteration of sediment transport during operation of a new facility would be assessed. The effectiveness of effluent treatment and control systems would be assessed as a part of the monitoring program. Whole effluent toxicity testing is anticipated to continue in a similar way for the testing of a combined discharge from RBS Units 1 and 3 under a combined facility LPDES permit.	Sampling locations, frequency, and parameter analysis would meet LPDES permit criteria applicable at the time of operation. Whole effluent toxicity testing conducted annually.	USEPA, LDEQ, NRC license LPDES Permit

Table 6.7-8
Noise Monitoring

Phase	Monitoring Actions	Monitoring Frequency	Corresponding Agency and Permit or Requirement
Preapplication	None.	NA	NA
Construction Monitoring	Monitoring of noise levels at nearby residences during daytime and nighttime construction activities.	Once during construction.	Proposed
Preoperational	None.	NA	NA
Operational	Monitoring of noise levels at nearby residences during daytime and nighttime.	Once, subsequent to station operation.	Proposed

CHAPTER 7 ENVIRONMENTAL IMPACTS OF POSTULATED ACCIDENTS INVOLVING RADIOACTIVE MATERIALS

This chapter assesses the environmental impacts of postulated accidents involving radioactive materials at the RBS Unit 3 site. The chapter is divided into four sections that address design basis accidents, severe accidents, severe accident mitigation alternatives, and transportation accidents as follows:

- Design Basis Accidents (Section 7.1).
- Severe Accidents (Section 7.2).
- Severe Accident Mitigation Alternatives (Section 7.3).
- Transportation Accidents (Section 7.4).

7.1 DESIGN BASIS ACCIDENTS

The purpose of this section is to assess the environmental risks of accidents involving radioactive material. The scope of this section is limited to a comparison of the off-site dose consequences and resulting health effects for design basis accidents (DBAs) as calculated by the Applicant and those contained in DCD Chapter 15.

7.1.1 SELECTION OF ACCIDENTS

The radiological consequences of accidents were assessed to demonstrate that new units could be constructed and operated at the RBS site without undue risk to the health and safety of the public. The assessment used site-specific accident meteorology with radiological analyses in DCD Chapter 15. The assessment used a robust and conservative set of surrogate DBAs for the selected reactor technology. The DBAs include a spectrum of events, including those of relatively greater probability of occurrence as well as those that are less probable but have greater severity.

The set of accidents selected focuses on the ESBWR design. From the DCD, the following accidents were evaluated:

- Feedwater Line Break Accident.
- Failure of Small Line Carrying Primary Coolant Outside Containment.
- Main Steam Line Break (MSLB) Accident.
- Loss-of-Coolant Accident (LOCA).
- Fuel Handling Accident (FHA).
- Reactor Water Cleanup/Shutdown Cooling (RWCU/SDC) Line Failure.

7.1.2 EVALUATION METHODOLOGY

Doses for the representative DBAs are evaluated at the Exclusion Area Boundary (EAB) and the Low Population Zone (LPZ). These doses must meet the site acceptance criteria in 10 CFR 50.34 and 10 CFR 100. Although the emergency safety features are expected to prevent core damage and mitigate releases of radioactivity, the LOCA dose analysis presumes substantial core melt with the release of significant amounts of fission products. The postulated DBA LOCA is expected to more closely approach 10 CFR 50.34 limits than the other DBAs that have a greater probability of occurrence but also have lower release activities. For these accidents, the calculated doses are compared to the acceptance criteria in Regulatory Guide 1.183 and NUREG-0800, to demonstrate that the consequences of the postulated accidents are acceptable.

The evaluations discussed herein use short-term accident atmospheric dispersion factors (χ/Q). The χ/Qs were calculated using the computer code PAVAN following the methodology in Regulatory Guide 1.145 and using site-specific meteorological data. Consistent with NUREG

1555, Section 7.1.III.(2), the χ/Qs used for this assessment should either be the "50th percentile χ/Q value that was based on onsite meteorological data, or 10% of the levels given in Regulatory Guide 1.3 or Regulatory Guide 1.4, to represent more realistic dispersion conditions than assumed in the safety evaluation." The analysis provided χ/Q values at the EAB and the LPZ for each combination of wind speed, and it calculated atmospheric stability for each of 16 downwind direction sectors. For a given location, either the EAB or the LPZ, the 0 to 2 hr. χ/Q value is the 50th percentile overall value calculated by PAVAN. For the LPZ, the χ/Q values for all subsequent times were calculated by logarithmic interpolation between the 50th percentile χ/Q value and the annual average χ/Q value. For the RBS site, the 50th percentile χ/Qs are provided in Table 7.1-1.

The accident doses are expressed as total effective dose equivalent (TEDE), consistent with 10 CFR 50.34. The TEDE consists of the sum of the committed effective dose equivalent (CEDE) from inhalation and either the deep dose equivalent (DDE) or the effective dose equivalent (EDE) from external exposure. The CEDE was determined using the dose conversion factors in Federal Guidance Report 11 (Reference 7.1-1), while the DDE and the EDE were based on dose conversion factors in Federal Guidance Report 12 (Reference 7.1-2).

7.1.3 SOURCE TERMS

Dose calculations were based on the time-dependent activities released to the environment during each DBA. The activities were based on the analyses used to support the DCD Chapter 15 safety analyses reports. The ESBWR source term, methodologies, and assumptions were based on the alternative source term methods outlined in Regulatory Guide 1.183. The activity releases and doses for the ESBWR were based on 102 percent of rated core thermal power.[a]

7.1.4 RADIOLOGICAL CONSEQUENCES

The RBS Unit 3 specific doses were calculated on the basis of the DCD doses for the ESBWR. For each of the DBAs, the RBS Unit 3 specific dose was calculated by multiplying the DCD dose (provided in DCD Section 15.4) by the ratio of the RBS Unit 3 site-specific χ/Q value to the DCD χ/Q value. The RBS Unit 3 site-specific χ/Q values are the time-dependent χ/Q values in Table 7.1-1. The resulting χ/Q ratios are shown in Table 7.1-2.

Because the RBS Unit 3 site-specific χ/Q values were bounded by the DCD χ/Q values, the RBS Unit 3 site-specific doses are within those calculated in DCD Section 15.4. The DBA doses summarized in Table 7.1-3 were based on the individual accident doses presented in Tables 7.1-4 through 7.1-11. For each accident, the EAB dose shown is for the 2-hr. period that yields the maximum dose, in accordance with Regulatory Guide 1.183.

The RBS Unit 3 specific doses summarized in Table 7.1-3 are within the acceptance criteria of Regulatory Guide 1.183 and NUREG-0800. Thus, the potential impact of the representative DBAs evaluated is SMALL. Refer to Section 5.4 for the impacts to the public from anticipated releases during normal operations.

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a. The ESBWR rated core thermal power is 4500 MWt (Table 3.8-2), and 102 percent of this value equates to 4590 MWt.

7.1.5 REFERENCES

7.1-1 U.S. Environmental Protection Agency, *Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion and Ingestion*, Federal Guidance Report 11, EPA-520/1-88-020, 1988.

7.1-2 U.S. Environmental Protection Agency, *External Exposure to Radionuclides in Air, Water and Soil*, Federal Guidance Report 12, EPA-402-R-93-081, 1993.

Table 7.1-1
Maximum 50th Percentile χ/Q Values

Location		χ/Q (sec/m^3)
EAB		1.580E-04
LPZ	0 - 8 hr.	1.619E-05
LPZ	8 - 24 hr.	1.304E-05
LPZ	24 - 96 hr.	8.151E-06
LPZ	96 - 720 hr.	4.153E-06

Table 7.1-2
Determination of χ/Q Ratios

Accident	Location		ESBWR DCD	50th % χ/Qs	Ratio (Unit 3/DCD)
FHA, RWCU/SDC (Equilibrium Iodine Activity and Pre-Incident Iodine Spike)	EAB		2.00E-03	1.58E-04	7.90E-02
	LPZ		1.90E-04	1.62E-05	8.52E-02
MSLB (Pre-Incident Iodine Spike and Equilibrium Iodine Activity)	EAB		2.00E-03	1.58E-04	7.90E-02
	LPZ		2.00E-03	1.62E-05	8.09E-03
LOCA	EAB		2.00E-03	1.58E-04	7.90E-02
	LPZ	0 - 8 hr.	1.90E-04	1.62E-05	8.52E-02
	LPZ	8 - 24 hr.	1.40E-04	1.30E-05	9.31E-02
	LPZ	24 - 96 hr.	7.50E-05	8.15E-06	1.09E-01
	LPZ	96 - 720 hr.	3.00E-05	4.15E-06	1.38E-01
Feedwater Line Break	EAB		1.00E-03	1.58E-04	1.58E-01
	LPZ		1.00E-03	1.62E-05	1.62E-02

Table 7.1-3
Summary of Design Basis Accident Doses

Accident	Location	TEDE (rem)	Limit (rem)
Feedwater Line Break	EAB	2.69E-05	2.5
	LPZ	2.75E-06	2.5
Failure of Small Line Carrying Primary Coolant Outside Containment	EAB	1.19E-02	2.5
	LPZ	2.04E-02	2.5
MSLB - Pre-Incident Iodine Spike	EAB	9.95E-01	25
	LPZ	1.02E-01	25
MSLB - Equilibrium Iodine Activity	EAB	5.53E-02	2.5
	LPZ	5.67E-03	2.5
LOCA	EAB	1.03E+00	25
	LPZ	2.00E+00	25
FHA	EAB	3.26E-01	6.3
	LPZ	3.32E-02	6.3
RWCU/SDC - Equilibrium Iodine Activity	EAB	3.87E-02	2.5
	LPZ	4.00E-03	2.5
RWCU/SDC - Pre-Incident Iodine Spike	EAB	7.74E-01	25
	LPZ	7.92E-02	25

Table 7.1-4
Feedwater Line Break

	DCD TEDE (rem)	χ/Q Ratio (sec/m^3)	Unit 3 TEDE (rem)
EAB	1.70E-04	1.58E-01	2.69E-05
LPZ	1.70E-04	1.62E-02	2.75E-06
Limit	2.5		2.5

Note: DCD doses are from DCD Table 15.4-16.

Table 7.1-5
Small Line Carrying Primary Coolant Outside Containment

		DCD TEDE (rem)		χ/Q Ratio (sec/m^3)	Unit 3 TEDE (rem)	
		EAB	LPZ		EAB	LPZ
EAB		0.15		7.90E-02	1.19E-02	
LPZ	0 - 8 hr.		0.04	8.52E-02		3.41E-03
LPZ	8 - 24 hr.		0.05	9.31E-02		4.66E-03
LPZ	24 - 96 hr.		0.05	1.09E-01		5.43E-03
LPZ	96 - 720 hr.		0.05	1.38E-01		6.92E-03
Total		0.15	0.19		1.19E-02	2.04E-02
Limit		2.5	2.5		2.5	2.5

Note: DCD doses are from DCD Table 15.4-19.

Table 7.1-6
Main Steam Line Break Pre-Incident Iodine Spike

	DCD TEDE (rem)	χ/Q Ratio (sec/m^3)	Unit 3 TEDE (rem)
EAB	12.6	7.90E-02	9.95E-01
LPZ	12.6	8.09E-03	1.02E-01
Limit	25		25

Note: DCD doses are from DCD Table 15.4-13.

Table 7.1-7
Main Steam Line Break Equilibrium Iodine Activity

	DCD TEDE (rem)	χ/Q Ratio (sec/m^3)	Unit 3 TEDE (rem)
EAB	0.7	7.90E-02	5.53E-02
LPZ	0.7	8.09E-03	5.67E-03
Limit	2.5		2.5

Note: DCD doses are from DCD Table 15.4-13.

Table 7.1-8
Loss-of-Coolant Accident

		DCD TEDE (rem)		χ/Q Ratio (sec/m^3)	Unit 3 TEDE (rem)	
		EAB	LPZ		EAB	LPZ
EAB		13.0		7.90E-02	1.03E+00	
LPZ	0 - 8 hr.		3.2	8.52E-02		2.73E-01
LPZ	8 - 24 hr.		2.7	9.31E-02		2.51E-01
LPZ	24 - 96 hr.		5.2	1.09E-01		5.65E-01
LPZ	96 - 720 hr.		6.6	1.38E-01		9.14E-01
Total		13.0	17.7		1.03E+00	2.00E+00
Limit		25	25		25	25

Note: DCD doses are from DCD Table 15.4-9.

Table 7.1-9
Fuel Handling Accident (Reactor Building or Fuel Building)

	DCD TEDE (rem)	χ/Q Ratio (sec/m^3)	Unit 3 TEDE (rem)
EAB	4.13	7.90E-02	3.26E-01
LPZ	0.39	8.52E-02	3.32E-02
Limit	6.3		6.3

Note: DCD doses are from DCD Table 15.4-4.

Table 7.1-10
RWCU/SDC Line Break Equilibrium Iodine Activity

	DCD TEDE (rem)	χ/Q Ratio (sec/m^3)	Unit 3 TEDE (rem)
EAB	0.49	7.90E-02	3.87E-02
LPZ	0.047	8.52E-02	4.00E-03
Limit	2.5		2.5

Note: DCD doses are from DCD Table 15.4-23.

Table 7.1-11
RWCU/SDC Line Break Pre-Incident Iodine Spike

	DCD TEDE (rem)	χ/Q Ratio (sec/m^3)	Unit 3 TEDE (rem)
EAB	9.8	7.90E-02	7.74E-01
LPZ	0.93	8.52E-02	7.92E-02
Limit	25		25

Note: DCD doses are from DCD Table 15.4-23.

7.2 SEVERE ACCIDENTS

This section discusses the probabilities and consequences of accidents of greater severity than the DBAs. As a class, the more severe accidents are considered less likely to occur than DBAs; however, because their consequences could be more severe, they are considered important both in terms of impact to the environment and off-site costs. These severe accidents can be distinguished from DBAs in two primary respects: (1) they involve substantial physical deterioration of the fuel in the reactor core, including overheating to the point of melting, and (2) they involve deterioration of the capability of the containment system to perform its intended function of limiting the release of radioactive materials to the environment. In NUREG-1437, the U.S. Nuclear Regulatory Commission (NRC) generically assessed the impacts of severe accidents during license renewal periods, using the results of existing analyses and site-specific information to conservatively predict the environmental impacts of severe accidents for each plant during the renewal period (Reference 7.2-1). This methodology was used as a basis for evaluating the severe accident environmental impacts of a new nuclear power plant that may be built on the RBS site.

In NUREG-1437, the RBS is one of just four sites described as a "large river site" for the purpose of evaluating fallout into open bodies of water. Table 5.16 of NUREG-1437 shows that large river sites are generically the most advantageous in terms of annual edible aquatic food harvest, whole-body population doses, and total exposure per reactor-year in person-rem. This is due to the high dilution effect and low residence times associated with a large river. Table 5.15 of NUREG-1437 shows that the RBS is bounded by the analyses performed at the RBS site.

7.2.1 GEH CONTAINMENT RESPONSE TO SEVERE ACCIDENTS APPROACH

The GEH Probabilistic Risk Assessment (PRA) for the ESBWR (Reference 7.2-2) established a containment event tree that defined the possible end states of the containment response following a severe accident. Using EPRI's Modular Accident Analysis Program (MAAP) code, GEH determined that 10 release categories with 15 source term categories would represent the entire suite of potential severe accidents.

The 10 release categories and associated source term categories are as follows:

1. Break Outside of Containment (BOC) - Radioactivity is released through an unisolated break outside of containment in the shutdown cooling piping, allowing direct communication between the reactor pressure vessel and the environment outside of containment. This is followed by no injection of cooling water into the reactor pressure vessel. Two separate locations of a break in the piping were selected for determining source term categories in this release category, one mid-level in the reactor pressure vessel (BOC1) and the other at the lower level (BOC2).

2. Containment Bypass (BYP) - Radioactivity is released directly to the atmosphere from containment as the result of a failure of the containment isolation system to function. Sequences in which the reactor pressure vessel is depressurized generally result in the core being uncovered earlier than those with a failure to depressurize. Both a low-pressure sequence (BYP3) and a high-pressure

sequence (BYP4) were selected for determining the source term categories for this release category.

3. Core-Concrete Interaction Dry (CCID) - This release category applies to sequences in which the containment fails because of interaction between the core and the containment concrete. The deluge function is assumed to fail, and the lower dry well debris bed is uncovered. Sequences in which the containment vessel is not depressurized may result in earlier containment vessel failure. A low-pressure sequence (CCID5) and a high-pressure sequence (CCID6) were selected for determining the source term in this release category.

4. Core-Concrete Interaction Wet (CCIW) - This release category applies to sequences in which the containment fails because of interaction between the core and containment concrete. The deluge function works; however, the basemat internal melt arrest and coolability device is not effective in providing debris bed cooling. Unlike the CCID category, cooling water is present and provides the potential of scrubbing for the radionuclides that evolve from the debris bed, thus reducing the magnitude of the source term. Sequences in which the reactor vessel is not depressurized may result in earlier reactor vessel failure. A low-pressure sequence (CCIW7) and a high-pressure sequence (CCIW8) were selected for determining the source term categories associated with each sequence in this release category.

5. Ex-Vessel Steam Explosion (EVE) - This release category applies to sequences in which the reactor vessel fails at low pressure and a significant steam explosion occurs (EVE9). Containment depressurization is assumed to occur when the vessel fails, at which time there is direct communication with the environment. Because of the uncertainties associated with equipment damage and water availability, no credit is taken for lower dry well water to reduce the source term.

6. Filtered Release (FR) - Radioactivity is released by manually venting the containment from the suppression chamber air space (FR10). This action may be implemented to limit the containment pressure increase, if containment heat removal fails or the containment is overpressurized. Venting the suppression chamber forces the radionuclides through the suppression pool, which reduces the magnitude of the source term.

7. Overpressure-Vacuum Breaker (OPVB) - This release category applies to sequences in which the vacuum breaker failure has occurred (either by failing to close or by remaining open in a pre-existing condition), resulting in failure of the containment pressure function, which, in turn, causes failure in containment heat removal. Two sequences are associated with this release category; both high- (OPVB11) and low-pressure sequences (OPVB12) were selected for source term categories.

8. Overpressure - Early Containment Heat Removal Loss (OPW1) - This release category applies to sequences in which containment heat removal fails within 24 hours after event initiation (OPW1-13). A sequence with the reactor pressure

vessel failure at high pressure was selected because it has an earlier failure and higher probability of the loss of containment heat removal. Containment heat removal is assumed to be unavailable for the duration of the sequence.

9. Overpressure - Late Containment Heat Removal Loss (OPW2) - This release category applies to sequences in which containment heat removal fails in the period after that addressed by OPW1-13, above, until 72 hours after the onset of core damage (OPW2-14). The passive containment cooling system is assumed to be unavailable 24 hours after event initiation, and the availability of the fuel and auxiliary pool cooling system is determined. A sequence with the reactor pressure vessel failure at high pressure was selected because it has an earlier failure and higher probability of the loss of containment heat removal. Containment heat removal is terminated 24 hours after the event initiation.

10. Technical Specification Leakage (TSL) - This category applies to sequences in which the containment is intact and the only release is due to the maximum leak rate allowed by Technical Specifications (TSL15). For additional conservatism, the area of containment leakage corresponding to the maximum allowable Technical Specification leak rate was doubled to produce the representative source term used for this release category.

In addition, a direct containment heating (DCH) category was evaluated. The DCH category applies to sequences in which the reactor fails at high pressure and a significant DCH event occurs. GEH subsequently determined that catastrophic containment failure due to DCH is physically unreasonable and studied local damage to the liner in the lower dry well as a sensitivity case. Thus, no DCH sequence was evaluated for the baseline case.

GEH then used the MACCS2 (MELCOR Accident Consequence Code System) (Reference 7.2-3) to model the environmental consequences of severe accidents, using generic, but conservative, meteorological and population parameters to represent a generic ESBWR site. The analysis focused on the 24-hour period following core damage, as a measure of the consequences from a large release and, therefore, did not address the chronic pathways such as ingestion, inhalation of re-suspended material, or groundshine subsequent to plume passage. GEH also considered the releases for the first 72 hours after core damage. Additional details of the analysis can be found in the ESBWR PRA (Reference 7.2-2) and are reported in the ESBWR DCD.

7.2.2 RBS UNIT 3 MACCS2 ASSESSMENT OF SEVERE ACCIDENT CONSEQUENCES

A severe accident consequence analysis was calculated using the Level 3 PRA MACCS2 code, discussed in NUREG/CR-6613 (Reference 7.2-3). The analysis methodology was the same as that used for the recently completed severe accident analysis of a proposed future ESBWR reactor at the Grand Gulf Nuclear Station site (Reference 7.2-4).

7.2.2.1 Code

The analysis was performed with the MACCS2 version designated as Oak Ridge National Laboratory RSICC Computer Code Collection MACCS2 V.1.13.1, CCC-652 Code Package.

MACCS2 simulates the impact of severe accidents at nuclear power plants on the surrounding environment. The principal phenomena considered in MACCS2 are atmospheric transport, mitigating actions based on dose projections, dose accumulation through a number of pathways including food and water ingestion, early and latent health effects, and economic costs. The basis model had no important deviations from the default code input values, except for site-specific values and reactor design information. The code values modified for the future designs were primarily the source term data from the ESBWR Level 2 probabilistic safety analyses. These data include the radionuclide inventory, power level, release fractions and corresponding frequencies, plume release start time, plume release height, delay and duration. Values for the ATMOS input data file (one of the five[a] input files used by MACCS2) were modified, as necessary, to use data appropriate for the ESBWR source terms and probability frequencies. The remaining MACCS2 input files were reviewed and modified as necessary.

7.2.2.2 Meteorology

Two years of site-specific hourly meteorological data were used as input into the MACCS2 meteorological files, including data from December 1, 2004 through November 30, 2005 (2005 data) and December 1, 2005 through November 30, 2006 (2006 data).

The hourly data (wind direction, wind speed, and precipitation) were collected on-site at the RBS meteorological tower. The MACCS2 code inputs require meteorological data for every hour, but most meteorological stations have periods when data are missing. The meteorological data provided for the analysis had approximately 950 missing hours of data out of a total of 17,520 hours. When only 1 hour of data was missing, values were interpolated based on the values immediately before and after the data gap. When more than 1 hour of data was missing in series, the data were replaced with data from days with similar meteorological conditions immediately before and after the missing data. Additionally, there were 8 hours in 2005 and 2 hours in 2006 in which the wind speed was zero when rounded for entry into the MACCS2 meteorological file. MACCS2 requires that the wind speed be at least 1 decimeter/second (dm/s), so these values were changed to 1.

Morning and afternoon mixing height values were taken from Table 2.7-8, Monthly and Annual Mean Mixing Heights (Meters) at Lake Charles, Louisiana (2000 - 2006), with the median values selected from January through March for the winter season, and so on. The treatment of rain/precipitation events follows the default recommended parameter values provided in the ATMOS file supplied with the MACCS2 code.

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a. The MACCS2 analysis requires five input files: ATMOS, EARLY, CHRONC, MET, and SITE. ATMOS provides data to calculate the amount of material released to the atmosphere that is dispersed and deposited. EARLY provides inputs to calculations regarding exposure in the time period immediately following the release, including parameters describing breathing rates and sheltering. CHRONC provides data for calculating long-term impacts and economic costs and includes region-specific data on agriculture and economic factors. MACCS2 requires a calendar year of meteorological data for the MET file. Two years were input into the system. SITE requires the 50-mi. population distribution as well as agricultural-economic data (Reference 7.2-3).

7.2.2.3 Population

The population distribution and land use information for the region surrounding the RBS site are specified in the SITE input data file. Contained in the SITE data file are the geometry data used for the site (spatial intervals and wind directions), population distribution, fraction of the area that is land, watershed data for the liquid pathways model, information on agricultural land use and growing seasons, and regional economic information. Some of the detailed data in this input file supersede certain data in the EARLY input data file.

A 50-mi. radius area around the site was divided into 16 directions that are equivalent to a standard navigational compass rosette. This rosette was further divided into inner radial rings consistent with Figure 2.5-3.

The Exposure Index (EI), defined in NUREG-1437, was verified to be consistent with the above population and meteorology data. The average population out to 10 mi. is 1550 people for each of the 16 wind segments; however, the estimated EI (10 mi.) for 2000 is slightly less than the NUREG-1437 values because the prevailing winds are away from population centers. The estimated EIs shown in Table 7.2-1 were generated for the RBS site based on NUREG-1437 population ratios and extrapolations.

The determination of EI is provided as a note in NUREG/CR-6613 as follows:

To calculate EI value: A x B = C; EI = sum of C.

Where:

A = Wind frequency in a given direction.

B = Population within 10 mi.

C = Product.

7.2.2.4 Major Site Assumptions Other than Meteorological and Population Data

The following assumptions were used for the analysis:

- The land fractions were interpolated from ER Figures 2.5-1 and 2.5-2. However, for watershed definitions in terms of ingestion factors for strontium (Sr)-89, Sr-90, cesium (Cs)-134, and Cs-137, it is conservative to ignore the Mississippi River and treat all segments as land.

- Regional indices are identified as either Louisiana or Mississippi for region indexing. The two states have similar fractional dairy, total annual farm sales in dollars/hectare, property values in dollars/hectare, and non-farm property values in dollars/person, but the land fraction devoted to farming is different within a 50-mi. radius of the plant. Most of the Mississippi side of the river is forested land within this range of the site. The default values supplied by the code are provided in Table 7.2-2.

- The default economic values supplied by the code were corrected based on the Consumer Price Index (CPI) for November of 1988 (when the NUREG-1150 data were generated) (Reference 7.2-5) and for February of 2008 (CPIs obtained from Reference 7.2-6). That is, each dollar amount was multiplied by 205.060/118.3 = 1.733. The results are presented in Table 7.2-3.

- The crop information required by MACCS2 input is slightly different in format than similar information provided in the ER. Values were collected from Louisiana electoral Districts 1, 3, 5, 6, and 7 and Mississippi electoral District 3. These were combined and weighted by the total farmland area within the 50-mi. radius to produce a single composite measure, which is shown in Table 7.2-4.

- The growing season was conservatively assumed to be year-round. Therefore, the growing season input is specified to start on Julian Day 1 and end on Julian Day 365.

7.2.2.5 Protective Actions

The EARLY module of the MACCS2 code models the time period immediately following a radioactive release. This period is commonly referred to as the emergency phase. This perod may extend up to 1 week after the arrival of the first plume at any downwind spatial interval. The subsequent intermediate and long-term periods are treated by the CHRONC module of the code. In the EARLY module, the user may specify emergency response scenarios that include evacuation, sheltering, and dose-dependent relocation. The EARLY module has the capability of combining results from up to three different emergency response scenarios. This is accomplished by appending change records to the EARLY input data file. The first emergency-response scenario is defined in the main body of the EARLY input data file. Up to two additional emergency-response scenarios can be defined through change record sets positioned at the end of the file.

This analysis used the same assumptions as Reference 7.2-7, and the default-supplied data. The emergency evacuation model has been modeled as a single evacuation zone extending out 10 mi. from the site. For the purposes of this analysis, an average evacuation speed of 1.8 m/s was used, with a 7200-second delay between the alarm and start of evacuation, and no sheltering for the base case. Once evacuees were more than 20 mi. from the site, they were no longer included in the analysis. The evacuation scenario was weighted 95 percent, compared to "no evacuation" for the purpose of composite results.

7.2.2.6 Source Terms

The ATMOS input data file calculates the dispersion and deposition of material released "source terms" to the atmosphere as a function of downwind distance. Source term release fractions (RELFRC) for the ESBWR DCD are shown in Table 7.2-5, and plume characterizations are shown in Table 7.2-6. These data include the source term inventory, power level, release fractions, plume start time, plume release height, delay, and duration.

The release times and durations and elevation and energy of release for the ESBWR were extracted from the ESBWR DCD. Parameters were assigned to each source term according to the Source Term Category (STC) number. Each release plume was assumed to have only one segment (refer to Table 7.2-6). The scaling factor (CORSCA) was used to adjust the ESBWR core inventory for a power level of 4500 MWt. The core inventory was based on an average fuel exposure (bundle average) of 35,000 megawatt days/metric ton (MWd/MT).

7.2.3 EVALUATION OF ECONOMIC IMPACTS OF SEVERE ACCIDENTS

This subsection discusses the potential economic impact as the result of postulated severe accidents at a nuclear reactor on the RBS site. Similar to Subsection 7.2.2.3, the EI was used as a predictor of cost because the cost, as identified in NUREG-1437, should be dependent upon the economic impact in the same way and for the same reason that population dose estimates are dependent on the EI values.

The critical parameters extracted are depicted in Table 7.2-7 for years 2005 and 2006 and involve population doses, dollar consequences, affected land areas, early fatalities, and latent fatalities. All critical parameters were combined with the release frequencies to put the results in terms of risk per year. The following is a summary of how each critical parameter was collected:

- The population dose shown in Table 7.2-7 was collected from the mean value of each scenario's total long-term pathways dose. The population dose is in person-rem per reactor year units.

- Dollar consequences shown in Table 7.2-7 were collected from the mean value of total economic costs. The dollar consequences are in dollars per reactor year units.

- The affected land area shown in Table 7.2-7 is the larger of the mean value of farm interdiction or the mean value of crop disposal area. The affected land areas are in hectares per reactor year units.

- Early and latent fatalities are shown in Table 7.2-7 and are the mean values collected (as suggested in the MACCS2 documentation) as a combination of cohort 1 (evacuation) multiplied by 95 percent, plus cohort 2 (no evacuation) multiplied by 5 percent plus cohort 3 (chronic effects). Note that early fatalities do not account for chronic effects. The fatalities represented are in fatalities per reactor year units.

- The water ingestion dose contribution, as shown in Table 7.2-7, was determined based on the mean value of the water ingestion dose. The water ingestion dose is in person-rem per reactor year units.

The results were used to determine the maximum averted cost-risk for a single ESBWR at the RBS Unit 3 site. The maximum averted cost-risk is the sum of the averted cost-risks pertaining to the off-site exposure cost, off-site economic cost, on-site exposure cost, on-site cleanup cost, and replacement power cost. The monetization was performed in accordance with procedures in Section 5.7 of NUREG/BR-0184 (Reference 7.2-8), with one exception. When calculating the replacement power cost, NUREG/BR-0184 gives equations applicable for discount rates between 5 and 10 percent. However, for discount rates between 1 and 5 percent, NUREG/BR-0184 recommends interpolating between two given values. This procedure is not allowed because it results in a greater replacement power cost for the 7 percent discount rate than for the 3 percent discount rate, even though the 3 percent rate represents the conservative case. To maintain consistency and conservatism, the equations recommended for discount rates between 5 and 10 percent were also used for the 3 percent case. The monetization was performed assuming a 7 percent discount rate and was then repeated using a conservatively low 3 percent discount rate. It should be noted that in the calculation of net present value of replacement power for a single event (PV_{RP}), a constant of 2.1E+8 was used rather than the 1.2E+8 recommended by NUREG/BR-0184. This constant was used because the constant in NUREG/BR-0184, which represents a string of replacement power costs that occur over the lifetime of the reactor, was based on a 910-MWe reactor. This value has been scaled up to represent a 1600-MWe reactor. That is, the constant of 1.2E+8 has been multiplied by 1600/910, resulting in the new constant of 2.1E+8. Tables 7.2-8 and 7.2-9 show the results of the monetization.

7.2.4 CONSIDERATION OF NRC SEVERE ACCIDENT AND SAFETY GOAL POLICIES

In 1985, the NRC adopted a "Policy Statement on Severe Reactor Accidents Regarding Future Designs and Existing Plants" (Reference 7.2-9). This policy statement indicated:

> "The Commission fully expects that vendors engaged in designing new standard (or custom) plants will achieve a higher standard of severe accident safety performance than their prior designs. This expectation is based on:
>
> The growing volume of information from industry and government-sponsored research and operating reactor experience has improved our knowledge of specific severe accident vulnerabilities and of low-cost methods for their mitigation. Further learning on safety vulnerabilities and innovative methods is to be expected.
>
> The inherent flexibility of this Policy Statement (that permits risk-risk tradeoffs in systems and sub-systems design) encourages thereby innovative ways of achieving an improved overall systems reliability at a reasonable cost.
>
> Public acceptance, and hence investor acceptance, of nuclear technology is dependent on demonstrable progress in safety performance, including the reduction in frequency of accident precursor events as well as a diminished controversy among experts as to the adequacy of nuclear safety technology."

Implementation of the NRC's Severe Accident Policy can be expected to show that the environmental impact of any new reactor or reactors on the RBS site would be within the range of risk previously determined to be SMALL.

A significant factor in the risk associated with a new reactor design is the probability of the postulated severe accident sequences. The NRC Safety Evaluation Report (SER) that was recently issued with Open Items for the DCD Chapter 19, "Probabilistic Risk Assessment and Severe Accidents" evaluation identified that the estimated core damage frequency (CDF) and risk calculated for the ESBWR design are very low (Reference 7.2-10). Refer to the following:

> "The low CDF and risk for the ESBWR design are a reflection of the Applicant's efforts to systematically minimize the effect of initiators/sequences that have been important contributors to CDF in previous BWR PRAs. This minimization has been done largely

> through the incorporation of a number of hardware improvements in the ESBWR design. Section 19.1 of this report discusses these improvements and the additional ESBWR design features that contribute to low CDF and risk for the ESBWR."

Therefore, the Severe Accident Policy Statement expectation has been met for the ESBWR and is expected to continue to be met for the future design certification and combined license approvals.

The ESBWR PRA (Reference 7.2-2) also compares the performance of the ESBWR under generic conditions to three NRC safety goals: (1) individual risk goal, (2) societal risk goal, and (3) radiation risk goal. A discussion of the ESBWR PRA Section 10.4 criteria and the RBS site-specific calculation results of these risk values follows.

7.2.4.1 Individual Risk Goal

The risk to an average individual in the vicinity of a nuclear power plant of experiencing a prompt fatality resulting from a severe reactor accident 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. As defined in the Safety Goals Policy Statement (51 FR 30028), "vicinity" is the area within 1 mi. of the plant site boundary. "Prompt Fatality Risks" are defined as the sum of risks which the average individual residing in the vicinity of the plant is exposed to as a result of normal daily activities (driving, household, chores, occupational activities, etc). For this evaluation, the sum of prompt fatality risks was taken as the U.S. accidental death risk value of 39.7 deaths per 100,000 people per year (Reference 7.2-11).

One-tenth of 1 percent of this risk results in a value of 3.97E-05 for prompt fatalities. As shown in Table 7.2-7 (Sheet 2), the risk for early (prompt) fatalities in 2006 was 2.63E-09 (1.90E-09 for 2005 in Table 7.2-7 (Sheet 1)), which is bounded by prompt fatality criteria. Therefore, the early fatality risk from a severe accident at the RBS site is considered acceptable.

7.2.4.2 Societal Risk Goal

The risk to the population in the area near a nuclear power plant of cancer fatalities that might result from its operation should not exceed 0.1 percent of the sum of the cancer fatality risks resulting from all other causes. As defined in the Safety Goal Policy Statement (51 FR 30028), "near" is within 10 miles of the plant. The cancer fatality risk was taken as 188.7 deaths per 100,000 people per year, based upon national Center for Health Statistics data for 2005 (Reference 7.2-11).

One-tenth of 1 percent of this risk results in a value of 18.7E-05 for cancer fatalities. As shown in Table 7.2-7 (Sheet 2), the risk for latent fatalities is in 2006 was 1.93E-06 (2.06E-06 for 2005 in Table 7.2-7 (Sheet 1)), which is bounded by cancer fatality criteria. Therefore, the latent fatality risk from a severe accident at the RBS site is considered acceptable.

7.2.4.3 Radiation Dose Goal

The probability of an individual exceeding a whole-body dose of 25 rem at a distance of 0.5 mi. from the reactor shall be less than one in a million per reactor year.

From a dose perspective, Table 7.2-7 illustrates that the total population dose-risk to the 50-mi. radius of the plant from airborne releases from an ESBWR reactor at the RBS site would be 0.024 person-rem per reactor year for 2005 (0.022 person-rem per reactor year for 2006). This value is less than the population risk for all current reactors that have undergone license renewal, and is less than the population risk for the five reactors analyzed in NUREG-1150 (Reference 7.2-5).

The ESBWR PRA (Reference 7.2-2) also demonstrates that the probability of exceeding 25 rem at a distance of 1/2 mi. from the reactor would be less than 2.03E-09 per reactor year, which meets the NRC Safety Goal.

7.2.5 REFERENCES

7.2-1 U.S. Nuclear Regulatory Commission, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437, Vol. 1, Washington, D.C., May 1996.

7.2-2 General Electric-Hitachi, *ESBWR Probabilistic Risk Assessment*, Licensing Topical Report, NEDO-33201, Revision 2, NRC Accession No. ML072410543, August 17, 2007.

7.2-3 U.S. Nuclear Regulatory Commission, *Code Manual for MACCS2*, NUREG/CR-6613, May 1998.

7.2-4 System Energy Resources, Inc., "Response to Request for Additional Environmental Information Related to Early Site Permit Application" (Partial Response No. 4), CNRO-2004-00050, NRC Accession No. ML042290395, August 10, 2004.

7.2-5 U.S. Nuclear Regulatory Commission, *Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants*, NUREG-1150, Vol. 1, October 1990.

7.2-6 U.S. Department of Labor Statistics, *CPI Detailed Report*, February 2008.

7.2-7 Dominion Nuclear North Anna, LLC, "Response to Request for Additional Information Regarding Environmental Portion of ESP Application," Serial No. 04-170, NRC Accession No. ML041450041, May 17, 2004.

7.2-8 U.S. Nuclear Regulatory Commission, *Regulatory Analysis Technical Evaluation Handbook*, NUREG/BR-0184, January 1997.

7.2-9 U.S. Nuclear Regulatory Commission, "Policy Statement on Severe Reactor Accidents Regarding Future Designs and Existing Plants," August 8, 1985.

7.2-10 U.S. Nuclear Regulatory Commission, "Safety Evaluation Report (SER) with Open Items (OIs) for Chapter 19 'Probabilistic Risk Assessment and Severe Accident Evaluation' Regarding the Economic Simplified Boiling Water Reactor (ESBWR) Design Certification Review," Adams Accession Numbers ML080850462 and ML080850468, May 16, 2008.

7.2-11 Centers for Disease Control and Prevention, "Deaths: Final Data for 2005," *National Vital Statistics Reports*, Volume 56, Number 10, April 24, 2008, Website, http://www.cdc.gov/nchs/fastats/deaths.htm, accessed May 27, 2008.

Table 7.2-1
Estimated Exposure Indices for RBS Unit 3

	2000	2017	2027	2037	2047	2057	2067
Population within 50 mi.	884,548	1,054,304	1,180,462	1,332,337	1,516,742	1,742,498	2,142,260
Multiplier	1.00	1.19	1.33	1.51	1.71	1.97	2.42
10-mi. EI	1438	1714	1919	2166	2466	2833	3483
150-mi. EI	334,565[a]	398,772	446,489	503,933	573,681	659,070	810,273

a) Source: Reference 7.2-1, Table 5.5.

Table 7.2-2
State Economic Statistics Provided by MACCS2 Code

Region No.	State	Fraction Farm	Fraction Dairy	Farm Sales ($/hectare)	Property Value ($/hectare)	Non-Farm Property Values ($/person)
16	LA	0.354	0.074	459	3284	61,000
22	MS	0.470	0.054	403	2084	53,000

Table 7.2-3
State Economic Statistics Corrected for Inflation

Region No.	State	Fraction Farm	Fraction Dairy	Farm Sales ($/hectare)	Property Value ($/hectare)	Non-Farm Property Values ($/person)
16	LA	0.354	0.074	795	5691	105,713
22	MS	0.470	0.054	698	3612	91,849

Table 7.2-4
District Farm Statistics and Weighted Composites

	LA-1	LA-3	LA-5	LA-6	LA-7	MS-3	Composite
Pasture	0.435	0.233	0.204	0.426	0.230	0.860	0.421
Stored Forage	0.227	0.033	0.031	0.074	0.049	0.074	0.062
Grains	0.023	0.059	0.226	0.057	0.197	0.012	0.100
Green Leafy	0.003	0.000	0.000	0.000	0.001	0.000	0.000
Other	0.002	0.402	0.052	0.131	0.070	0.001	0.102
Legumes/ Seeds	0.000	0.038	0.223	0.115	0.249	0.014	0.130
Roots/Tubers	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 7.2-5
Source Term Release Fractions

Release Category	Xe/Kr	I	Cs	Te	Sr	Ru	La	Ce	Ba
BOC1	9.8E-01	7.0E-01	3.7E-01	5.0E-01	1.3E-02	1.7E-01	2.5E-04	1.2E-03	3.1E-02
BOC2	2.6E-01	1.3E-01	3.6E-02	1.2E-01	4.5E-04	1.6E-02	3.1E-05	1.4E-04	2.0E-03
BYP3	9.7E-01	3.0E-01	1.2E-01	3.1E-01	4.6E-03	6.2E-02	1.8E-04	8.5E-04	1.3E-02
BYP4	6.8E-01	3.5E-02	2.5E-02	7.5E-02	4.1E-02	2.3E-02	4.1E-02	4.1E-02	4.0E-02
CCID5	9.1E-01	6.2E-02	1.4E-01	7.6E-02	1.1E-07	3.2E-07	6.9E-09	1.3E-08	4.0E-06
CCID6	9.6E-01	3.5E-01	6.2E-02	1.4E-01	8.1E-07	4.0E-07	3.6E-07	4.7E-07	1.1E-05
CCIW7	8.9E-01	1.6E-05	2.8E-05	3.5E-02	3.3E-08	2.1E-07	2.2E-09	1.2E-08	1.3E-07
CCIW8	8.3E-01	1.1E-02	2.8E-02	1.1E-02	2.7E-06	2.2E-06	2.6E-06	2.6E-06	2.8E-06
EVE9	8.3E-01	1.5E-01	2.3E-01	2.8E-01	1.7E-03	6.5E-05	4.9E-05	6.6E-04	7.5E-04
FR10	1.0E+00	6.1E-03	4.0E-03	1.6E-01	7.1E-09	3.3E-08	5.1E-10	2.2E-09	3.5E-08
OPVB11	9.6E-01	4.1E-03	1.1E-02	6.1E-02	7.5E-06	1.6E-06	1.8E-06	1.9E-06	4.9E-06
OPVB12	1.0E+00	1.5E-02	6.8E-03	3.3E-01	1.2E-05	2.3E-06	1.2E-06	8.7E-06	6.1E-06
OPW1-13	9.9E-01	3.7E-04	8.9E-03	3.0E-03	5.6E-08	9.3E-08	5.4E-08	5.4E-08	7.1E-08
OPW2-14	9.7E-01	8.5E-05	7.6E-04	5.1E-03	1.1E-08	7.2E-09	1.0E-08	1.0E-08	1.1E-08
TSL15	2.7E-03	1.6E-04	5.9E-05	1.7E-04	2.6E-06	6.2E-05	1.1E-07	3.7E-07	1.3E-05

Table 7.2-6
Plume Characterization Data

Release Category	Alarm (s)	Number of Plume Releases	Risk-Dominant Plume	Ref Tim	Plume Heat (W)	Plume Release Height (m)	Plume Duration (s)	Plume Delay (s)
BOC1	1200	1	1	0.0	0.0E+00	0	26820	2520
BOC2	1200	1	1	0.0	0.0E+00	0	19800	2160
BYP3	1200	1	1	0.0	0.0E+00	0	28800	2520
BYP4	1200	1	1	0.0	0.0E+00	0	27000	4680
CCID5	21100	1	1	0.0	0.0E+00	0	36000	92880
CCID6	21100	1	1	0.0	0.0E+00	0	9360	57600
CCIW7	21100	1	1	0.0	0.0E+00	0	36000	92160
CCIW8	21100	1	1	0.0	0.0E+00	0	36000	66240
EVE9	22400	1	1	0.0	0.0E+00	0	36000	26640
FR10	9800	1	1	0.0	0.0E+00	0	36000	104040
OPVB11	16500	1	1	0.0	0.0E+00	0	36000	49680
OPVB12	16500	1	1	0.0	0.0E+00	0	10800	31320
OPW1-13	16600	1	1	0.0	0.0E+00	0	36000	123120
OPW2-14	17600	1	1	0.0	0.0E+00	0	36000	191160
TSL15	21000	1	1	0.0	0.0E+00	0	27000	1800

Table 7.2-7 (Sheet 1 of 2)
Impacts to the Population and Land from Severe Accidents Analysis

Accident Category	Release Frequency (per reactor year)	Population Dose-Risk (person-rem per reactor year)	Number of Fatalities (per reactor year)		Cost-Risk (dollars per reactor year)	Land Requiring Decontamination (hectares per reactor year)	Population Dose from Water Ingestion (person-rem per reactor year)
			Early	Latent			
RBS 2005 Data Summary							
BOC1	7.35E-11	2.16E-04	1.26E-09	3.79E-07	8.23E-01	6.35E-06	1.93E-05
BOC2	7.35E-11	8.38E-05	2.65E-10	7.94E-08	2.43E-01	4.16E-06	1.78E-06
BYP3	1.46E-12	3.04E-06	9.02E-12	3.74E-09	9.84E-03	1.17E-07	1.25E-07
BYP4	5.45E-11	9.05E-05	3.48E-10	3.46E-07	3.76E-01	3.07E-06	4.21E-06
CCID4	7.17E-13	1.63E-06	0.00E+00	8.82E-10	4.78E-03	5.21E-08	6.59E-08
CCID6	2.83E-13	3.23E-07	0.00E+00	2.32E-10	1.03E-03	1.42E-08	1.15E-08
CCIW7	5.33E-11	2.95E-06	0.00E+00	4.00E-09	3.92E-03	9.06E-07	9.81E-10
CCIW8	4.57E-11	5.71E-05	0.00E+00	2.74E-08	1.24E-01	2.10E-06	8.41E-07
EVE9	6.10E-10	1.63E-03	2.20E-11	1.05E-06	5.31E+00	4.96E-05	9.39E-05
FR10	1.00E-12	5.61E-07	0.00E+00	4.50E-10	6.89E-04	3.61E-08	2.62E-09
OPVB11	3.00E-13	2.63E-07	0.00E+00	1.49E-10	4.32E-04	9.42E-09	2.17E-09
OPVB12	5.70E-12	3.39E-06	0.00E+00	3.33E-09	7.47E-03	2.17E-07	2.56E-08
OPW1-13	1.00E-12	8.29E-07	0.00E+00	3.83E-10	1.06E-03	2.79E-08	5.84E-09
OPW2-14	1.00E-12	1.84E-07	0.00E+00	9.11E-11	9.92E-05	5.39E-09	4.98E-10
TSL15	1.12E-08	3.11E-04	0.00E+00	1.67E-07	1.79E-01	1.51E-05	4.77E-07
Total	**1.21E-08**	**2.40E-03**	**1.90E-09**	**2.06E-06**	**7.08E+00**	**8.18E-05**	**1.21E-04**

Table 7.2-7 (Sheet 2 of 2)
Impacts to the Population and Land from Severe Accidents Analysis

Accident Category	Release Frequency (per reactor year)	Population Dose-Risk (person-rem per reactor year)	Number of Fatalities (per reactor year)		Cost-Risk (dollars per reactor year)	Land Requiring Decontamination (hectares per reactor year)	Population Dose from Water Ingestion (person-rem per reactor year)
			Early	Latent			
RBS 2006 Data Summary							
BOC1	7.35E-11	1.96E-04	1.91E-09	3.71E-07	7.64E-01	5.76E-06	1.82E-05
BOC2	7.35E-11	7.30E-05	2.95E-10	7.79E-08	2.32E-01	3.18E-06	1.68E-06
BYP3	1.46E-12	2.80E-06	1.01E-11	3.59E-09	8.69E-03	9.56E-08	1.18E-07
BYP4	5.45E-11	8.39E-05	3.91E-10	3.38E-07	3.31E-01	2.47E-06	4.07E-06
CCID4	7.17E-13	1.46E-06	0.00E+00	7.96E-10	4.24E-03	4.09E-08	6.19E-08
CCID6	2.83E-13	2.94E-07	0.00E+00	2.12E-10	9.71E-04	1.13E-08	1.08E-08
CCIW7	5.33E-11	2.83E-06	0.00E+00	3.87E-09	3.81E-03	6.88E-07	9.22E-10
CCIW8	4.57E-11	4.94E-05	0.00E+00	2.40E-08	1.16E-01	1.67E-06	7.91E-07
EVE9	6.10E-10	1.48E-03	2.49E-11	9.46E-07	4.81E+00	3.93E-05	8.78E-05
FR10	1.00E-12	5.18E-07	0.00E+00	4.19E-10	7.37E-04	3.03E-08	2.47E-09
OPVB11	3.00E-13	2.35E-07	0.00E+00	1.35E-10	4.26E-04	8.46E-09	2.04E-09
OPVB12	5.70E-12	3.10E-06	0.00E+00	2.99E-09	7.52E-03	1.74E-07	2.41E-08
OPW1-13	1.00E-12	7.08E-07	0.00E+00	3.28E-10	1.19E-03	2.42E-08	5.48E-09
OPW2-14	1.00E-12	1.73E-07	0.00E+00	8.56E-11	9.72E-05	4.79E-09	4.68E-10
TSL15	1.12E-08	2.99E-04	0.00E+00	1.60E-07	1.96E-01	1.30E-05	4.50E-07
Total	**1.21E-08**	**2.19E-03**	**2.63E-09**	**1.93E-06**	**6.48E+00**	**6.64E-05**	**1.13E-04**

Table 7.2-8
Monetization Results Summary for 2005 Meteorological Data

	7% Discount Rate ($)	3% Discount Rate ($)
Off-Site Exposure Cost	34	85
Off-Site Economic Cost	51	126
On-Site Exposure Cost	6	17
On-Site Cleanup Cost	180	403
Replacement Power Cost	455	993
Total	726	1624

Table 7.2-9
Monetization Results Summary for 2006 Meteorological Data

	7% Discount Rate ($)	3% Discount Rate ($)
Off-Site Exposure Cost	31	78
Off-Site Economic Cost	46	115
On-Site Exposure Cost	6	17
On-Site Cleanup Cost	180	403
Replacement Power Cost	455	993
Total	719	1606

7.3 SEVERE ACCIDENT MITIGATION ALTERNATIVES

7.3.1 INTRODUCTION AND BACKGROUND

This subsection updates the GEH Severe Accidents Mitigation Design Alternatives (SAMDA) report provided in NEDO-33306, *ESBWR Severe Accident Mitigation Design Alternatives* (Reference 7.3-1) with RBS Unit 3 site and regional data. The RBS site-specific analysis demonstrates that the severe accident mitigation design alternatives determined not to be cost beneficial by GEH are also not cost beneficial when RBS site-specific data are considered.

The NRC staff has expanded the concept of SAMDAs to encompass design alternatives to prevent severe accidents as well as to mitigate them. By doing so, the staff makes the set of SAMDAs considered under the National Environmental Policy Act (NEPA) the same as the set of SAMDAs considered in satisfaction of the NRC's severe accident requirements and policies.

In performing the probabilistic risk assessment (PRA) for the ESBWR design, GEH identified and evaluated a number of severe accident sequences. Only the sequences with frequencies greater than 1E-9 per reactor year were considered. For each sequence considered, the analysis identified an initiating event and traced the accident's progression to its end. For sequences resulting in core damage, off-site consequences were estimated. The complete radiological consequence analysis of the dominant sequences can be found in the GEH Licensing Topical Report, NEDO-33201, *ESBWR Probabilistic Risk Assessment*, Revision 2 (Reference 7.3-2). Sequences with probabilities of occurrence less than 1E-9 were considered remote and speculative.

As stated in NEDO-33201, the environmental effects of severe accidents for plants of ESBWR design represent a low and acceptable risk to the population and to the environment. For the ESBWR design, all reasonable steps have been taken to reduce the occurrence of a severe accident involving substantial damage to the core and to mitigate the consequences of such an accident should one occur. No further cost-effective modifications to the ESBWR design have been identified that would reduce the risk from a severe accident involving substantial damage to the core. No further evaluation of severe accidents for the ESBWR design is required to demonstrate compliance with the NRC's severe accident requirements of Policy SECY-90-016 (Reference 7.3-3).

The GEH SAMDA analysis, which was based on NEDO-33201 (Reference 7.3-2), determined that severe accident impacts are considered SMALL and all potential mitigating design alternatives that would be cost-effective are already incorporated into the plant design. The analysis in this subsection provides assurance that there are no additional cost-beneficial design alternatives that would need to be implemented at the RBS site to further mitigate the already small, severe accident impacts.

7.3.2 THE SAMA ANALYSIS PROCESS

Design or procedural modifications that could mitigate the consequences of a severe accident are known as severe accident mitigation alternatives (SAMAs). SAMAs are somewhat broader than SAMDAs, which primarily focus on design changes and do not consider procedural modifications. The GEH analysis in Reference 7.3-1 is a SAMA analysis. For an existing plant with a well-defined design and with established procedural controls, the normal evaluation process for identifying and analyzing potential SAMAs includes the following four steps:

1. Define the base case - The base case is the dose-risk and cost-risk of severe accidents before implementation of any SAMAs. The plant-specific probabilistic risk assessment is a primary source of data in calculating the base case. The base case risks are converted to a monetary value to use as screening values for subsequent SAMAs.

2. Identify and screen potential SAMAs - Potential SAMAs can be identified from the individual plant examination, the PRA, and the results of other plants' SAMA analyses. This list of potential SAMAs is assigned a conservatively low implementation cost based on historical costs, similar design changes, and/or engineering judgment and is then compared to the base case screening value. SAMAs with a higher implementation cost than the base case cost are not evaluated further.

3. Determine the cost of each SAMA - A detailed engineering cost evaluation is developed using current plant engineering processes for each SAMA remaining after Step 2. If the SAMA cost is lower than the screening value, Step 4 is performed.

4. Determine the benefit associated with each screened SAMA - Each SAMA that passes the screening in Step 3 is evaluated using the PRA model to determine the reduction in risk associated with implementation of the proposed SAMA. The reduction in risk benefit is then monetized and compared to the detailed cost estimate. Those SAMAs with reasonable cost-benefit ratios are considered for implementation.

In the absence of a completed plant with established procedural controls, the current analysis is limited to demonstrating that the RBS site parameters are bounded by the GEH SAMDA analysis and determining what magnitude of plant-specific design or procedural modification would be cost-effective. The base case benefit value (Step 1) was calculated by assuming that the current dose-risk of the unit could be reduced to zero and assigning a defined dollar value for this change in risk. Any design or procedural change cost that exceeds the benefit value would not be considered cost-effective.

The dose-risk and cost-risk results are monetized in accordance with the methods established in NUREG/BR-0184, *Regulatory Analysis Technical Evaluation Handbook*, 1997 (Reference 7.3-4). Reference 7.3-4 presents methods for determining the value of decreases in risk, using the following attributes: public health, occupational health, off-site property, replacement power costs, and on-site property. Any SAMAs in which the conservatively low implementation cost exceeds the base case monetization would not be expected to pass the screening in Step 2. If the baseline analysis produces a value that is below that expected for implementation of any reasonable SAMA (no matter how inexpensive to implement), then the remaining steps of the SAMA analysis are not necessary.

7.3.3 THE ESBWR SAMDA ANALYSIS

Reference 7.3-1 provide a list of severe accident mitigation design candidates that were compiled from a list of SAMDA issues from GEH Report 25A5680, *Technical Support Document for the ABWR*, Revision 1 (Reference 7.3-5), and from a generic list compiled for license renewal environmental reports (Reference 7.3-6). This list was screened to eliminate activities that do not apply to the ESBWR design or have no significant benefit. The following screening criteria were applied:

- Not applicable - An issue that only pertains to another class of reactors, even on a functional level.
- Already incorporated into the ESBWR design - Cases where the risk-beneficial design features have already been applied to the ESBWR.
- Not a design alternative - The proposed activity does not involve a design change; it is for procedural or administrative changes only.
- Excessive implementation cost - If a SAMDA requires extensive changes that obviously would exceed the maximum averted risk benefit, it is not retained.
- Very low benefit - If the change in reliability is known to have a negligible effect on risk, it is not retained.
- Candidate for cost-benefit consideration - If a SAMDA was not eliminated by application of the previous criteria, it would then become a candidate for cost-benefit analysis.

The initial list of 177 items identified in Reference 7.3-1 was analyzed by GEH to determine if there were cost-beneficial design alternatives that should be considered for the ESBWR. The screening analysis identified 42 alternatives that are not applicable, primarily due to issues involving either loss of reactor coolant pump seals, which is an issue with current PWRs, or boiling water reactor-specific issues (e.g., reactor core isolation cooling pump operations). There were 65 design alternatives that are similar to, or are already incorporated into, the ESBWR design. A summary of these types of design features is provided in Reference 7.3-1. Twenty-nine items are identified in Reference 7.3-1 that are procedural or administrative and, therefore, are not design features. Twenty-six of the issues were not feasible because their cost would clearly outweigh any risk-benefit consideration. The final 15 issues were considered to have very low benefit due to their insignificant contribution to reducing risk. As a result, no further SAMDA design modifications were considered. Several design enhancements relative to severe accident mitigation have already been incorporated into the ESBWR design. Potential design enhancements from generic boiling water reactor SAMDA analyses and from the ABWR have been evaluated on a risk-benefit basis. The economic impacts of radiological consequences, when combined with the probability of a severe accident, yield an overall risk that is significantly lower than current operating reactors. Therefore, no additional design modifications yield a positive cost-benefit.

7.3.4 COST-BENEFIT EVALUATION

7.3.4.1 Cost-Benefit Standard for Evaluation of ESBWR SAMDAs

The cost-benefit ratio of $2000 per person-rem averted is viewed by the NRC and the nuclear industry as an acceptable standard for the purposes of evaluating SAMDAs. This standard was used by GEH as a surrogate for all off-site costs in the cost-benefit evaluation of SAMDAs for ESBWR design plants. To accurately reflect the costs associated with prevention of severe accidents, averted on-site costs were incorporated for SAMDAs that were at least partially preventive in nature. On-site costs resulting from a severe accident include replacement power, on-site cleanup costs, and economic loss of the facility. A plant lifetime of 60 years was assumed to maximize the reduction in residual risk.

7.3.4.2 Cost Estimates of Potential Modifications to the ESBWR Design

All previous evaluations of design alternatives (e.g., the Limerick and Comanche Peak Final Environmental Statement [FES] Supplements, the Peach Bottom license renewal, and the ABWR SAMDA) (Reference 7.3-5) and NUREG-1437 have reported design alternative costs which, at a minimum, are in the hundreds of thousands of dollars. The high cost of design alternatives that have the potential to provide risk reduction is also demonstrated in several state-of-the-art surveys (e.g., NUREG/CR-9308, NUREG/CR-4025, and NUREG/CR-4920). In fact, most proposed design alternatives cost in the millions of dollars to implement.

The analysis in Reference 7.3-1 uses a best estimate maximum averted implementation cost of $4628 (which is below the cost of all design alternatives that would be expected to provide a non-negligible reduction in risk) to determine if additional analysis needs to be performed for plants of ESBWR design. The upper bounded total maximum averted cost provided in Reference 7.3-1 is $41,383. The NEDO maximum averted cost assumes a discount rate of 7 percent.

ESBWR design alternatives that provide only severe accident mitigation must cost less than $4628, which is the minimum cost for a design alternative that has the potential for a measurable reduction in severe accident risk. This low cost limitation is a result of the ESBWR providing adequate protection to the public and the environment. A more detailed analysis of specific design alternatives is not warranted because none of the identified alternatives has an estimated cost lower than $4628. Therefore, ESBWR plants do not require additional SAMDA evaluations.

7.3.5 MONETIZATION OF THE RBS BASE CASE

A site-specific analysis to determine the probability weighted consequences of severe accidents for an ESBWR at the RBS site was performed using the source term for the ESBWR reactor and site-specific data. The probability weighted consequences of severe accidents for an ESBWR are bounded by those for the ABWR evaluated and reported in NUREG-1817.

The principal inputs to the site-specific monetization calculations are the release frequency, dose-risk and dollar-risk, dollars per person-rem ($2000 as provided by the NRC in NUREG/BR-0184), licensing period, and economic discount rate (7 percent and 3 percent are NRC precedents). With these inputs, the monetized value of reducing the base case core damage frequency to zero is presented in Table 7.3-1. The monetized value, known as the maximum averted cost-risk, is conservative because no SAMDA can reduce the core damage frequency to zero. The maximum averted cost-risk of $726 for a single ESBWR at the RBS site is so low that there are no design changes, besides those already incorporated into the ESBWR design, that could be determined to be cost-effective. Even with a conservative 3 percent discount rate, the valuation of the averted risk is only $1624.

These values were compared to the GEH generic analysis results of $4628 for the 7 percent discount rate. The plant-specific analysis used actual population and meteorological characteristics that resulted in lower impacts than did the conservative values used in GEH's generic SAMDA analysis. Accordingly, further evaluation of design-related SAMAs is not warranted for RBS Unit 3.

7.3.6 SUMMARY AND CONCLUSIONS

Further evaluation of design-related SAMAs for RBS Unit 3 is not warranted. Because of the costs associated with processing procedural and administrative changes (including training costs), administrative changes are likely to cost more than the maximum averted cost-risk. Furthermore, since procedural and administrative changes would likely have a small impact on risk, the reduction in risk benefit from such changes would likely be substantially less than the cost of the administrative changes. Evaluation of procedural and administrative controls would not be appropriate until a plant design is finalized and plant administrative processes and procedures are being developed. At that time, appropriate administrative controls on plant operations would be incorporated into the plant's management systems as part of its baseline.

7.3.7 REFERENCES

7.3-1 General Electric-Hitachi, *ESBWR Severe Accident Mitigation Design Alternatives*, Licensing Topical Report, NEDO-33306, NRC Accession No. ML072390051, Revision 1, August 14, 2007.

7.3-2 General Electric-Hitachi, *ESBWR Probabilistic Risk Assessment*, Licensing Topical Report, NEDO-33201, Revision 2, NRC Accession No. ML072410543, August 17, 2007.

7.3-3 U.S. Nuclear Regulatory Commission, *Evolutionary Light Water Reactor (LWR) Certification Issues and Their Relationship to Current Regulatory Requirements*, SECY-90-016, January 12, 1990.

7.3-4 U.S. Nuclear Regulatory Commission, *Regulatory Analysis Technical Evaluation Handbook*, NUREG/BR-0184, January 1997.

7.3-5 General Electric, *Technical Support Document for the ABWR*, Nuclear Technology 25A5680, Revision 1, January 1995.

7.3-6 License Renewal Application "Peach Bottom Atomic Power Station, Units 2 and 3," Docket Nos. 50-277 and 50-278, July 2001.

Table 7.3-1
Maximum Averted Risk Benefit

		RBS Site	
	Generic ESBWR Best Estimate 7% Discount Rate[(a)]	Best Estimate 7% Discount Rate	Best Estimate 3% Discount Rate
Averted Public Exposure Cost	$366	$34	$85
Averted Off-Site Property Damage Cost	$157	$51	$126
Averted Occupational Exposure Cost	$38	$6	$17
Averted On-Site Cost	$1167	$180	$403
Replacement Power Cost	$2900	$455	$993
Total (Maximum Averted Cost Benefit)	$4628	$726	$1624

a) Source: Reference 7.3-1.

7.4 TRANSPORTATION ACCIDENTS

This section addresses the environmental impact of transportation accidents involving radioactive materials. A discussion of the means of transporting radioactive materials is included in Section 3.8.

NUREG-1817, *Environmental Impact Statement for an Early Site Permit (ESP) at Grand Gulf ESP Site,* Appendix H.2, presents an analysis of transportation and transportation accidents addressing several different proposed sites. The analysis presented discusses the RBS site as being bounded by the analysis performed for the Grand Gulf ESP site because of the proximity of the sites (approximately 90 mi. apart). This section uses the NUREG-1817 analysis as a basis and presents information to support the conclusions drawn for the RBS site.

7.4.1 TRANSPORTATION OF UNIRRADIATED FUEL

Accidents involving unirradiated fuel shipments are addressed in Table S-4 of 10 CFR 51.52, which summarizes the environmental impacts of transporting fuel and radioactive wastes to and from a reference reactor.

Accident risks are a combination of accident frequency and consequence. Because of improvements in highway safety, security and an expected decrease in traffic accident, injury, and fatality rates 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 (Reference 7.4-1), which forms the basis for Table S–4 of 10 CFR 51.52. 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, as described in NUREG-1817, the impacts of accidents during transport of unirradiated fuel for advanced LWRs to the RBS site are expected to be smaller than the impacts listed in Table S–4 for current generation LWRs.

7.4.2 TRANSPORTATION OF IRRADIATED FUEL

For the analysis documented in NUREG-1817, Appendix H.2, the RADTRAN 5 computer code was used 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 (i.e., "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).

The analysis in NUREG-1817, Appendix H.2, obtained the radionuclide inventories of the advanced LWR spent fuel after 5 years of decay from the Idaho National Engineering and Environmental Laboratory (INEEL) (Reference 7.4-2) and performed a screening analysis to select the dominant contributors to accident risks in order to simplify the RADTRAN 5 calculations. This 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 NRC found that the dominant radionuclides are similar regardless of the fuel type.

The spent fuel radionuclide inventory used in the NRC analysis for the ESBWR is presented in Table 7.4-1.

Massive shipping casks are used to transport spent fuel because of the radiation shielding and accident resistance required by 10 CFR 71. Spent fuel shipping casks must be certified Type B packaging systems; that is, they must withstand a series of severe hypothetical accident conditions with essentially no loss of containment or shielding capability. According to NUREG/CR-6672, the probability 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 NRC analysis assumed that shipping casks for advanced LWR spent fuels would provide equivalent mechanical and thermal protection of the spent fuel cargo.

The RADTRAN 5 accident risk calculations documented in NUREG-1817, Appendix H.2, used unit radionuclide inventories (curies/metric ton uranium [Ci/MTU]) for the spent fuel shipments for the advanced LWRs. The resulting risk estimates were multiplied by the expected annual spent fuel shipments (MTU/yr) to derive estimates of the annual risks associated with spent fuel shipments from each potential advanced LWR. The amounts of spent fuel shipped per year were assumed to be equivalent to the annual discharge quantities: 32.76 MTU/yr for the ESBWR (Reference 7.4-2). The value normalized to the reference LWR net electrical generation is 20.3 MTU/reference reactor year (NUREG-1817, Table H-14).

The NUREG-1817 analysis used the release fractions for current generation LWR fuels to approximate the impacts from the advanced LWR 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.

NUREG-1817, Subsection 6.2.2.2, states that "… 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."

According to NUREG/CR-6672, a bounding value for crud surface activity for boiling water reactor (BWR) fuel rods is 595 x 10^{-6} Ci/cm^2 (2.20 x 10^7 Bq/cm^2). This value is based on measurements taken from operating BWRs. Because ESBWR operational parameters are similar to operating BWRs, this bounding value is appropriate for the ESBWR. Furthermore, based on previous operational experience, the ESBWR design incorporates provisions to minimize crud buildup, which further justifies use of this bounding value.

The crud surface activity used for the analysis in NUREG-1817 was 1.01 x 10^{14} Bq/MTU. Using the ESBWR bounding fuel rod dimensions, uranium loading, and the 595 x 10^{-6} Ci/cm^2 bounding crud surface activity from NUREG/CR-6672, the ESBWR crud surface activity was calculated to be 1.48 x 10^{13} Bq/MTU, more than a factor of six less than that used in NUREG-1817. Therefore, the impacts of crud and activation products on spent fuel transportation accidents are enveloped by the analysis in NUREG-1817 and can be considered as SMALL.

Route-specific accident rates (accidents per km) were derived for the RADTRAN 5 accident risk analysis presented in NUREG-1817. 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 (Reference 7.4-3) 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 were used. This approach allowed computation of route-specific accident rates.

The estimated distances for the Grand Gulf ESP site, which were used in the RADTRAN analysis in NUREG-1817, are presented in Table 7.4-2. These distances are bounding for the RBS site (NUREG-1817, Table H-6, Note [a]).

The 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. in NUREG/CR-6672 (Reference 7.4-4) were adopted.

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 enter either Pasquill atmospheric-stability category data or averaged time-integrated concentrations. In the NUREG-1817, Section H.2, analysis, the default standard cloud option (using time-integrated concentrations) was used.

Using RADTRAN 5, the NUREG-1817 analysis calculated the population dose from the released radioactive material for five possible exposure pathways:

1. External dose from exposure to the passing cloud of radioactive material.

2. External dose from the radionuclides deposited on the ground by the passing plume (the NRC 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.

4. Internal dose from resuspension of radioactive materials that were deposited on the ground (the NRC 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).

5. Internal dose from ingestion of contaminated food (the NRC analysis assumed interdiction of foodstuffs and evacuation after an accident so no internal dose due to ingestion of contaminated foods was calculated).

A sixth pathway, external doses from increased radiation fields surrounding a shipping cask with damaged shielding, was considered but not included in the analysis. It is possible that shielding materials incorporated into the cask structures could become damaged as a result of an accident. However, the NRC did not include loss of shielding events in its analysis because their contribution to spent fuel transportation risk is much smaller than the dispersal accident risks from the pathways listed above.

The NUREG-1817 analysis calculated the environmental consequences of transportation accidents when shipping spent fuel from other potential new reactor sites to a spent fuel repository assumed to be at Yucca Mountain, Nevada. The consequences for transportation accidents from the Grand Gulf ESP site were determined to be bounding of transportation from the RBS site because of the proximity of the sites.

Table 7.4-3 presents unit (per MTU) accident risks associated with the transportation of spent fuel from the RBS site to the proposed Yucca Mountain repository. The accident risks are provided in the form of a collective population dose (i.e., person-rem over the shipping campaign). The table also presents estimates of accident risk per reactor year normalized to the reference reactor analyzed in WASH-1238.

7.4.3 TRANSPORTATION OF RADIOACTIVE WASTE

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 a 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.

Radwaste shipped from the RBS Unit 3 site will be solidified, packaged, and transported by truck.

Additionally, existing NRC (10 CFR 71) and DOT (49 CFR 171, 172, 173, and 178) packaging and transportation regulations specify requirements for the shipment of radioactive material. RBS Unit 3 is also subject to these regulations.

Table 3.8-3 provides an estimate of the number of truck shipments of unirradiated fuel for the ESBWR design compared to those of the reference 1100 MWe reactor specified in WASH-1238 (Reference 7.4-1). Estimates are normalized for an equivalent 1100 MWe electric generating capacity. The bases for the shipment estimates can be found in Appendix H of NUREG-1817.

Table 3.8-7 presents estimates of annual waste volumes and annual waste shipment numbers for the ESBWR normalized to the reference 1100 MWe LWR defined in WASH-1238 (Reference 7.4-1). The annual water volumes and waste shipments for the ESBWR were less than those of the 1100 MWe reference reactor that was the basis for Table S-4.

The sum of the daily shipments of unirradiated fuel, spent fuel, and radioactive waste is well below the one-truck-shipment-per-day condition presented in 10 CFR 51.52, Table S-4 for the ESBWR. Doubling the shipping estimates to account for empty return shipments of fuel and waste is still below the one-truck-shipment-per-day condition.

7.4.4 CONCLUSION

Considering the uncertainties in the data and computational methods, NUREG-1817, Appendix H.2, concluded that the overall transportation accident risks associated with advanced LWR spent fuel shipments are likely to be SMALL and are consistent with the risks associated with the transportation of spent fuel from current generation reactors, as presented in Table S-4 of 10 CFR 51.52. The same conclusion is true of the the transportation accident risks associated with the spent fuel from the proposed new reactor at the RBS site.

7.4.5 REFERENCES

7.4-1 U.S. Atomic Energy Commission, *Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants,* WASH-1238, Washington, D.C., December 1972.

7.4-2 Idaho National Engineering and Environmental Laboratory, *Early Site Permit Environmental Report Sections and Supporting Documentation,* Engineering Design File Number 3747, Idaho Falls, Idaho, 2003.

7.4-3 Saricks, C. L., and M. M. Tompkins, *State-Level Accident Rates of Surface Freight Transportation: A Reexamination,* ANL/ESD/TM-150, Argonne National Laboratory, Argonne, Illinois, 1999.

7.4-4 U.S. Nuclear Regulatory Commission, *Reexamination of Spent Fuel Shipment Risk Estimates,* NUREG/CR-6672, Washington, D.C., 2000.

Table 7.4-1
Radionuclide Inventory Used in
Transportation Accident Risk Calculations for the ESBWR

Radionuclide	ESBWR Inventory Ci/MTU[a]
Am-241	1340
Am-242m	33.5
Am-243	32.4
Ce-144	1.14E+4
Cm-242	55.1
Cm-243	37.0
Cm-244	4860
Cm-245	0.66
Co-60	2730
Cs-134	4.81E+4
Cs-137	1.24E+5
Eu-154	1.03E+4
Eu-155	5220
I-129	0.4
Kr-85	8890
Pm-147	3.38E+4
Pu-238	6135
Pu-239	386
Pu-240	616
Pu-241	1.22E+5
Pu-242	2.2
Ru-106	1.64E+4
Sb-125	5380
Sr-90	8.84E+4
Y-90	8.84E+4

a) Ci/MTU = curies per metric ton uranium.

Source: NUREG-1817, Table H-11.

Table 7.4-2
Transportation Route Information for Shipments from GGNS/RBS Sites to the Proposed High-Level Waste Repository at Yucca Mountain

One-Way Shipping Distance, km				Population Density, persons/km^2			Stop Time per Trip, hr.
Total	Rural	Suburban	Urban	Rural	Suburban	Urban	
3718.3	3030.4	581.3	106.6	9.2	339.4	2429.4	4

Source: NUREG-1817, Table H-6.

Table 7.4-3
Spent Fuel Transportation Accident Risk for the ESBWR

MTU/Reference Reactor Year	Person-rem per Reference Reactor Year[(a)]
20.3	4.1 E-04

a) Value presented is the product of probability times collective dose.

Source: NUREG-1817, Table H-14.

CHAPTER 8 NEED FOR POWER

This ER chapter describes the methods utilized to assess the need for power for the proposed project. The evaluation of need for power is described in the following sections:

- Description of Power System (Section 8.1)
- Power Demand (Section 8.2)
- Power Supply (Section 8.3)
- Assessment of Need for Power (Section 8.4)

8.1 DESCRIPTION OF POWER SYSTEM

The proposed location of the new facility is near St. Francisville, Louisiana, on the River Bend Station (RBS) site. RBS is operated by Entergy Operations, Inc. and is interconnected to load by the Entergy Gulf States Louisiana, L.L.C. (EGSL) transmission system. EGSL is a member of the Entergy Electric System (EES). Other members of the EES are Entergy Texas, Inc. (ETI), Entergy Arkansas, Inc. (EAI), Entergy Louisiana, LLC (ELL), Entergy New Orleans, Inc. (ENO), and Entergy Mississippi, Inc. (EMI) (collectively the "Entergy Operating Companies"). EGSL and ETI were formerly combined under one entity, Entergy Gulf States, Inc. (EGSI), and jurisdictionally separated and formed the current two companies on December 31, 2007. The tables and figures in this chapter have not yet been updated to reflect EGSL and ETI; the tables and figures reflect EGSI. However, as the need for power is developed based on the EES, the information is applicable.

The EES is located within the Southeastern Electric Reliability Corporation (SERC). The SERC is the regional entity responsible for promoting, coordinating and ensuring the reliability and adequacy of the bulk power supply systems in the area served by the member systems. SERC promotes the development of reliability and adequacy arrangements among the systems, participates in the establishment of reliability standards, administers a regional compliance and enforcement program, and provides a mechanism to resolve disputes on reliability issues (Reference 8.1-1). Figure 8.1-1 is a map indicating the boundaries of the SERC region within the North American Electric Reliability Council. The SERC region is divided into five subregions: Entergy, Gateway, Southern, TVA, and Virginia-Carolinas Reliability Agreement (VACAR).

8.1.1 SERVICE AREA OVERVIEW

The Entergy Operating Companies are operated on an integrated, coordinated basis as a single electric system under the provisions of the System Agreement. The current version of the System Agreement was approved by the Federal Energy Regulatory Commission (FERC) in 1985 and has been amended from time to time since then. Unless otherwise noted, historical load data and projections of future electric load requirements provided in this Chapter are for the EES.

EAI has provided notice to terminate its participation in the System Agreement effective 96 months from December 19, 2005 or such earlier date as authorized by the FERC. EMI has provided notice to terminate its participation in the System Agreement effective 96 months from November 8, 2007 or such earlier date as authorized by the FERC. EAI and EMI will remain as Entergy Operating Companies. Power production and consumption by EAI and EMI will remain along the trends as forecast later in this chapter. EAI and EMI terminating their participation in the System Agreement may affect how they interact with the other EES members with respect to purchases, sales and rates. Successor arrangements are currently being considered by the Entergy Operating Companies. However, whether EAI and EMI continue to participate in successor arrangements with the other Operating Companies should not have a significant effect on total regional power supply and demand.

Figure 8.1-2 is a regional map of the EES, which shows the relevant service area of the system, including major transmission connections to neighboring utility systems. The relevant service area is defined as the service areas of all Entergy Operating Companies within the EES as shown by highlighted regions. Figure 8.1-3 highlights the service areas within the EES further.

The region served by EGSL includes southwest Louisiana, which includes Baton Rouge, Louisiana and Lake Charles, Louisiana. The region served by ETI is southeastern Texas.

The EES is interconnected with the Southwestern Power Administration, Associated Electric Cooperatives, Inc., Missouri Utilities, AmerenUE, Tennessee Valley Authority, Mississippi Power Company, Central Louisiana Electric Company, Southwestern Electric Power Company, Oklahoma Gas and Electric Company, Empire District Electric Company, and Arkansas Electric Cooperative Corporation. To the east, EES interconnects with Tennessee Valley Authority at West Memphis, Arkansas, and West Point, Mississippi. It interconnects to the west with Oklahoma Gas and Electric at Fort Smith, Arkansas. Other system connections exist at 345 kV, 230 kV, 161 kV, and 115 kV voltages (Reference 8.1-2).

Tables 8.1-1 through 8.1-5 provide annual sales for each Operating Company for the period 1994 through 2006 as reported in Entergy's general ledger. The tables list sales by customer class in both MWh and by percentage of total sales. In the tables, the data for "Wholesale sales" include sales to both Associated companies (Entergy Affiliates) and Non-Associated companies. Data for "Interdepartmental sales" represent electrical energy used by the Operating Companies' gas business units. Data for "Lighting" represents sales of electrical energy used in lighting applications, such as street or highway illumination.

Based on data presented in Tables 8.1-1 through 8.1-5, 2006 sales for the EES (combining 2006 data for each operating company) totaled slightly in excess of 120 million MWh. EGSI, serving portions of Texas and Louisiana (illustrated in Figure 8.1-3), accounted for the largest fraction of those sales (i.e., approximately 33 percent). EGSI has now split into two entities, EGSL and ETI. EAI, EMI, and ELL each serve portions of their respective states, as shown in Figure 8.1-3. EAI and ELL made up about 25 percent each of total EES 2006 sales. EMI's portion was approximately 12 percent. ENO, serving the city of New Orleans, except Algiers, accounted for less than 5 percent in 2006.

8.1.2 REFERENCES

8.1-1 SERC Reliability Corporation. 2006 About the Region. Website available at: http://www.serc1.org/Application/ContentPageView.aspx?ContentId=24, accessed 7/23/07.

8.1-2 River Bend Unit 1 Updated Safety Analysis Report, dated July 2006, Chapter 8.0, Electric Power.

Table 8.1-1
EAI Annual Sales by Customer Class (MWh and Percentage of Energy Sold to Each Class)

Year	Residential	Commercial	Industrial	Lighting	Governmental	Wholesale	Interdepartmental
1994	5,521,794	4,147,156	5,940,649	64,549	166,994	15,501,824	
	17.6%	13.2%	19.0%	0.2%	0.5%	49.5%	0.0%
1995	5,867,479	4,267,287	6,314,098	65,711	177,178	13,451,621	
	19.5%	14.2%	20.9%	0.2%	0.6%	44.6%	0.0%
1996	6,022,826	4,390,358	6,487,151	67,288	166,858	17,190,436	
	17.5%	12.8%	18.9%	0.2%	0.5%	50.1%	0.0%
1997	5,988,297	4,445,068	6,646,562	69,764	169,312	16,384,550	
	17.8%	13.2%	19.7%	0.2%	0.5%	48.6%	0.0%
1998	6,613,558	4,773,306	6,836,749	72,214	160,590	12,447,623	
	21.4%	15.4%	22.1%	0.2%	0.5%	40.3%	0.0%
1999	6,492,924	4,880,194	7,053,935	74,050	162,568	12,460,205	
	20.9%	15.7%	22.7%	0.2%	0.5%	40.0%	0.0%
2000	6,791,425	5,063,402	7,239,730	75,758	163,006	12,049,849	
	21.6%	16.1%	23.1%	0.2%	0.5%	38.4%	0.0%
2001	6,912,359	5,160,404	7,165,757	76,634	168,701	12,125,819	
	21.9%	16.3%	22.7%	0.2%	0.5%	38.4%	0.0%
2002	7,049,464	5,221,181	7,074,252	75,873	179,319	11,880,474	
	22.4%	16.6%	22.5%	0.2%	0.6%	37.7%	0.0%
2003	7,057,090	5,328,042	6,998,773	74,684	191,246	12,435,011	
	22.0%	16.6%	21.8%	0.2%	0.6%	38.8%	0.0%
2004	7,027,994	5,427,761	7,004,259	74,821	199,680	12,348,692	
	21.9%	16.9%	21.8%	0.2%	0.6%	38.5%	0.0%
2005	7,653,320	5,730,359	7,333,653	75,406	212,317	8,657,656	
	25.8%	19.3%	24.7%	0.3%	0.7%	29.2%	0.0%
2006	7,655,291	5,816,121	7,587,187	75,565	197,686	10,607,974	
	24.0%	18.2%	23.8%	0.2%	0.6%	33.2%	0.0%

Table 8.1-2
EGSI Annual Sales by Customer Class (MWh and Percentage of Energy Sold to Each Class)

Year	Residential	Commercial	Industrial	Lighting	Governmental	Wholesale	Interdepartmental
1994	7,351,363	6,088,734	15,026,405	84,034	213,730	3,511,557	231,812
	22.6%	18.7%	46.2%	0.3%	0.7%	10.8%	0.7%
1995	7,698,897	6,218,555	15,393,276	84,553	226,255	5,147,221	102,774
	22.1%	17.8%	44.1%	0.2%	0.6%	14.8%	0.3%
1996	8,035,034	6,417,338	16,660,548	85,694	352,696	2,803,276	44,552
	23.4%	18.7%	48.4%	0.2%	1.0%	8.1%	0.1%
1997	8,177,716	6,574,900	18,038,484	86,823	394,233	1,916,710	
	23.2%	18.7%	51.3%	0.2%	1.1%	5.4%	0.0%
1998	8,903,380	6,975,328	18,157,721	87,208	473,087	4,080,726	
	23.0%	18.0%	46.9%	0.2%	1.2%	10.6%	0.0%
1999	8,928,647	7,310,108	17,684,464	88,334	336,360	4,085,288	
	23.2%	19.0%	46.0%	0.2%	0.9%	10.6%	0.0%
2000	9,405,201	7,660,226	17,959,908	90,932	358,796	4,629,158	
	23.5%	19.1%	44.8%	0.2%	0.9%	11.5%	0.0%
2001	9,059,246	7,667,790	16,658,012	91,496	360,080	4,392,549	
	23.7%	20.1%	43.6%	0.2%	0.9%	11.5%	0.0%
2002	9,501,615	7,893,573	15,887,250	91,852	385,634	5,099,021	
	24.5%	20.3%	40.9%	0.2%	1.0%	13.1%	0.0%
2003	9,739,406	8,174,395	15,417,052	92,771	381,897	4,542,848	
	25.4%	21.3%	40.2%	0.2%	1.0%	11.8%	0.0%
2004	9,802,567	8,444,081	16,596,469	93,622	338,360	4,700,346	
	24.5%	21.1%	41.5%	0.2%	0.8%	11.8%	0.0%
2005	10,023,899	8,485,910	14,966,734	94,587	346,587	6,016,649	
	25.1%	21.2%	37.5%	0.2%	0.9%	15.1%	0.0%
2006	10,110,183	8,837,611	15,065,280	93,479	360,700	6,154,902	
	24.9%	21.8%	37.1%	0.2%	0.9%	15.2%	0.0%

Table 8.1-3
ELL Annual Sales by Customer Class (MWh and Percentage of Energy Sold to Each Class)

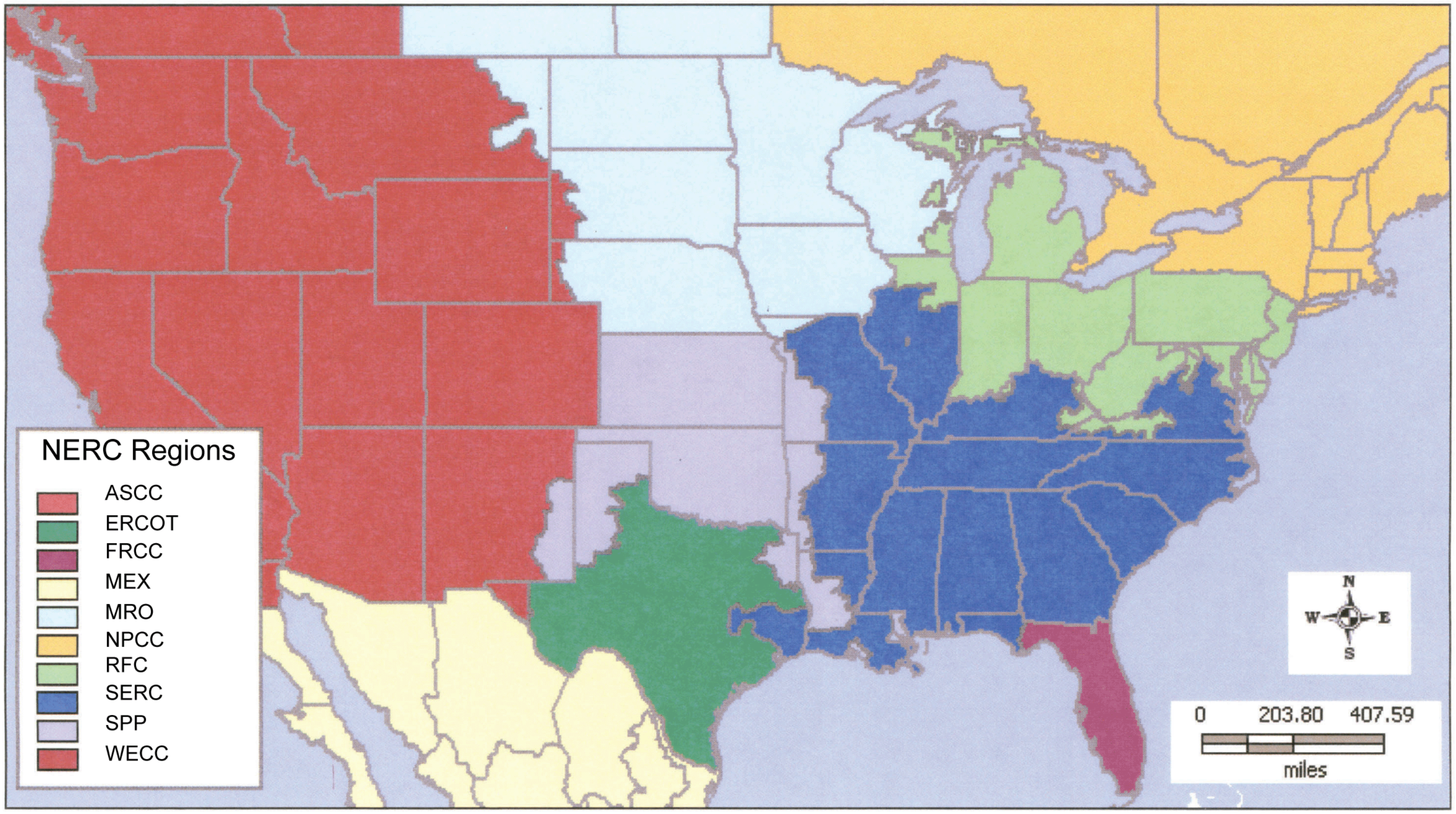
Year	Residential	Commercial	Industrial	Lighting	Governmental	Wholesale	Interdepartmental
1994	7,449,214	4,631,241	16,560,325	112,796	310,019	786,443	
	25.0%	15.5%	55.5%	0.4%	1.0%	2.6%	0.0%
1995	7,855,344	4,786,321	16,970,892	113,429	325,296	1,337,078	
	25.0%	15.2%	54.1%	0.4%	1.0%	4.3%	0.0%
1996	7,893,292	4,845,843	17,647,060	114,431	342,219	1,125,497	
	24.7%	15.2%	55.2%	0.4%	1.1%	3.5%	0.0%
1997	7,826,013	4,905,439	16,390,339	114,382	345,767	908,934	
	25.7%	16.1%	53.8%	0.4%	1.1%	3.0%	0.0%
1998	8,477,063	5,264,999	14,781,421	116,511	364,709	1,240,392	
	28.0%	17.4%	48.9%	0.4%	1.2%	4.1%	0.0%
1999	8,354,190	5,221,419	15,051,633	117,169	351,247	1,245,680	
	27.5%	17.2%	49.6%	0.4%	1.2%	4.1%	0.0%
2000	8,647,787	5,366,805	15,183,756	116,829	364,664	782,406	
	28.4%	17.6%	49.8%	0.4%	1.2%	2.6%	0.0%
2001	8,254,832	5,369,253	14,401,455	119,060	379,385	714,779	
	28.2%	18.4%	49.3%	0.4%	1.3%	2.4%	0.0%
2002	8,780,158	5,538,479	14,737,545	120,756	389,387	284,943	
	29.4%	18.6%	49.4%	0.4%	1.3%	1.0%	0.0%
2003	8,795,215	5,622,219	12,870,061	118,910	372,149	1,475,891	
	30.1%	19.2%	44.0%	0.4%	1.3%	5.0%	0.0%
2004	8,841,949	5,761,604	13,140,000	121,413	317,575	1,251,274	
	30.0%	19.6%	44.6%	0.4%	1.1%	4.3%	0.0%
2005	8,558,912	5,553,940	12,347,669	116,722	311,532	2,559,527	
	29.1%	18.9%	41.9%	0.4%	1.1%	8.7%	0.0%
2006	8,557,866	5,714,381	12,770,061	121,790	318,711	2,470,480	
	28.6%	19.1%	42.6%	0.4%	1.1%	8.2%	0.0%

Table 8.1-4
EMI Annual Sales by Customer Class (MWh and Percentage of Energy Sold to Each Class)

Year	Residential	Commercial	Industrial	Lighting	Governmental	Wholesale	Interdepartmental
1994	4,013,640	3,151,614	2,985,101	66,876	263,354	1,590,653	
	33.2%	26.1%	24.7%	0.6%	2.2%	13.2%	0.0%
1995	4,233,001	3,367,646	3,044,302	71,306	264,447	1,651,427	
	33.5%	26.7%	24.1%	0.6%	2.1%	13.1%	0.0%
1996	4,354,617	3,508,149	3,063,315	71,483	274,606	1,888,950	
	33.1%	26.7%	23.3%	0.5%	2.1%	14.4%	0.0%
1997	4,322,913	3,673,434	3,089,456	72,088	260,535	2,329,152	
	31.4%	26.7%	22.5%	0.5%	1.9%	16.9%	0.0%
1998	4,799,743	4,015,211	3,162,512	73,104	274,098	2,908,244	
	31.5%	26.4%	20.8%	0.5%	1.8%	19.1%	0.0%
1999	4,753,342	4,155,622	3,245,509	74,227	289,146	2,199,433	
	32.3%	28.2%	22.1%	0.5%	2.0%	14.9%	0.0%
2000	4,975,796	4,306,704	3,188,694	74,891	301,390	1,588,285	
	34.5%	29.8%	22.1%	0.5%	2.1%	11.0%	0.0%
2001	4,867,086	4,322,232	3,050,912	74,816	306,397	2,016,743	
	33.2%	29.5%	20.8%	0.5%	2.1%	13.8%	0.0%
2002	5,092,000	4,445,079	2,910,241	75,361	306,729	1,320,565	
	36.0%	31.4%	20.6%	0.5%	2.2%	9.3%	0.0%
2003	5,091,849	4,476,355	2,939,081	52,318	331,618	442,711	
	38.2%	33.6%	22.0%	0.4%	2.5%	3.3%	0.0%
2004	5,084,819	4,518,023	2,976,785	97,780	322,273	697,797	
	37.1%	33.0%	21.7%	0.7%	2.4%	5.1%	0.0%
2005	5,333,039	4,630,233	2,966,479	78,056	333,085	935,772	
	37.4%	32.4%	20.8%	0.5%	2.3%	6.6%	0.0%
2006	5,386,994	4,745,716	2,927,485	82,206	334,706	899,872	
	37.5%	33.0%	20.4%	0.6%	2.3%	6.3%	0.0%

Table 8.1-5
ENO Annual Sales by Customer Class (MWh and Percentage of Energy Sold to Each Class)

Year	Residential	Commercial	Industrial	Lighting	Governmental	Wholesale	Interdepartmental
1994	1,896,161	2,031,146	518,055	54,507	896,466	294,302	2,552
	33.3%	35.7%	9.1%	1.0%	15.7%	5.2%	0.0%
1995	2,049,442	2,079,205	536,701	54,120	928,821	445,804	1,914
	33.6%	34.1%	8.8%	0.9%	15.2%	7.3%	0.0%
1996	1,997,728	2,072,531	481,468	973,761	-	278,061	2,552
	34.4%	35.7%	8.3%	16.8%	0.0%	4.8%	0.0%
1997	1,970,506	2,072,262	483,952	198,149	796,244	475,852	2,552
	32.8%	34.5%	8.1%	3.3%	13.3%	7.9%	0.0%
1998	2,141,134	2,148,775	514,240	54,902	982,462	569,844	2,552
	33.4%	33.5%	8.0%	0.9%	15.3%	8.9%	0.0%
1999	2,101,652	2,207,776	513,825	54,467	1,016,461	621,918	2,552
	32.2%	33.9%	7.9%	0.8%	15.6%	9.5%	0.0%
2000	2,177,828	2,260,300	383,717	53,803	1,004,609	711,560	2,552
	33.0%	34.3%	5.8%	0.8%	15.2%	10.8%	0.0%
2001	1,980,932	2,184,743	414,191	53,354	963,407	174,236	2,552
	34.3%	37.8%	7.2%	0.9%	16.7%	3.0%	0.0%
2002	2,158,084	2,255,283	409,152	52,108	1,000,667	176,363	2,552
	35.6%	37.3%	6.8%	0.9%	16.5%	2.9%	0.0%
2003	2,132,976	2,261,498	411,606	52,989	982,643	1,339,665	2,552
	29.7%	31.5%	5.7%	0.7%	13.7%	18.6%	0.0%
2004	2,138,663	2,316,256	575,195	45,744	978,839	1,539,188	2,552
	28.2%	30.5%	7.6%	0.6%	12.9%	20.3%	0.0%
2005	1,615,771	1,798,124	498,316	58,943	741,179	2,041,327	1,701
	23.9%	26.6%	7.4%	0.9%	11.0%	30.2%	0.0%
2006	913,892	1,666,327	547,171	25,257	606,666	1,298,113	2,339
	18.1%	32.9%	10.8%	0.5%	12.0%	25.7%	0.0%

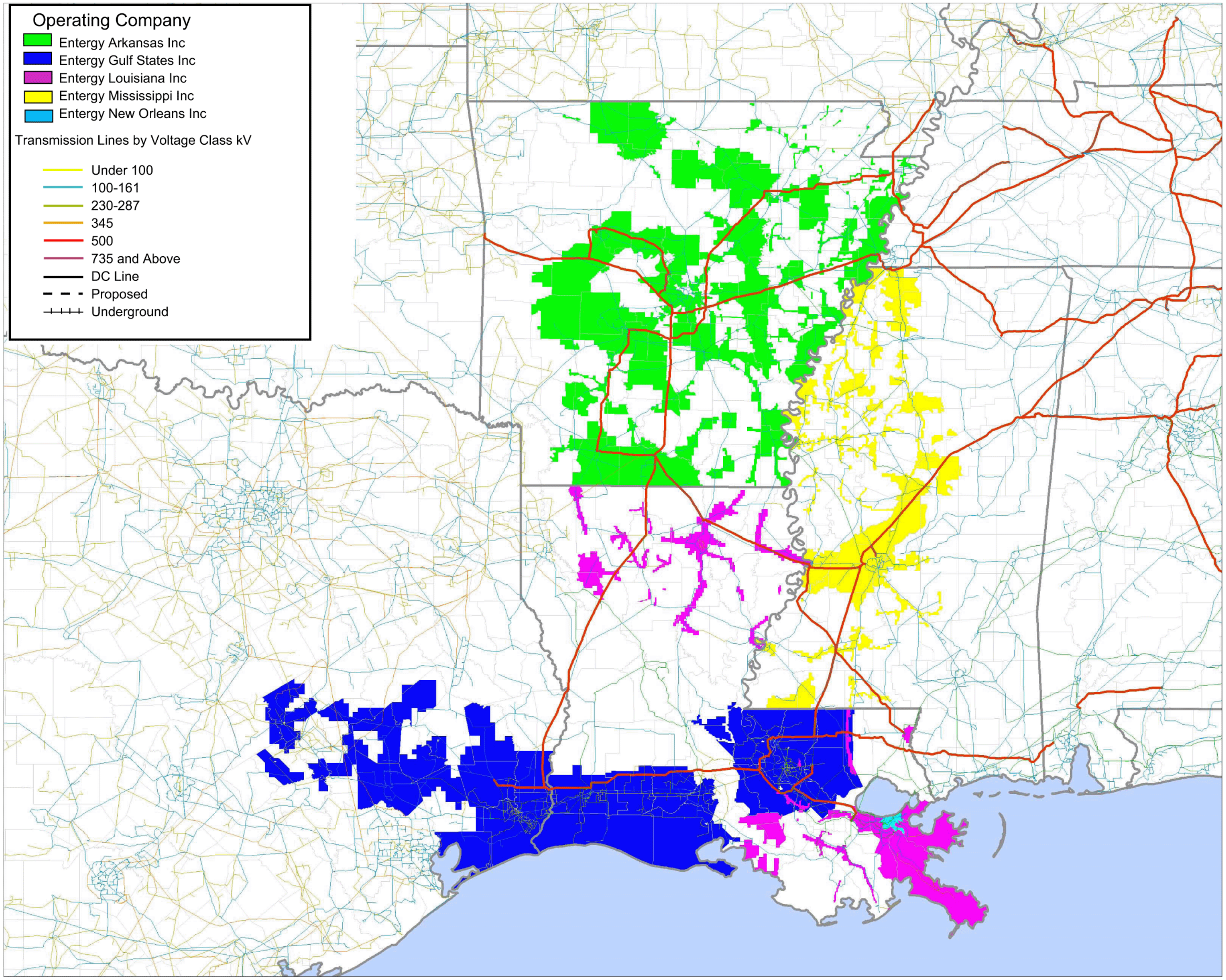


Source: Global Energy Decisions Inc. Energy Velocity

Legend:

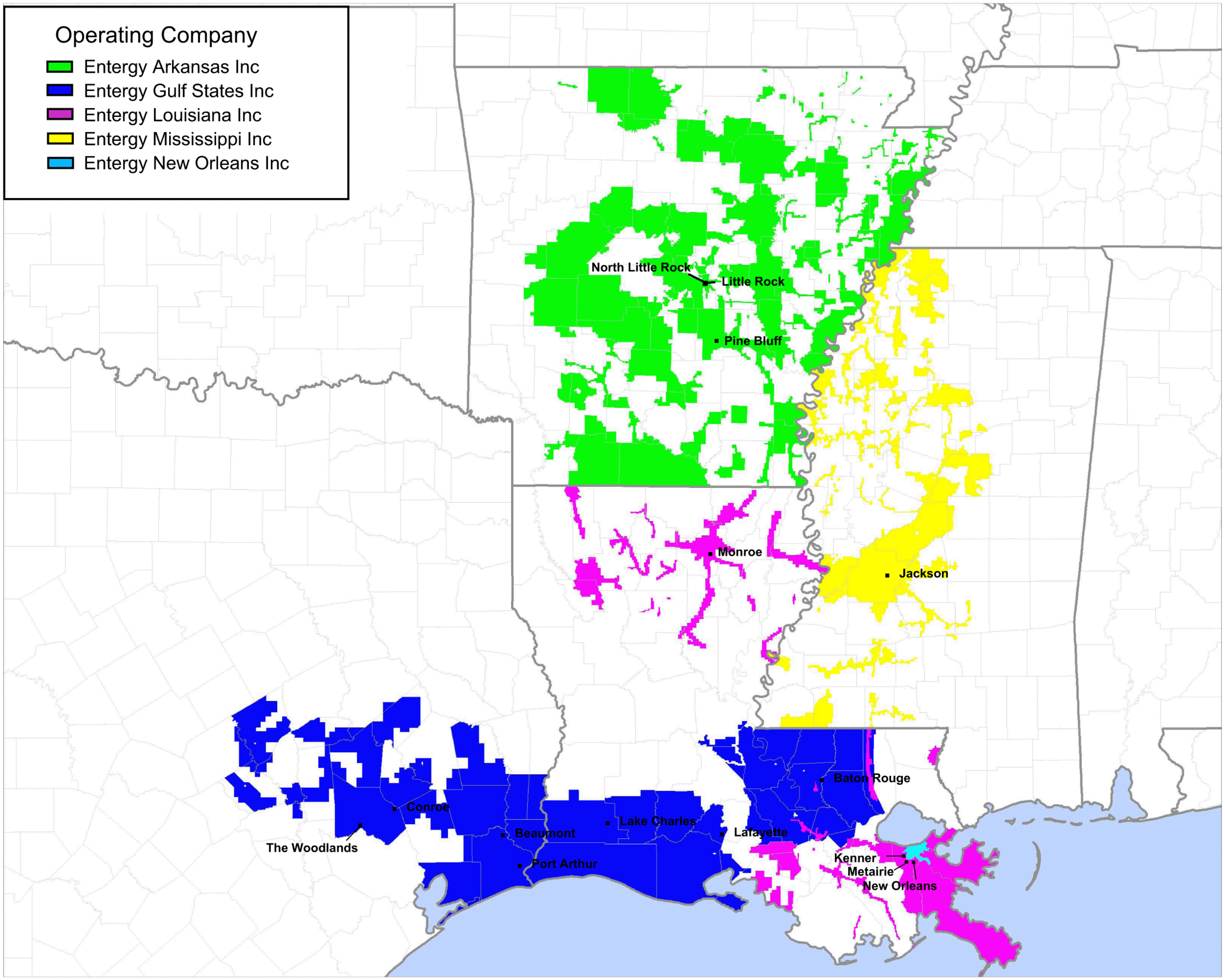
ASCC – Alaska Systems Coordinating Council
ERCOT – Electric Reliability Council of Texas
FRCC – Florida Reliability Coordinating Council
MEX - Mexico
MRO – Midwest Reliability Organization
NPCC – Northeast Power Coordinating Council
RFC – Reliability First Corporation
SERC – Southeastern Electric Reliability Council
SPP - Southwest Power Pool
WECC – Western Electricity Coordinating Council

Figure 8.1-1. NERC Regions



Source: Global Energy Decisions Inc. Energy Velocity

Figure 8.1-2. Regional Transmission Lines and Entergy Service Areas **Revision 0**



Source: Global Energy Decisions Inc. Energy Velocity

Figure 8.1-3. Entergy Service Areas with Major Load Centers (Cities > 50,000 Population)

8.2 POWER DEMAND

The electrical power distribution system considered in this need for power evaluation is described in Section 8.1, including the definition of the service area considered. For the purposes of this need for power evaluation, the approximate target schedule for commercial operation is the 2nd quarter of 2015.

A detailed evaluation was performed to determine peak load and hourly load levels for the EES. The EES System Planning and Operations (SPO) Department reviews and evaluates electrical energy resources to support the Operating Companies' strategic planning. The EES Strategic Supply Resource Plan (SSRP) ("the plan") (Reference 8.2-1) projects the peak load for 10 years into the future. The plan considers historical and projected electrical energy use and the availability of purchased power in forecasting the need for new generation to meet the demand for power in the EES service area. These factors are considered when evaluating the power and energy requirements and the potential growth of demand for resource planning purposes. The plan is submitted for review to various local and state regulators, and is available as a public record. The plan is not subject to approval by the regulators.

Proper resource planning includes a long-term hourly load forecast. The SPO Department annually develops a 10-year hour-by-hour load forecast. The forecast covers each of the Entergy Operating Companies and the total Entergy System. This forecast may be updated during a given year if major events occur (for example, the load forecast developed in August 2005 was replaced with a new forecast following Hurricane Katrina and again following Hurricane Rita). The EES SPO forecast is used in this need for power evaluation.

8.2.1 POWER AND ENERGY REQUIREMENTS

Data related to the electrical energy demand by major customer categories (residential, commercial, government, and industrial) are used to forecast retail energy consumption and wholesale contract requirements and as an input to the decision to add new generating resources. The total electrical energy used by the major customer categories has increased by an average of 1.2 percent per year from 1994 to 2005. The approximate apportionment of total EES retail energy sales by major customer categories for 2006 is as follows: Residential: 33 percent, Commercial: 26 percent, Industrial: 40 percent and Government: 2 percent. The apportionment has remained essentially constant since 2002. The percentages for each Entergy Operating Company are provided in Tables 8.1-1 through 8.1-5.

8.2.1.1 Historical Projections

The historical data of what has been previously forecast are shown in Table 8.2-1. When compared to tables of actual energy demand, this table shows growth has been consistently forecast. The planning forecast for the period 2007 – 2016 projects continued growth in energy demand.

{{{***Proprietary Information – Withheld Under 10 CFR 2.390(a)(4)***}}}
(see COL Application – Part 9)

The total annual kilowatt-hour sales starting from 1994 are shown in Table 8.2-2. The data in Table 8.2-2 show that actual total annual sales have increased from 1995 through 2005 at an average of 1.2 percent per year. Table 8.2-3 provides the total EES actual sales, the weather-adjusted sales, and the year-to-year growth rates. Weather-adjusted sales are actual sales that have been adjusted to a normal weather period (month or year). The absolute change in weather-adjusted retail sales compared to the actual retail sales was added or subtracted, as appropriate, to the Intra-System Billing (ISB) sales to calculate the weather-adjusted ISB sales. These data show that weather-adjusted sales have increased by an average of 0.8 percent per year from 1995 through 2005. Comparisons of the historical projections and the actual values of electricity sales demonstrate that the projection model is accurate.

From Tables 8.2-1 through 8.2-5, the data over the longer period (1994 - 2006) show that growth has been predominantly occurring from residential and commercial customer demand. The major factors involved in this growth are increases in population and income. Future growth in these customer classes is expected to follow this trend. Note that ENO was severely impacted by Hurricane Katrina, which struck the area on August 29, 2005. ENO is currently recovering from the effects of the hurricane so its growth in 2007 is likely to be larger than typical; however, the absolute level of demand at ENO for all sectors except industrial is likely to be below the 2004 levels for several years. ENO, which is limited to the city of New Orleans, excluding Algiers, makes up approximately 4 percent of the entire EES.

EES expects a steadily increasing growth in sales from its largest industrial customers (approximately 150) over the next 5 years, from about a 2.1 percent annualized growth rate
Proprietary during the 2004 - 2008 time frame to about a {{{ }}} rate over the 2009-to-2013 business planning cycle. If realized, the energy requirements to serve these customers will increase over
Proprietary {{{ }}} over that time span alone. To place this in context, this increase in industrial demand represents a substantial increase over the system total sales for the industrial sector in 2006. EES anticipates this growth to be driven by a need for additional refinery and basic chemical production capacity along the Louisiana and Texas Gulf Coast. Given the long lead times and large investment outlays involved, EES expects an uptrend in large industrial projects to continue for a period of 5 years, possibly longer. Further, EES' relatively conservative approach to sales forecasting likely understates the extent and duration of increased growth rates. EES does not include in its sales forecasts any projects that are not well advanced in development and for which EES does not have a signed contract. EES is aware of a number of other large projects in the early development stages that could further add to sales growth over the next 5 to 10 years.

8.2.1.2 Forecast Methodology

The planning information is typically developed a year in advance of the relevant planning horizon. In some cases, the forecast may include information for the remainder of the year in which it was developed. For example, the 2007 forecast information was developed in mid-2006 and included a forecast for the remainder of 2006. In other cases, the plan may not include the current year. Thus, the starting year for each forecast shown in Table 8.2-1 may vary. In some cases, multiple forecasts are developed for the same year, as changing conditions warrant.

The EES SPO Department uses computer software from Itron to develop annually a 10-year, hour-by-hour load forecast. Itron is a metering and consulting services company that produces the MetrixND and MetrixLT software (References 8.2-2 and 8.2-3) that the Entergy System uses for energy forecasting, weather normalization (mostly MetrixND), and hourly load forecasting and peak load forecasting (MetrixLT). MetrixND is a package for running regression analyses to establish the relationships of energy usage to various economic variables and weather. MetrixLT is used for applying load shapes to the energy forecast. Both versions of Metrix software are used widely in the utility industry, to the point where they may be considered industry standards. The forecast covers each of the Entergy Operating Companies and the total EES load. The forecast uses key inputs from several sources.

The Monthly Retail Energy Sales Forecast, prepared by EES Sales & Marketing, is developed using an econometric model (MetrixND) for each revenue class by operating company. EAI, ELL, ENO, EGSL, ETI, and EMI are broken out separately in this model. The econometric model is a regression analysis that uses various national, state, and local variables as drivers in the forecast. Sales are forecasted at the revenue class level, i.e., residential, commercial, industrial and governmental. Econometric sales forecasts for each of the four classes for each operating company are derived from separate usage per customer (UPC) and customer count models, the outputs of which are multiplied together on a monthly basis to produce total gigawatt-hour sales. The key drivers for the UPC models are generally gross area economic output (similar to national gross domestic product) or real income, while customer count models are typically based on drivers such as population or households. Key macroeconomic inputs are supplied by Moody's Economy.com. Sales and customer count data are loaded directly into the software as well as customized economic data (income, households, gross product, etc.).

EES’s largest industrial customers' load is forecasted individually based on EES’s specific relationship and knowledge of the account. Some of the industrial customers have interruptible and/or curtailable contracts. These interruptible customers are identified and each has an hourly load shape profile that is aggregated to the Operating Company level so that the hourly load forecast that is generated can be at the total level or at the firm[1] only load level. This individual forecasting tailored to these accounts defines the total load shape to a degree beyond macro economic forecasting alone.

In addition to the largest customers, other models of forecast hourly load are developed. The Monthly Wholesale Energy Sales Forecast is prepared by EES Sales & Marketing for each wholesale customer. Each wholesale customer is assigned an appropriate load shape or in some cases multiple load shapes depending upon the contractual requirement and the customer class composition of the wholesale customers being served.

Once the inputs are collected, ten-year "typical weather" is used to convert historical load shapes into typical load shapes. "Typical Weather" is determined as described below. SPO then uses two ITRON models to construct an hourly energy and peak load forecast for each operating company and the Entergy System.

1. Sales of power to the customers, which cannot be interrupted except in certain circumstances. A utility plans to have adequate resources to serve these customers.

The actual load shapes are influenced by the weather during the year the actual load is recorded. A weather response function in the MetrixND software adjusts the load shapes to reflect typical weather. For example, if the actual July load for Entergy Arkansas residential customers came from a month where weather was very mild, this would flatten the load shape. The Weather Response function adjusts the load shape to reflect typical weather. Each customer class in each Operating Company responds differently to weather so each has its own weather response function. For energy forecasting and weather normalization, the Entergy System has developed its own models using the Itron software. Sales and customer count data are loaded directly into the software as well as customized economic data (income, households, gross product, etc.) that is received from Moody's Economy.com and weather data received from the National Weather Service. The weather data are processed first to transform it into degree days, but otherwise the data are not transformed before use. MetrixND is then used to create a 10-year energy forecast. Ten years of historical weather is then used to determine what is considered typical weather. MetrixND then adjusts the historical load shapes provided by Load Research by this typical weather to produce the load shapes in which the energy forecast will be applied to create the 10-year hourly load forecast.

To estimate the final retail and wholesale sales, the MetrixLT – ITRON model is used. The MetrixLT Model combines the forecasted load shapes that come out of the MetrixND model with the Retail and Wholesale Monthly Forecast to produce the final 8760-hour curve. Internal company use is a forecast add-on to the Retail and Wholesale Forecasts to finalize the projected demands for production. MetrixLT then adds up sales by jurisdiction to produce a total Entergy System hourly load forecast. As the energy forecasts are input "at the meter," a transmission/distribution factor for each revenue class by jurisdiction is used to produce a forecast of load required at the generator. The load at the generator is higher than the load at the meter to account for the need to produce power sufficient to cover line losses.

Because there is a lag between when energy is generated and consumed and when it is billed, and because the Retail Energy Forecast is based on billed energy, the energy must be adjusted to arrive at a generator based load forecast. In historical forecasts (those prior to the forecast for the period beginning in 2008), monthly retail energy is assumed to have been generated and consumed in the prior month. In other words, January 2007 billed sales MWs roughly are equal to December generation. Beginning with the forecast for the period starting in 2008, a model has been developed to more accurately convert the billed energy to generated energy.

The historical weather-adjusted annual peak load data are shown in Table 8.2-5. From the data projected for the 1995 forecast shown in Table 8.2-1, it can be seen that the peak loads predicted for 2004 and 2005 were 21,150 MW and 21,501 MW, respectively, as compared to the weather-adjusted values shown in Table 8.2-5 of 21,652 MW and 21,391 MW. The significant decrease from the 1995 forecast of energy use for 2005 as compared to the actual weather adjusted sales shown in Table 8.2-3 is largely attributable to Hurricanes Katrina and Rita. When looking at the comparison between forecast and weather-adjusted sales, notwithstanding the 2005 actual as predicted in the 1995 Historic Forecast, the long term forecast is accurate.

{{{***Proprietary Information – Withheld Under 10 CFR 2.390(a)(4)***}}}
(see COL Application – Part 9)

As shown in Table 8.2-4, load factors have been historically constant from 1994 to 2006 (ranging from 60 percent to 64 percent). The forecast load factors through 2018 are expected to be {{{ }}}. The normalized (weather-adjusted only) regional system peak loads are shown in Table 8.2-5. The historical peak load data (1999 to 2006) indicate that there has been little difference between the actual peak loads, as shown on Table 8.2-4, and the weather adjusted data as shown on Table 8.2-5.

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Load duration curves for 2007 and 2015 (the year of the referenced SSRP and projected first year of new unit operation) are shown in Figures 8.2-1 and 8.2-2. The minimum hourly loads for these curves are forecast to be 8248 MW for 2007 and 9604 MW for 2015.

The results of these forecasts indicate that the demand for power will continue to increase over the next 10 years, which the EES considers when planning for future needs. The SSRP concludes that additional electric resources will be required to meet these needs.

8.2.2 FACTORS AFFECTING GROWTH OF DEMAND

The SSRP includes the results of the analyses of data for the EES service area for estimated population growth, per capita income growth, manufacturing output growth, known availability of gas and oil, growth of the real price of electricity and rate structures for major customer classes. As described above, the detailed data are input into the forecasting software to develop a macroeconomic model. The analyses show continued growth of energy demand in the future.

One of the most difficult factors when forecasting demand is the unknown effect of weather. Table 8.2-5 shows the actual historical weather-adjusted peak load data, as far back as they are available, for the system. The historical peak load data (1999 to 2006) indicate that the largest difference between the actual peak loads and the weather-adjusted peak loads, with the average adjustment of 566 MW, has been just over one gigawatt. In addition, the forecast data for 1999 to 2006 from Table 8.2-1 compared to the weather-adjusted peak values indicate that the forecasting model is fairly accurate.

Data related to the electrical energy used by major customer categories (residential, commercial, government, and industrial) are used to forecast energy usage, forecast load demand and support the decision to add new generating facilities. Data related to the electrical energy used provide direct input to forecast electrical demand. Data related to alternate energy use are considered in the forecast indirectly through the input of macroeconomic data.

Entergy Corporation promotes electrical energy conservation and has participated in an EPA/DOE sponsored conservation program (Reference 8.2-4) since 2004. Entergy provides conservation and energy efficiency information to customers on its website and in brochures distributed at a wide range of community events. In addition, members of the EES administer energy efficiency and conservation programs within their respective service areas. Entergy is also a member of the leadership group for the National Action Plan for Energy Efficiency (NAPEE). NAPEE is a joint effort between the EPA/DOE and utilities, regulators, state agencies, large energy users, consumer advocates, energy service providers, and environmental organizations designed to promote a sustainable national commitment to energy efficiency. EES does consider conservation and energy efficiency in its planning process; however, demand and consumption of electric energy is projected to grow throughout the forecast period. EES's forecast of ongoing growth despite conservation and energy efficiency is consistent with the Department of Energy's Annual Energy Outlook 2007 (Reference 8.2-5) which also concludes that demand and consumption will continue to grow throughout the forecast period.

Cost of energy also has an impact on demand. Since 2000 there has been a significant increase in the commodity price of fuels including natural gas, residual fuel oil and to a lesser extent coal prices. These higher costs have driven up the cost of electricity production and have been passed on to the end user. As a consequence, these higher costs may have resulted in a reduction in the growth of demand and consumption of electric energy. While isolating and measuring the specific effects of such price changes are difficult and uncertain, historical usage patterns reflect such trends and are incorporated into EES' planning process. Furthermore, historical data indicates that increases in the cost of energy have caused temporary reductions in end-use energy consumption, but over the longer term, demand continues to increase as customers adjust to cost changes. The particular pricing regime for electric generating markets, whether prices are regulated or deregulated, appears to have little if any affect on the demand and consumption of electric energy. The growth in demand is illustrated by Table 8.2-3. Table 8.2-6 shows that despite the increase in the price of natural gas, oil, and coal, the required electrical supply has been steady. The cost of natural gas and oil has risen from 2000 to 2005 and EES has reduced its production by owned resources and has relied upon purchased power to economically meet the demand.

Sensitivity studies are used to determine the impact of a change in growth rate on forecast load data. Table 8.2-7 shows the forecast load for base load, peak firm load, and peak firm load plus margin to 2017. Each year, growth is predicted based upon the inputs as previously discussed. From annual growth, the yearly rate can be determined, and a 0.5 percent factor applied to that value to determine the impact from a change in the predicted growth rate. As can be seen from the 2017 values, the forecast is relatively unaffected by this uncertainty. The AEO2007 (Reference 8.2-5) predicts an increase in total electricity consumption through 2030 at an average rate of 1.5 percent, thus it is reasonable to conclude that the growth forecast resulting from the detailed analysis of SPO is a reasonable prediction.

8.2.3 REFERENCES

8.2-1 Plan Summary Document, Entergy Electric System Strategic Supply Resource Plan for the Planning Period 2007 – 2016, October 20, 2006.

8.2-2 MetrixND, Version 4.0, Itron Inc., Website, http://www.itron.com/pages/products_detail.asp?id=itr_000482.xml, accessed 7/31/07.

8.2-3 MetrixLT, Version 4.0, Itron Inc., Website, http://www.itron.com/pages/products_detail.asp?id=itr_000485.xml, accessed 7/31/07.

8.2-4 Energy Star, Website, http://www.energystar.gov/index.cfm?c=about.ab_index, accessed 7/23/07.

8.2-5 Energy Information Administration/ Annual Energy Outlook 2007 (AEO2007), Website, http://www.eia.doe.gov/oiaf/aeo/index.html, accessed 7/23/07.

Table 8.2-1 (Sheet 1 of 2)
Historical Forecasts for EES Total Sales and Peak Load

	Planning Year											
	1995		1996		1997		1998		1999		2000	
Forecast Year	Total Load (GWh)	Peak Load (MW)	Total Load (GWh)	Peak Load (MW)	Total Load (GWh)	Peak Load (MW)	Total Load (GWh)	Peak Load (MW)	Total Load (GWh)	Peak Load (MW)	Total Load (GWh)	Peak Load (MW)
1995	101,679	18,682	103,368	18,913								
1996	101,679	18,682	103,368	18,913								
1996	103,665	19,017	106,180	19,347	107,162	19,710						
1997	104,578	19,207	107,668	19,655	107,724	19,972						
1998	105,949	19,496	109,303	20,093	109,309	20,359	110,790	19,239				
1999	107,324	19,813	109,023	20,199	110,973	20,769	112,267	19,649	110,421	20,394	112,185	21,152
2000	107,976	19,964	107,815	20,212	110,273	20,908	110,771	19,623	111,259	20,551	114,360	21,516
2001	108,653	20,125	110,564	20,688	113,355	21,491	113,489	20,160	112,672	20,898	114,761	21,773
2002	110,531	20,453	113,417	21,182	116,483	22,088	116,291	20,684	113,877	21,165	117,071	22,202
2003	112,440	20,786	116,347	21,687	119,707	22,703	118,566	21,159	111,702	21,046	114,248	22,032
2004	114,571	21,150	119,371	22,207	123,041	23,333	120,858	21,602	112,769	21,298	116,005	22,346
2005	116,575	21,501	122,474	22,737	126,467	23,990	123,653	22,169	115,087	21,769	118,410	22,637
2006					130,004	24,665	126,513	22,733	117,385	22,185	120,742	23,304
2007							129,445	23,299	119,855	22,615	123,252	23,771
2008							132,517	23,864	122,378	23,017	125,812	24,187
2009									124,964	23,520	128,433	24,735

Table 8.2-1 (Sheet 2 of 2)
Historical Forecasts for EES Total Sales and Peak Load

	Planning Year													
	2001		2002		2002		2003		2004		2005		2006	
Forecast Year	Total Load (GWh)	Peak Load (MW)	Total Load (GWh)	Peak Load (MW)	Total Load (GWh)	Peak Load (MW)	Total Load (GWh)	Peak Load (MW)	Total Load (GWh)	Peak Load (MW)	Total Load (GWh)	Peak Load (MW)	Total Load (GWh)	Peak Load (MW)
2000	114,610	21,156												
2001	116,535	21,562	113,080	21,460										
2002	118,243	21,884	114,148	21,720	112,251	21,048								
2003	115,034	21,382	113,198	21,730	111,186	20,707	113,919	20,270						
2004	117,108	21,720	113,535	21,825	114,743	21,289	116,210	20,698	115,301	21,318				
2005	119,182	22,166	114,497	22,159	115,515	21,487	117,723	21,053	117,749	22,007	116,537	21,605		
2006	121,232	22,412	116,742	22,595	115,958	21,554	118,723	21,232	118,344	22,203	117,514	21,749	113,542	20,778
2007	123,264	22,934	118,941	23,019	117,814	21,901	120,679	21,573	120,218	22,522	118,632	22,115	115,133	21,273
2008	125,277	23,240	121,048	23,340	119,819	22,194	122,762	21,970	122,157	22,937	120,333	22,536	117,498	21,844
2009	127,261	23,665	123,207	23,852	121,865	22,625	123,349	22,235	123,936	23,177	121,567	22,775	119,279	22,204
2010	129,281	24,052	125,461	24,281	123,952	23,013	125,611	22,651	124,404	23,468	122,311	23,089	120,799	22,542
2011			127,792	24,720	126,080	23,418	127,921	23,082	126,492	23,980	124,098	23,332	122,743	22,732
2012					128,257	23,790	130,281	23,483	128,625	24,378	125,925	23,800	125,001	23,172
2013							132,691	23,998	130,804	24,949	127,792	24,325	127,238	23,730
2014									133,029	25,421	129,700	24,794	129,464	24,226
2015											131,650	25,079	131,801	24,658
2016													134,037	24,885

Table 8.2-2
EES Annual Increase in Total Sales[1]

Year	Energy (GWh)	Annual Increase (GWh)
1994	100,299	
1995	105,281	4982
1996	108,788	3507
1997	109,283	495
1998	113,289	4006
1999	111,258	(2030)
2000	115,689	4431
2001	110,911	(4778)
2002	114,491	3579
2003	113,154	(1336)
2004	116,476	3322
2005	113,418	(3058)

Notes:

1. These sales numbers represent the net area requirement from Entergy's Intra System Billing (ISB) report and differ slightly from the total of the Operating Companies' reflected in the EES general ledger, which are given in Tables 8.1-1 through 8.1-5. For purposes of planning, EES uses energy or load at the generator as opposed to sales numbers at the meter.

Table 8.2-3
EES Weather-Adjusted ISB Sales Growth Rate

Year	Actual ISB Sales (GWh)	Weather-Adjustment Factor (GWh)	Weather-Adjusted Sales (GWh)	Weather-Adjusted Annual Growth Rate
1995	105,281	(932)	104,349	--
1996	108,788	(903)	107,885	3.4%
1997	109,283	(268)	109,015	1.0%
1998	113,289	(2,661)	110,628	1.5%
1999	111,258	349	111,607	0.9%
2000	115,689	(766)	114,923	3.0%
2001	110,911	897	111,808	-2.7%
2002	114,491	(529)	113,962	1.9%
2003	113,154	257	113,411	-0.5%
2004	116,476	794	117,270	3.4%
2005	113,418	(390)	113,028	-3.6%

{{{***Proprietary Information – Withheld Under 10 CFR 2.390(a)(4)***}}}
(see COL Application – Part 9)

Table 8.2-4
EES Actual (1994 - 2006) and Forecast (2007 - 2018) Load Factors

Year	Peak (MW)	Load Factor
1994	18,028	64%
1995	19,590	61%
1996	19,444	64%
1997	19,545	64%
1998	20,656	63%
1999	20,664	61%
2000	22,052	60%
2001	20,315	62%
2002	20,419	64%
2003	20,162	64%
2004	21,174	63%
2005	21,391	61%
2006	20,887	62%
2007	{{{	}}}
2008	{{{	}}}
2009	{{{	}}}
2010	{{{	}}}
2011	{{{	}}}
2012	{{{	}}}
2013	{{{	}}}
2014	{{{	}}}
2015	{{{	}}}
2016	{{{	}}}
2017	{{{	}}}
2018	{{{	}}}

Note: Peak load forecast for the period 2007 - 2018 does not include factor of reserve margin.

Table 8.2-5
Historical Weather-Adjusted Annual Peak Load Data

	Year	Actual Peak (MW)	Weather-Adjusted Peak (MW)
Actual	1997	19,545	Data Not Available
Actual	1998	20,656	Data Not Available
Actual	1999	20,664	20,349
Actual	2000	22,052	20,961
Actual	2001	20,315	21,235
Actual	2002	20,419	21,144
Actual	2003	20,162	21,125
Actual	2004	21,174	21,652
Actual	2005	21,391	21,391
Actual	2006	20,887	20,697

Table 8.2-6
Entergy Electric System's Supply Mix 2000 - 2005

(GWh)	2000	2001	2002	2003	2004	2005
Purchases	24,188	19,466	27,328	37,687	37,967	40,190
Gas / Oil	43,073	38,873	35,195	22,797	22,619	21,388
Coal	14,799	14,586	13,743	14,057	15,359	13,502
Nuclear	37,059	41,038	40,917	40,628	41,710	38,432
Hydro	133	154	164	115	151	97
Total	119,252	114,117	117,337	115,284	117,806	113,609

{{{***Proprietary Information – Withheld Under 10 CFR 2.390(a)(4)***}}}
(see COL Application – Part 9)

Table 8.2-7
Forecast Baseload and Peak Load Demand (MW)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017[c]
Forecast Baseload Demand [a], [c]	{{{										}}}
Baseload Resources [b]	{{{										}}}
Surplus/(Deficit)	{{{										}}}
Forecast Firm Peak Demand [c]	{{{										}}}
Forecast Peak Demand + Reserve Margin	{{{										}}}
Predicted Growth Rate	{{{										}}}
Forecast Peak + Margin (- 0.5% growth)	{{{										}}}
Forecast Peak + Margin (+ 0.5% growth)	{{{										}}}

a) Load forecast is subject to a number of uncertainties, including but not limited to:
* The potential for retail open access in parts of the System.
* The potential for retail customer losses.

b) Includes owned resources and all contracted resources, including Entergy Arkansas, Inc. and Entergy Mississippi, Inc. resources. Values subject to factors including but not limited to:
* Future portfolio changes in the planning horizon.
* Potential retirements (i.e., Muni Coal has additional scheduled retirement in capacity accounted for here but not shown in the SSRP for 2007 - 2016).

c) Beyond 2016, detailed forecasting is not available. For purposes of this discussion, the 2017 peak load forecast was calculated based on a 1.7 percent energy growth rate (the same rate from 2015 to 2016) and a {{{ }}} load factor assumption. The value is provided to complete the projection profile to 3 years past the expected first year of operation of RBS Unit 3.

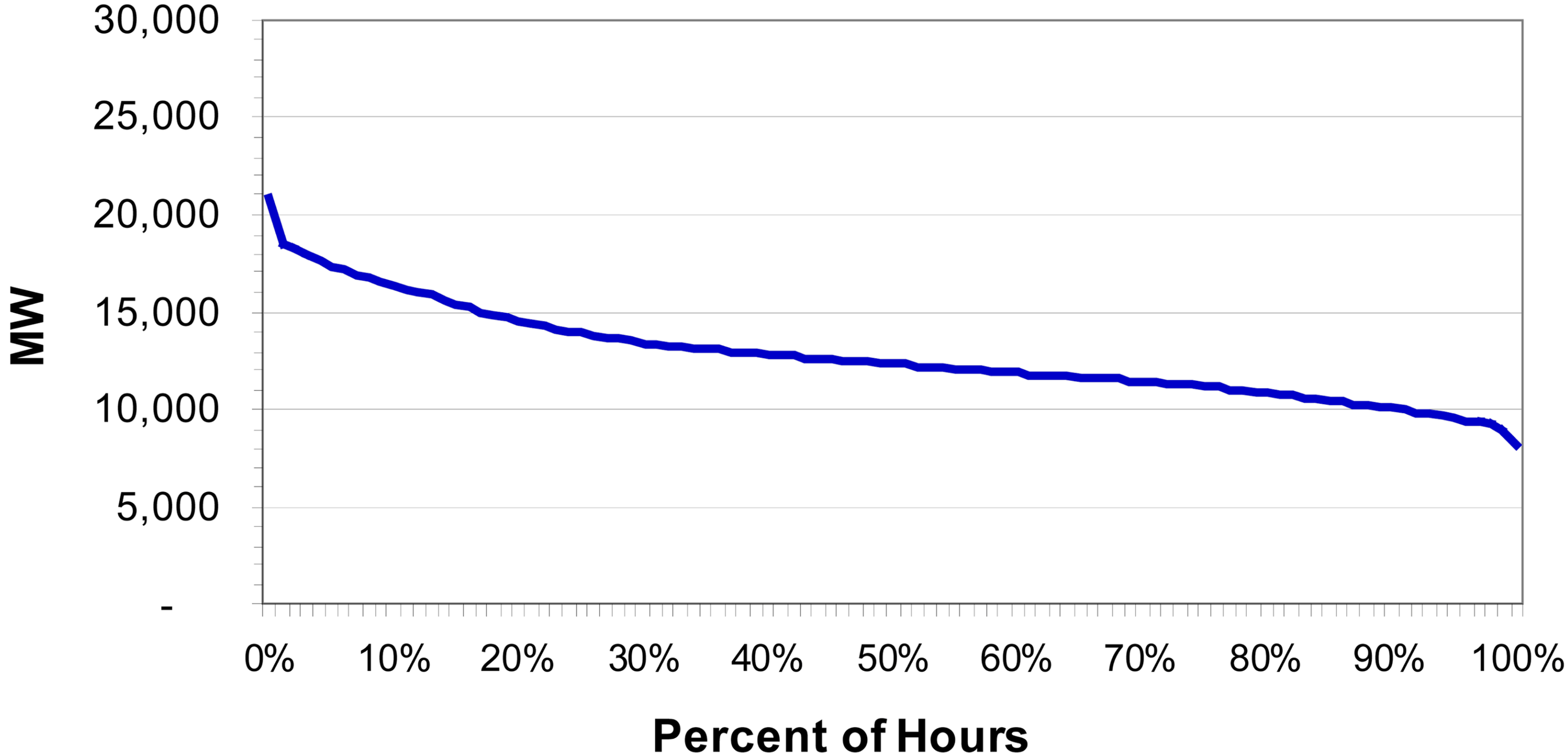

Figure 8.2-1. Entergy System Forecast Firm Load for 2007

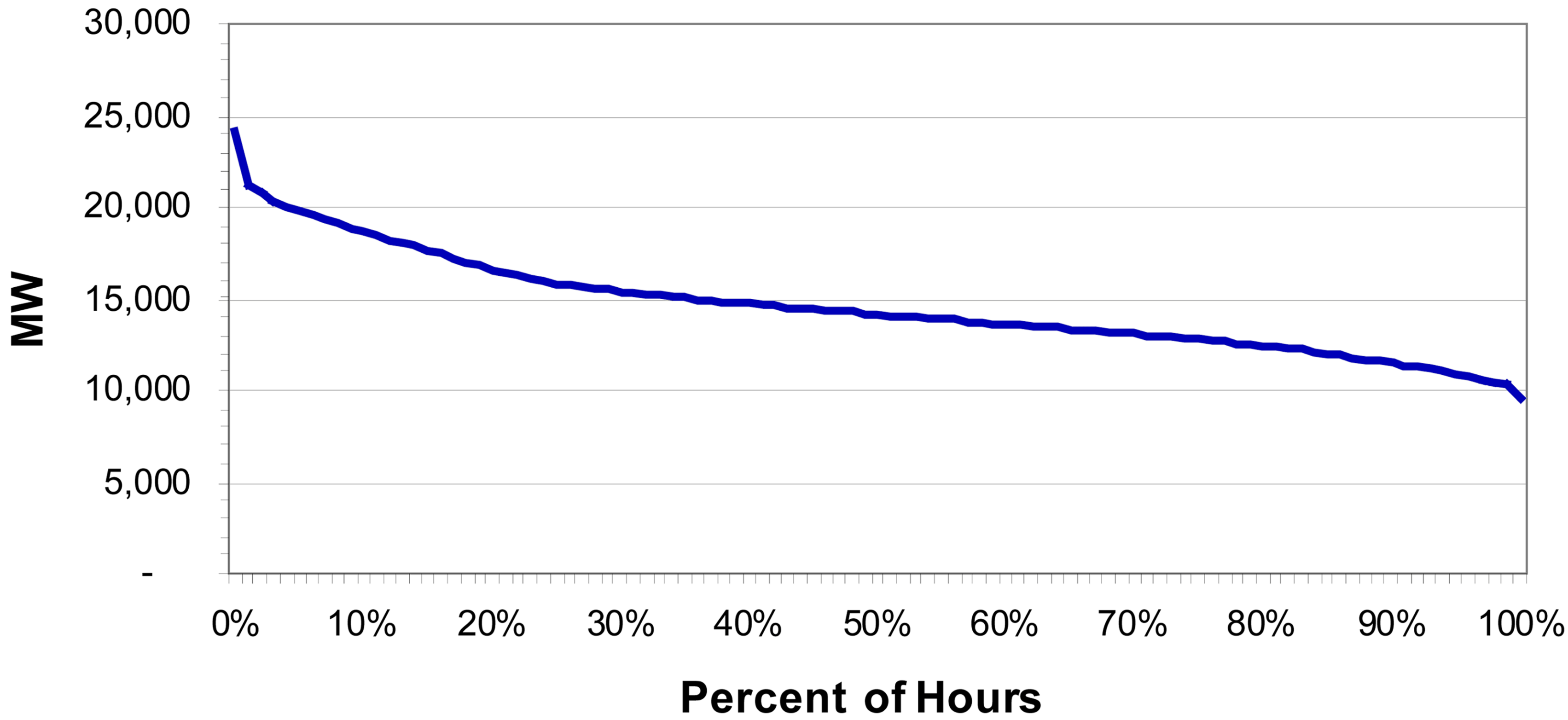

Figure 8.2-2. Entergy System Forecast Firm Load for 2015

8.3 POWER SUPPLY

As described in the Entergy Electric System (EES) Strategic Supply Resource Plan (SSRP) (Reference 8.3-1), the supply needs that determine the resource requirements of the Operating Companies (OPCOs) are driven by six basic resource supply objectives. These objectives are to:

- Provide adequate resources to meet peak load demands reliably.
- Provide low-cost resources to serve base load requirements.
- Provide efficient, dispatchable load following resources to serve the time varying load shape levels that are above the base load supply requirement.
- Provide a generation portfolio that is more efficient and avoids an over-reliance on aging resources.
- Mitigate the exposure to price volatility associated with uncertainties in fuel and purchased power costs.
- Mitigate the exposure to major supply disruptions that could occur from concentrated or systematic risks, for example, outages of a single generation facility.

Within its planning process, the EES plans over three resource planning horizons: annual planning (1 year), tactical planning (1 - 3 years), and strategic planning (10 years). The SSRP addresses the 10-year strategic planning horizon. For long-term capacity planning purposes, the System determines its capacity requirement by comparing forecast peak demand plus a reserve margin (Total Reliability Needs) with long-term resources (owned or contracted). This comparison, adjusted for controlled resources, planned unit retirement, and demand-side management (DSM) programs in place, yields the Total Expected Procurement for each year within the planning horizon. The SSRP indicates that the EES is presently short 2 gigawatts based on this criterion. This deficit is projected to increase for each subsequent year studied.

The EES is also presently short of base load generating capacity relative to its base load planning guideline. As a planning guideline, the SSRP envisions that base load capacity should be sufficient to meet the load levels projected to exist in approximately 75 - 85 percent of hours within the planned horizon. While not a reliability requirement, this guideline seeks to mitigate exposure to the price volatility normally associated with load-following and peaking units. The units that serve in a base load role are expected to operate at high average capacity factors and to be dispatched at or near maximum capacity to meet the electrical demand most often experienced by the EES. Some base load units also have the ability to reduce electrical output during off-peak hours to take advantage of attractive off-peak purchase opportunities.

8.3.1 EXISTING AND FORECAST GENERATION

The 2007 resource requirements and capability for EES are shown in Table 8.3-1. The value for "Total Requirements" represents forecasted firm load plus a 16.8 percent reserve margin (2007 "Forecast Peak Demand + Reserve Margin" from Table 8.2-7). The "Base Load Requirements" value shown in Table 8.3-1 is a planning guideline representing the minimum load level that is expected to exist in 75 - 85 percent of the hours within the planning horizon. The values for "Resources" are for currently owned and long-term contracted generating resources only. Table 8.3-1 shows a total generation capacity deficit of almost 2 gigawatts for 2007, and a base load generation capacity deficit of about 3000 MW for 2007. This indicates not only a need for EES to purchase power, but also a need to increase base load generating resources. Further examination of Table 8.2-7 indicates that the projected base load generation capacity deficit ("Forecast Base Load Demand" - "Base Load Resources") is shown to increase for each of the years studied.

For planning, the SSRP uses the reliability requirement, also referred to as forecast firm peak load plus a reserve margin of 16.8 percent (shown in Table 8.2-7) as a basis for establishing the Total Expected Procurement (MW) for each year in the planning horizon. The Total Expected Procurement for 2007 - 2016 is shown in Table 8.3-3. The reliability requirement is expected to increase 19 percent during the period from 2007 to 2016. However, controlled resources for 2016, as shown in Table 8.3-3, fall short of meeting the 2016 forecast reliability requirement by approximately 8000 MW. Including definitive long-term purchased power agreement (PPA) resources, the capacity deficit is approximately 7300 MW in 2016. The System's base load deficit is currently about 3000 MW (see Table 8.2-7). Assuming no long-term base load resources are added to the System, the utility base load deficit is expected to increase to approximately 4700 MW by 2016.

The SSRP presumes that reliability requirements are met largely from long-term resources, whether owned assets or long-term power purchase agreements. The emphasis on long-term resources mitigates exposure to price volatility and ensures the availability of resources sufficient to meet long-term reliability needs. Over-reliance on limited-term purchased power exposes customers to the risk associated with market price volatility and power availability. A listing of each long-term generator and purchase power contract in the EES for 2007 is provided in Table 8.3-2. The SSRP projects this information for each year within the planning horizon for use in defining the Total Expected Procurement for each year.

The result of comparing forecast Total Reliability Needs with Total Resources indicates that the EES will experience a significant increase in Total Expected Procurement of generating resources over the period studied. Over the planning horizon discussed, the level of procurement needed will be multiples of that needed in 2007. In addition, the SSRP presents a supply plan to address the projected deficit and balance the resources that are needed with existing and planned resources and what is available for purchase. The SSRP presents a supply plan consisting of acquisitions, PPAs, and planned long-term additions in combination with other limited-term resources to meet system growth.

The SSRP is a dynamic process for long-range planning that provides for a flexible approach to resource selection. The planning scenarios resulting from the SSRP planning process provide guidance regarding a supply plan that includes long-term resource additions, but are not intended as static plans or pre-determined schedules for resource additions. Actual portfolio decisions are made at the time of execution. SSRP planning scenarios presently assume a mix of additional generation supply resources, including long-term and limited-term resources including approximately 2560 MW of solid fuel base load resources, will be added in the 10-year planning horizon, as shown in Table 8.3-3, to meet the predicted increase in demand over the planning horizon.

The availability of all generating capability and purchased power contracts is subject to a number of general risk factors. These factors include plant mechanical condition, emissions limits, fuel supply and transmission outlet capacity. For EES plants that are included in the Resource Plans, plant capital and O&M budgets are developed. These budgets include sufficient funding levels to maintain fleet-wide plant mechanical condition, standards and requirements such that the fleet-wide mechanical availability is within industry norms. In addition, EES maintains its plants to meet established emissions limits. Likewise, EES plans fuel supply and transmission outlet capacity to support the anticipated operation of its plants. SSRP planning includes a provision for unit deactivations (see Table 8.3-3). The data for "Provision for ERS/IR units" represent an estimate of capacity levels that might be moved into extended reserve shutdown or into inactive reserve based on the System's assessment of unit condition and current utilization levels.

Table 8.3-4 shows the annual forecast net power sales though 2016. The forecast data indicate that total annual sales will continue to increase within the EES.

8.3.2 REFERENCES

8.3-1 Plan Summary Document, Entergy Electric System Strategic Supply Resource Plan for the Planning Period 2007 – 2016, October 20, 2006.

Table 8.3-1
EES Resource Requirements and Long-Term Capability for 2007

	Baseload	Other[a]	Total
Resources (MW)	7451	15,041	22,492
Requirements (MW)	10,484[b]	13,835	24,319
Excess/(Deficit) (MW)	(3033)	1206	(1827)

a) Other resources include load-following, peaking, and reserve resources.

b) Projected to exist in approximately 75 - 85 percent of hours.

Table 8.3-2 (Sheet 1 of 8)
2007 Owned and Long-Term Contracted Resources Categorized to Type, Fuel, and Function

Name[1]	Load Role	Fuel	Operating Company	Capacity 2007 (MW)
Big Cajun 2, 3	Base Load	Coal	EGS	242
Independence 1	Base Load	Coal	EAI	263
Independence 1	Base Load	Coal	EMI	209
Independence 2	Base Load	Coal	EMI	211
Roy S. Nelson 6	Base Load	Coal	EGS	385
White Bluff 1	Base Load	Coal	EAI	465
White Bluff 2	Base Load	Coal	EAI	470
ANO 1	Base Load	Nuclear	EAI	843
ANO 2	Base Load	Nuclear	EAI	995
Grand Gulf	Base Load	Nuclear	EAI	411
Grand Gulf	Base Load	Nuclear	ELL	160
Grand Gulf	Base Load	Nuclear	EMI	377
Grand Gulf	Base Load	Nuclear	ENO	194
River Bend 70	Base Load	Nuclear	EGS	679
Waterford 3	Base Load	Nuclear	ELL	1,157
Attala	Other	Gas	EMI	455
Perryville CCGT	Other	Gas	EGS	401

Table 8.3-2 (Sheet 2 of 8)
2007 Owned and Long-Term Contracted Resources Categorized to Type, Fuel, and Function

Name[1]	Load Role	Fuel	Operating Company	Capacity 2007 (MW)
Perryville CCGT	Other	Gas	ELL	134
Baxter Wilson 1	Other	Gas	EMI	500
Baxter Wilson 2	Other	Gas	EMI	700
Gerald Andrus	Other	Gas	EMI	741
Lake Catherine 4	Other	Gas	EAI	547
Lewis Creek 1	Other	Gas	EGS	229
Lewis Creek 2	Other	Gas	EGS	230
Little Gypsy 1	Other	Gas	ELL	238
Little Gypsy 2	Other	Gas	ELL	415
Little Gypsy 3	Other	Gas	ELL	545
Michoud 2	Other	Gas	ENO	230
Michoud 3	Other	Gas	ENO	530
Ninemile 3	Other	Gas	ELL	125
Ninemile 4	Other	Gas	ELL	730
Ninemile 5	Other	Gas	ELL	740
Perryville CT	Other	Gas	EGS	117
Perryville CT	Other	Gas	ELL	39
Rex Brown 3	Other	Gas	EMI	70

Table 8.3-2 (Sheet 3 of 8)
2007 Owned and Long-Term Contracted Resources Categorized to Type, Fuel, and Function

Name[1]	Load Role	Fuel	Operating Company	Capacity 2007 (MW)
Rex Brown 4	Other	Gas	EMI	203
Roy S .Nelson 3	Other	Gas	EGS	153
Roy S .Nelson 4	Other	Gas	EGS	500
Sabine 1	Other	Gas	EGS	212
Sabine 2	Other	Gas	EGS	212
Sabine 3	Other	Gas	EGS	390
Sabine 4	Other	Gas	EGS	530
Sabine 5	Other	Gas	EGS	470
Sterlington 6	Other	Gas	ELL	212
Waterford 1	Other	Gas	ELL	411
Waterford 2	Other	Gas	ELL	405
Blakely	Other	Hydro	EAI	11
Buras 8	Other	Gas	ELL	12
Carpenter 1	Other	Hydro	EAI	29
Carpenter 2	Other	Hydro	EAI	30
Cecil Lynch 2	Other	Gas	EAI	60
Cecil Lynch 3	Other	Gas	EAI	110
Cecil Lynch Diesel	Other	Oil	EAI	5

Table 8.3-2 (Sheet 4 of 8)
2007 Owned and Long-Term Contracted Resources Categorized to Type, Fuel, and Function

Name[1]	Load Role	Fuel	Operating Company	Capacity 2007 (MW)
Degray	Other	Hydro	EAI	10
Delta 1	Other	Gas	EMI	97
Delta 2	Other	Gas	EMI	95
Hamilton Moses 1	Other	Gas	EAI	70
Hamilton Moses 2	Other	Gas	EAI	70
Harvey Couch 1	Other	Gas	EAI	12
Harvey Couch 2	Other	Gas	EAI	125
LA Station 10	Other	Gas	EGS	40
LA Station 11	Other	Gas	EGS	40
LA Station 12	Other	Gas	EGS	58
Lake Catherine 1	Other	Gas	EAI	0
Lake Catherine 2	Other	Gas	EAI	0
Lake Catherine 3	Other	Gas	EAI	0
Mabelvale 1	Other	Gas	EAI	14
Mabelvale 2	Other	Gas	EAI	14
Mabelvale 3	Other	Gas	EAI	14
Mabelvale 4	Other	Gas	EAI	14
Michoud 1	Other	Gas	ENO	0

Table 8.3-2 (Sheet 5 of 8)
2007 Owned and Long-Term Contracted Resources Categorized to Type, Fuel, and Function

Name[1]	Load Role	Fuel	Operating Company	Capacity 2007 (MW)
Monroe 10	Other	Gas	ELL	0
Monroe 11	Other	Gas	ELL	0
Monroe 12	Other	Gas	ELL	0
Natchez	Other	Gas	EMI	0
Ninemile 1	Other	Gas	ELL	50
Ninemile 2	Other	Gas	ELL	60
Remmel 1	Other	Hydro	EAI	4
Remmel 2	Other	Hydro	EAI	0
Remmel 3	Other	Hydro	EAI	4
Rex Brown 1	Other	Gas	EMI	15
Rex Brown 5	Other	Oil	EMI	11
Robert Ritchie 1	Other	Gas	EAI	300
Robert Ritchie 3	Other	Gas	EAI	16
Sterlington 7A	Other	Gas	ELL	180
Toledo Bend	Other	Hydro	EGS	46
Toledo Bend	Other	Hydro	ELL	23
Vidalia	Other	Hydro	ELL	64
Willow Glen 1	Other	Gas	EGS	152

Table 8.3-2 (Sheet 6 of 8)
2007 Owned and Long-Term Contracted Resources Categorized to Type, Fuel, and Function

Name[1]	Load Role	Fuel	Operating Company	Capacity 2007 (MW)
Willow Glen 2	Other	Gas	EGS	205
Willow Glen 3	Other	Gas	EGS	450
Willow Glen 4	Other	Gas	EGS	540
Willow Glen 5	Other	Gas	EGS	485
EAI WBL Sale (2003-2005) - ANO 1	Base Load	Nuclear	EAI	-46
EAI WBL Sale (2003-2005) - ANO 1	Base Load	Nuclear	EGS	0
EAI WBL Sale (2003-2005) - ANO 1	Base Load	Nuclear	ELL	23
EAI WBL Sale (2003-2005) - ANO 1	Base Load	Nuclear	EMI	0
EAI WBL Sale (2003-2005) - ANO 1	Base Load	Nuclear	ENO	23
EAI WBL Sale (2003-2005) - ANO 2	Base Load	Nuclear	EAI	-54
EAI WBL Sale (2003-2005) - ANO 2	Base Load	Nuclear	EGS	0
EAI WBL Sale (2003-2005) - ANO 2	Base Load	Nuclear	ELL	27
EAI WBL Sale (2003-2005) - ANO 2	Base Load	Nuclear	EMI	0

Table 8.3-2 (Sheet 7 of 8)
2007 Owned and Long-Term Contracted Resources Categorized to Type, Fuel, and Function

Name[1]	Load Role	Fuel	Operating Company	Capacity 2007 (MW)
EAI WBL Sale (2003-2005) - ANO 2	Base Load	Nuclear	ENO	27
EAI WBL Sale (2003-2005) - Grand Gulf	Base Load	Nuclear	EAI	-56
EAI WBL Sale (2003-2005) - Grand Gulf	Base Load	Nuclear	EGS	0
EAI WBL Sale (2003-2005) - Grand Gulf	Base Load	Nuclear	ELL	28
EAI WBL Sale (2003-2005) - Grand Gulf	Base Load	Nuclear	EMI	0
EAI WBL Sale (2003-2005) - Grand Gulf	Base Load	Nuclear	ENO	28
EAI WBL Sale (2003-2005) - Independence 1	Base Load	Coal	EAI	-14
EAI WBL Sale (2003-2005) - Independence 1	Base Load	Coal	EGS	0
EAI WBL Sale (2003-2005) - Independence 1	Base Load	Coal	ELL	7
EAI WBL Sale (2003-2005) - Independence 1	Base Load	Coal	ENO	7
EAI WBL Sale (2003-2005) - White Bluff 1	Base Load	Coal	EAI	-25
EAI WBL Sale (2003-2005) - White Bluff 1	Base Load	Coal	ELL	13

Table 8.3-2 (Sheet 8 of 8)
2007 Owned and Long-Term Contracted Resources Categorized to Type, Fuel, and Function

Name[1]	Load Role	Fuel	Operating Company	Capacity 2007 (MW)
EAI WBL Sale (2003-2005) - White Bluff 1	Base Load	Coal	ENO	13
EAI WBL Sale (2003-2005) - White Bluff 2	Base Load	Coal	EAI	-25
EAI WBL Sale (2003-2005) - White Bluff 2	Base Load	Coal	ELL	13
EAI WBL Sale (2003-2005) - White Bluff 2	Base Load	Coal	ENO	13
EPI - ISES 2	Base Load	Coal	ELL	50
EPI - ISES 2	Base Load	Coal	ENO	50
River Bend 30%	Base Load	Nuclear	ELL	196
River Bend 30%	Base Load	Nuclear	ENO	98

Notes:

1. WBL = Wholesale Base Load

{{{***Proprietary Information – Withheld Under 10 CFR 2.390(a)(4)***}}}
(see COL Application – Part 9)

Table 8.3-3- (Sheet 1 of 2)
Summary of Planned Resources 2007 - 2016

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
DEMAND and OWNED RESOURCES										
Total Reliability Needs[a]	{{{									}}}
Nuclear	{{{									}}}
Coal	{{{									}}}
Gas/Oil	{{{									}}}
Hydro	{{{									}}}
Controlled Resources	{{{									}}}
Provision for ERS/IR Units[b]	{{{									}}}
Total Resources	{{{									}}}
Provision for DSM Program[c]	{{{									}}}
Total Expected Procurement	{{{									}}}
SUPPLY PLAN										
Long-Term Resources										
Definitive Acquisitions	{{{									}}}
Definitive PPAs	{{{									}}}
Planned Long-Term Additions										
Load Following	{{{									}}}

{{{***Proprietary Information – Withheld Under 10 CFR 2.390(a)(4)***}}}
(see COL Application – Part 9)

Table 8.3-3- (Sheet 2 of 2)
Summary of Planned Resources 2007 - 2016

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
SUPPLY PLAN (cont.)										
Solid Fuel	{{{									}}}
Total Long-Term	{{{									}}}
Limited-Term Resources										
Definitive Limited-Term Resources										
Load Following	{{{									}}}
Peaking	{{{									}}}
Annual Call / Block Options	{{{									}}}
Solid Fuel	{{{									}}}
Planned Limited-Term Resources										
Load Following	{{{									}}}
Peaking	{{{									}}}
Annual Call / Block Options	{{{									}}}
Solid Fuel	{{{									}}}
Total Limited-Term	{{{									}}}
Total Planned Resources	{{{									}}}

a) Reliability Requirement (MW) consists of "Forecast Peak Demand + Reserve Margin" from Table 8.2-7.
b) Provision for ERS/IR units represents the planned retirement of gas/oil units.
c) Provision for DSM program represents optional retirement of gas/oil units.

Table 8.3-4
Annual Forecast Net Power Sales (in MWh)

	Firm	Nonfirm
2006	{{{	}}}
2007	{{{	}}}
2008	{{{	}}}
2009	{{{	}}}
2010	{{{	}}}
2011	{{{	}}}
2012	{{{	}}}
2013	{{{	}}}
2014	{{{	}}}
2015	{{{	}}}
2016	{{{	}}}

Note:

Load forecast is subject to a number of uncertainties including, but not limited to, the following:

* The potential for retail open access in parts of the EES.

* The potential for retail customer losses.

8.4 ASSESSMENT OF NEED FOR POWER

8.4.1 BASE LOAD DEMAND

The EES SSRP (Reference 8.4-1) comprehends a set of planning objectives and principles for long-term generation supply resource planning. The planning process determines the type of generation needed to meet customer requirements by analysis of expected customer load. For long-term planning purposes EES has adopted the guideline that base load capacity should be sufficient to meet load levels projected to exist in 85 percent of hours. Based on that criterion, EES currently has a base load deficit of approximately 3 gigawatts. That deficit is expected to increase over time with load growth as shown in Table 8.2-7. See Figure 8.4-1.

EES anticipates adding base load generating capacity to meet the current and projected supply role deficit. Additional long-term base load capacity is needed to ensure a reliable supply of base load energy, meet base load energy needs at an economic price, and reduce the risk for price volatility associated with reliance on gas-fueled generation and power purchases. EES plans to meet these requirements largely with long-term resources, whether owned assets or long-term power purchase agreements.

8.4.2 RESERVE MARGIN

The EES SSRP (Reference 8.4-1) comprehends a set of planning objectives and principles for long-term generation supply resource planning. The SSRP envisions that EES will maintain sufficient generating capacity to meet its reliability requirement, expressed as peak load plus an adequate provision for reserves. EES presently estimates its reserve requirement to be 16.8 percent based on a criterion that loss of load probability should not exceed one day in ten years. The reserve requirement increase anticipated to occur following EAI's and EMI's termination of their participation in the System Agreement has not yet been factored into the SSRP analysis. Table 8.2-7 presents the forecasted firm peak demand and the total reliability power need (peak demand plus the reserve requirement) from 2007 through 2017. For example, in 2007, the firm peak demand is just under 21,000 MW. With a reserve margin of 16.8 percent (or 3500 MW), the total reliability need is approximately 24,300 MW.

As shown in Table 8.3-1, EES currently has a reliability deficit of almost 2 gigawatts, when compared to existing owned and long-term contracted resources. That deficit is expected to increase as load grows. EES plans to meet these requirements largely from long-term resources, whether owned assets or long-term power purchase agreements.

8.4.3 CONCLUSION

EES needs to add long-term generating capacity in order to meet both reliability requirements and base load supply needs. The EES SSRP for the period 2007 – 2016 systematically and comprehensively provides the analysis of future power needs and concludes that additional supply resources will be required to meet the need for power. The SSRP has been shown to be responsive to forecasting uncertainty and is provided for review to the operating companies' retail regulators for information purposes.

8.4.4 REFERENCES

8.4-1 Plan Summary Document, Entergy Electric System Strategic Supply Resource Plan for the Planning Period 2007 - 2016, October 20, 2006.

{{{***Proprietary Information – Withheld Under 10 CFR 2.390(a)(4)***}}}

(See COL Application - Part 9)

Figure 8.4-1. Need For Power

CHAPTER 9 ALTERNATIVES TO PROPOSED ACTION

The proposed action is the U.S. Nuclear Regulatory Commission (NRC) issuance of a combined license (COL) to the Applicant to construct and operate RBS Unit 3. The Applicant's objective is to obtain a license for the construction and operation of a baseload generating facility.

This chapter describes the alternatives to construction and operation of a new nuclear unit at the RBS site and alternative plant and transmission systems. The following descriptions provide sufficient detail for the reader to evaluate the effects of these alternative generation options or plant and transmission systems relative to those of the proposed action.

The chapter is divided into four sections:

- No-Action Alternative (Section 9.1).
- Energy Alternatives (Section 9.2).
- Alternative Sites (Section 9.3).
- Alternative Plant and Transmission Systems (Section 9.4).

9.1 NO-ACTION ALTERNATIVE

The no-action alternative, in the context of a COL application, means that some portion of the necessary federal, state, or other required approvals, licenses, and/or permits for the project would be denied. As a result, it is assumed that the Applicant would not proceed with the construction and operation of the proposed Unit 3 facility, even though the need for power is demonstrated in Chapter 8.

The Applicant's intent, consistent with the intent of 10 CFR 52, is to obtain a COL for the potential future construction and operation of a new nuclear powered electricity generating unit (Unit 3) at the RBS site. Chapter 8 of this Environmental Report (ER) provides an assessment of the need for electrical power. In accordance with the intent of 10 CFR 51 (Subpart A, Appendix A.4), this section describes the no-action alternative as well as the impacts that would result if the no-action alternative is chosen (i.e., the need for electrical power is not satisfied by construction and operation of the proposed unit).

Electricity demand in the South, which is driven primarily by increased population and higher per capita consumption of electricity, is expected to increase by almost 1.1 percent annually for the foreseeable future (Reference 9.1-1). Without adding electric power generating capability, the Applicant would not be able to maintain an adequate reserve electrical power margin. If the Applicant took no action at all to meet the growing electricity demands, the ability of the Applicant to continue to supply low-cost, reliable electrical power to its customers would be impaired. Additionally, the no-action alternative could lead to blackouts and a failure of the Applicant's utilities to satisfy their statutory obligation to supply reliable power to their customers. Consequently, it would be unreasonable for the Applicant or the state to take no action at all to meet the growing demands for electricity.

By not adding the proposed new source of nuclear-generated electrical power, customers would lose the possibility of having one of the least expensive and less price-volatile electrical generation sources displaced by more expensive, and often more price-volatile electrical generation options in the dispatch mix. In addition, national goals to advance the use of nuclear energy would have to be achieved by other means.

Consistent with the guidance of Section 9.1 of NUREG-1555, the no-action alternative would result in the proposed RBS Unit 3 not being built. The no-action alternative would mean that the electric power generation capacity to be provided by RBS Unit 3 would not become available. In accordance with NUREG-1555 guidance, the no-action alternative also presupposes that no additional conservation measures would be enacted to decrease the amount of electrical capacity that would otherwise be required.

As evaluated in Chapter 8 and summarized in Section 8.4, it has been shown that the Entergy Electric System (EES) must add baseload generating capacity to meet the current and projected supply role deficits. The cancellation of this project along with no action to replace (owner-controlled) capacity could (1) prevent the Applicant from ensuring a reliable supply of baseload energy, (2) compromise its ability to meet baseload energy needs at an economic price, and (3) increase the Applicant's exposure to the price volatility associated with reliance on gas-fueled generation and power purchases. In light of these consequences, the no-action alternative is not reasonable.

Given the need for power demonstrated in Chapter 8, in the absence of the proposed generation capability, the Applicant would act to meet its reliability goals and service area power needs, thus mitigating adverse impacts to consumers and to the broader economic productivity of the region. Therefore, the EES would pursue (1) appropriate power purchase agreements and/or (2) construction of new owner-controlled generation assets at other sites. Both alternatives are addressed below regarding prior environmental impact analyses. In addition, as a matter of completeness, energy conservation and efficiency measures (that is, demand-side management) are also addressed below. Without having the proposed unit as an electrical power resource, the Applicant could be forced to consider and/or pursue alternate ways of fulfilling the need for electrical power as discussed below:

- Power purchase agreement options from existing generating sources are discussed in Subsection 9.2.1. Options for new alternative generating sources are discussed in Subsections 9.2.2 and 9.2.3.

- The required electrical power could be provided by the construction of a new electricity generating capacity, using other generating alternatives rather than nuclear power. The new capacity may be constructed at the RBS or at other nondesignated sites. Assessments of these alternatives are provided in Section 9.2.

- It is also possible that some combination of the above approaches could be taken to provide the equivalent of the electricity generating capacity lost by pursuing the no-action alternative. For example, the needed capacity could be obtained by a certain amount of new gas turbine electricity generation, combined with the purchasing of electricity from outside the EES. Potential combinations of alternative energy sources are considered in Section 9.2.

- Energy conservation and efficiency (that is, demand-side management) programs typically consist of a wide range of planning, implementing, communication, and monitoring activities that are designed to encourage consumers to modify their level and pattern of electrical usage. Entergy already has active programs in place that encourage conservation and offer public education information and tools to assist residential and commercial clients to improve energy use efficiency. However, given the magnitude of the current and projected need for power, it is reasonable to conclude that energy conservation and related demand-side management programs could offset only a small fraction of the required baseload power need.

Section 10.4 evaluates the overall benefit and cost of the proposed new facility. As concluded in Subsection 10.4.3, on balance, the benefits of construction and operation of RBS Unit 3 significantly outweigh the associated economic, environmental, and social costs. If the unit were not constructed or operated, then the associated costs would not be incurred. However, given the overall assessment that the project represents a significant outweighing benefit, it follows that net benefit would not be realized under the no-action alternative.

9.1.1 REFERENCES

9.1-1 Energy Information Administration, "Supplemental Tables to the Annual Energy Outlook 2008," Website, http://www.eia.doe.gov/oiaf/aeo/supplement/index.html, accessed January 16, 2008.

9.2 ENERGY ALTERNATIVES

This section provides an analysis of the environmental impacts associated with alternatives to the RBS Unit 3 project.

The RBS Unit 3 project is a nuclear-powered electrical generation facility, to be used in a baseloaded manner. One GEH ESBWR is proposed at RBS Unit 3. Power generated by the facility would be expected to be baseload capable. The Applicant assumed a target value of 1600 megawatts electrical (MWe) for the net electrical output from the facility. This is a bounding value and is the basis for the alternatives analyzed in this section.

The options considered as alternatives to this proposal are consistent with, and bounded by, the suite of actions included in the Applicant's comprehensive analysis (Reference 9.2-1) of energy supply options to meet the anticipated need for power in the Applicant's power service area through the year 2016. The resulting Strategic Supply Resource Plan (SSRP) was developed to provide the Applicant's roadmap or guide for addressing those energy needs with a flexible energy supply plan.

In that review, the Applicant considered a broad range of supply-side and customer service options, using multiple evaluation criteria and considering future uncertainties. The Applicant created an extensive list of generating options to meet new peaking, intermediate, baseload, and storage power supply needs. These options include traditional technologies (such as coal plants and combustion turbines), as well as potential renewable and advanced combustion facilities and options to create greater flexibility in planning (such as purchasing competitively priced power from other suppliers, buying options on future power delivery, and entering business partnering arrangements).

From an extensive series of iterative evaluations, strategies emerged that met the demand for power and offered the Applicant low-cost, lower debt, improved environmental and economic development performance, as well as providing hedges against key uncertainties, namely load growth, natural gas prices, possible environmental regulations for air and water, and nuclear performance. The strategies involving both supply- and demand-side management options were further evaluated in the SSRP.

The SSRP identifies preliminary expectations regarding timing and location (planning region) for new long-term resources, and the expected participation in each resource (to be finalized by the Applicant's Operating Committee at the time the commitment to the resource is made). The amounts and timing discussed in the SSRP reflect the Applicant's needs. Preliminary resource participation is based on consideration of the Applicant's operating companies' supply requirements to meet load shape and expected business risks and conditions.

Alternatives that do not require new generating capacity are discussed in Subsection 9.2.1, while new generation alternatives are discussed in Subsection 9.2.2. In Subsection 9.2.2, some of the alternatives that require new generating capacity are eliminated from further consideration and discussion based on their availability in the region, overall feasibility, ability to supply baseload power, or environmental consequences. In Subsection 9.2.3, the alternatives that were not eliminated are investigated in further detail relative to specific criteria such as environmental impacts, reliability, and economic costs. Subsection 9.2.4 provides a summary and conclusions for the review of energy alternatives.

9.2.1 ALTERNATIVES NOT REQUIRING NEW GENERATING CAPACITY

This subsection provides an assessment of the economic and technical feasibility of meeting energy demand without building a new nuclear facility. Alternatives to a new nuclear facility include the following:

- Power purchases from other utilities or power generators (Subsection 9.2.1.1).
- Plant reactivation or extended service life (Subsection 9.2.1.2).
- DSM measures (Subsection 9.2.1.3).
- Any combination of these options that would be equivalent to the output of the project and, therefore, eliminate the need for new generation (Subsection 9.2.1.4).

9.2.1.1 Power Purchases

The amount of additional generating capacity required in the Southeastern Electric Reliability Council (SERC) area is expected to be more than 65,000 MW between 2006 and 2030 (Reference 9.2-2).

If power to replace the capacity of a new nuclear unit were to be purchased from sources within the United States or a foreign country, the generating technology would likely be one of those described in Subsection 9.2.2 (i.e., coal, natural gas, or nuclear) (Reference 9.2-3). The description of the environmental impacts associated with the construction and operation of other technologies is discussed in Subsection 9.2.2. The environmental impacts of the purchased power alternative would still occur, but the impacts would occur somewhere else in the region, nation, or another country.

As described in NUREG-1817, Section 8.2.1, if the purchased power alternative were implemented, one major environmental unknown would be whether new transmission rights-of-way (ROWs) would be required. If existing ROWs could be utilized, the environmental impacts of transmission of purchased power would be SMALL. If new ROWs would have to be acquired, there are both environmental and aesthetic consequences related to their construction. The environmental impacts related to new ROWs could range from SMALL to LARGE. The environmental impacts of the power generation would be unknown because of the unknown technology and location of the power generation.

Purchasing power from other utilities or power generators is not considered a reasonable or environmentally preferable alternative to the proposed project for large baseload capacity.

9.2.1.2 Plant Reactivation or Extended Service Life

The likely replacement for the proposed project would be coal- or natural gas-fired units. As a result, it was concluded that the environmental impacts of a refurbishment scenario would be bounded by the coal- and natural gas-fired alternatives evaluated in Subsection 9.2.2.

Fossil fuel plants slated for retirement tend to be ones that are old enough to have difficulty economically meeting modern restrictions on air pollutant emissions and, as a result, would require extensive refurbishing at great economic cost to meet the more restrictive environmental standards. Therefore, refurbishment of a fossil plant is not a reasonable alternative from an economic perspective. As is the case for purchased power, if additional capacity could economically be made available and meet company, state, and federal environmental goals, then the market demand precondition criteria for building the proposed project would not be met and is thus a bounding condition.

It is conceivable that another nuclear plant could be a potential alternative energy source through reactivation or license renewal. Continued operation of a nuclear power plant would avoid the environmental impacts related to construction, so continued operation of an existing nuclear power plant would have fewer environmental impacts than the construction of a new plant. However, continued operation of an existing plant does not provide additional generating capacity. All of the Applicant's nuclear plants underwent power uprates recently.

Therefore, given the need for the proposed project, the reactivation or additional extended service life options are not considered reasonable or environmentally preferable.

9.2.1.3 Demand-Side Management (DSM) Measures

DSM is the practice of reducing customers' demand for energy through programs such as energy conservation, efficiency, and load management, so that the need for additional generation capacity is reduced or eliminated.

Current measures by the Applicant, as reported in Reference 9.2-4, accounted for approximately 2 MW in residential and commercial sectors in 2006, at a cost of approximately $3.24 million. Although DSM programs are an important part of the Applicant's energy portfolio, the Applicant concludes that additional DSM, by itself, would not be sufficient to replace the capacity of RBS Unit 3 when it comes on line in the 2015 to 2020 time frame. Additional energy savings are anticipated as described in Section 8.2; however, the Applicant's forecast of ongoing growth despite conservation and energy efficiency concludes that demand and consumption will continue to grow throughout the forecast period. Furthermore, it is anticipated that the savings will largely relate to peak load, with relatively little impact on baseload power needs.

The purpose of RBS Unit 3 is to generate baseload power. DSM programs do not generate baseload power. Therefore, DSM programs are not considered a reasonable alternative to a baseload nuclear power plant. Consequently, this alternative was not considered further for RBS Unit 3.

9.2.1.4 Combination of Alternative Elements

From an environmental impact standpoint, conservation could be considered in combination with other energy sources. Combinations of the viable alternatives, such as coal and natural gas, are addressed in Subsection 9.2.3. That evaluation concludes that such combinations would not result in an environmentally preferable alternative. The ability to offset some portion of required capacity is not expected significantly to reduce environmental impacts.

9.2.2 ALTERNATIVES REQUIRING NEW GENERATING CAPACITY

This subsection discusses the possible use of alternatives requiring new generating capacity that could equal the additional 1600 MW generating capacity (1520 MW net capacity) expected from a new nuclear facility considered for the RBS site. This COLA is premised on the installation of a facility that would primarily serve as a large baseload generator; any feasible alternative would also need to be able to generate baseload power. This subsection considers (1) alternatives not yet commercially available, (2) fossil fuels, and (3) alternatives uniquely available within the region to be served by the proposed project.

During the lifetime of the proposed project, it is expected that technology would allow continued improvement of RBS Unit 3's operational and environmental performance. Thus, qualitative or quantitative analyses of future relative competitiveness or impacts are subject to those uncertainties. However, as in the case of alternatives evaluated in Subsection 9.2.1, it is believed that sufficient knowledge is available at this time to make reasonable comparisons of the alternatives in the principal areas of environmental impacts to satisfy the intent and requirements of a COLA.

NUREG-1437 represents a useful spectrum of alternative source analyses. In this document, the NRC calculated alternatives with commonly known generation technologies and researched various states' energy plans to identify alternative generation sources typically being considered. Although NUREG-1437 is specific to license renewal, the alternative analyses in it can be applied to determine if the alternative technology represents a reasonable alternative to the proposed action and satisfies the intent and requirements of 10 CFR 52 regarding a COLA.

In satisfying National Environmental Policy Act (NEPA) requirements, the NRC considered these reasonable alternatives, as documented in NUREG-1437:

- Wind power.
- Solar power.
- Hydropower.
- Geothermal energy.
- Biomass-derived fuels.
- Municipal solid waste.

- Fuel cells.
- Petroleum liquids.
- Coal.
- Integrated gasification combined cycle (IGCC).
- Natural gas.
- Possible combinations of the above.

Each of the alternatives is assessed and discussed in the subsequent subsections relative to the following criteria:

- The alternative energy conversion technology is developed, proven, and available in the applicable region during the RBS lifetime.
- The alternative energy source provides baseload generating capacity and availability equal to the project.
- The alternative energy source does not result in environmental impacts in excess of those of a nuclear plant, and the costs of an alternative energy source do not exceed the costs that make it economically impractical.

Based on one or more of these criteria, several of the alternative energy sources were considered technically or economically infeasible after a preliminary review and were not considered further. Alternatives that were considered technically and economically feasible were assessed in detail in Subsection 9.2.3.

9.2.2.1 Wind

While wind technology is continuously improving in capacity factor and, of course, is attractive because of the renewable energy source characteristics, low capacity factors and intermittent energy production for wind-generated power, along with excessive cost of energy storage devices, make this source unacceptable as an alternative to a baseload electricity generator. Wind turbines can achieve periods of installed capacity ranging from 24 to 63 percent, depending on location. Common capacity factors range from 25 to 40 percent for wind turbines. However, such performance falls short of the 90 to 95 percent required for a baseload plant. Utilities today that utilize wind as a variable energy resource typically integrate 10 to 20 percent of their energy needs to this resource. Absorbing intermittent generation can be an issue for small utilities or systems, but not for large regional markets.

Another key consideration is land use. Wind turbines must be sufficiently spaced to maximize capture of the available wind energy. If the turbines are too close together, one turbine can affect the efficiency of another turbine. In open, flat terrain, a utility-scale wind plant will require about 60 ac. per megawatt of installed capacity. However, only 5 percent (3 ac.) or less of this area is actually occupied by turbines, access roads, and other equipment; 95 percent remains free for other compatible uses such as farming or ranching (Reference 9.2-5). Thus, for an equivalent 1600 MWe of electrical generation, at least 4800 ac. is required. This does not factor in the reduced capacity factor for wind. Using the information that, on average, wind would require 3.5 times as many MWe installed capacity to provide an average capacity factor of 90 percent, the required land commitment increases to 16,800 ac.[a]

Wind resource maps estimate the resource in terms of wind power classes ranging from Class 1 (the lowest - average wind speeds of 12.5 mph [5.6 m/s]) to Class 7 (the highest - average wind speeds of 11.9 mph [26.6 m/s]). Each class also represents a range of mean wind power density (in units of W/m^2) or equivalent mean wind speed at the specified height(s) aboveground. Areas designated Class 3 or greater are suitable for most wind turbine applications, whereas Class 2 areas are marginal. Class 1 areas are generally not suitable, although a few locations (e.g., exposed hilltops not shown on the resource maps) with adequate wind resource for wind turbine applications may exist in some Class 1 areas (Reference 9.2-7). Louisiana is predominantly a Class 1 wind power region, with some offshore capability as Class 2. Therefore, the area is not suitable, in general, for utilizing wind as a variable energy resource, including through the possible use of offshore wind farms (Reference 9.2-8).

Although wind technology is considered mature, technological advances may make wind a more economical choice for developers than other renewables (Reference 9.2-9). Technological improvements in wind turbines have helped reduce capital and operating costs. In 2006, wind power was produced in a range of $0.03 - $0.06/kWh (depending on wind speeds), but by 2020, wind power generating costs are projected to fall to an average of $0.04/kWh (Reference 9.2-10).

The installed capital cost of a wind farm includes planning, equipment purchase, and construction of the facilities. This cost, typically measured in $/kWe at peak capacity, has decreased from more than $2500/kWe in the early 1980s to less than $1000/kWe for wind farms in the United States. This decrease in construction costs is due primarily to improvements in wind turbine technology and also to the general increase in wind farm sizes. Larger wind farms in windy areas benefit from economies of scale during all phases of a wind project, from planning to decommissioning, because fixed costs can be spread over a larger total generating capacity. These "economies of scale" may not be available in the region of interest, given the extremely limited availability of the resource (Reference 9.2-9).

As an example of cost, a wind generating facility that has an installed capacity of 75 MWe can produce power at a levelized rate of $0.049/kWh. With the federal Production Tax Credit (PTC), the cost is reduced to $0.027 - $0.035/kWh. The PTC primarily reduces the tax burden and operating costs for wind generating facilities, which has been vital to the financing of facilities. The PTC is scheduled to expire in December 2008 and has not yet been renewed. As a tax credit, the PTC represents 1.8 cents per kWh of tax-free money to the project owner. If the owner did not receive the tax credit and wanted to recoup the 1.8 cents per kWh with taxable revenue from electricity sales, the owner would have to add at least 1.8 cents and possibly as much as 2.8 cents to the sales price of each kWh, assuming a 36 percent marginal tax rate.

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a. NRC has estimated that wind farms with sufficient capacity to meet the target site requirement of 1600 MWe would require from 64,000 to 214,400 ac. The range is based on estimated land use rates per MW, reported by the NRC for the Storm Mountain project (West Virginia) and the Altamont Pass Facility (California) (Reference 9.2-6).

The Energy Information Agency (EIA) *Annual Energy Outlook 2007 with Projections to 2030* (Reference 9.2-2) estimated that the levelized cost of electricity generated by wind plants coming on line in 2015 (over a 20-year financial project life) would be approximately 5.06 cents per kWh (based on 2005 cents per kWh). In contrast, the levelized cost for electricity from new natural gas combined cycle plants is 5.53 cents per kWh, and for new coal-fired plants, the projected cost is 5.36 cents per kWh. Nuclear plants are anticipated to produce power at 4.78 cents per kWh (see also References 9.2-11 and 9.2-12).

In addition to the construction and operating and maintenance costs for wind farms, there are costs for connection to the transmission grid. Any wind project would have to be located where the project would produce economical generation, and that location may be far removed from the nearest possible connection to the transmission system. A location far removed from the power transmission grid might not be economical, because new transmission lines would be required to connect the wind farm to the distribution system. Existing transmission infrastructure may need to be upgraded to handle the additional supply. Soil conditions and the terrain must be suitable for the construction of the towers' foundations. Finally, the choice of a location may be limited by land use regulations and the ability to obtain the required permits from local, regional, and national authorities. The farther a wind energy development project is from transmission lines, the higher will be the cost of connection to the transmission and distribution system. In contrast, the RBS Unit 3 site is located in south-central Louisiana and is located near interties with the adjoining transmission systems.

The distance from transmission lines at which a wind developer can profitably build depends on the cost of the specific project. Consider, for example, the cost of construction and interconnection for a 115 kV transmission line that would connect a 50 MWe wind farm with an existing transmission and distribution network. The EIA estimated that, in 1995, the cost of building a 115 kV line was $130,000 per mile, excluding ROW costs (Reference 9.2-13). This amount includes the cost of the transmission line itself and the supporting towers. It also assumes relatively ideal terrain conditions, including fairly level and flat land with no major obstacles or mountains (more difficult terrain would raise the cost of erecting the transmission line). In 1993, the cost of constructing a new substation for a 115 kV transmission line was estimated at $1.08 million and the cost of connection for a 115 kV transmission line with a substation was estimated at $360,000 (Reference 9.2-14).

Another consideration about the integration of the wind capacity into the electric utility system is the variability of wind energy generation. Wind-driven electricity generating facilities must be located at sites with specific characteristics to maximize the amount of wind energy captured and electricity generated (Reference 9.2-10). In addition, for transmission purposes, wind generation is not considered "dispatchable," meaning that the generator cannot control output to match load and economic requirements. Since the resource is intermittent, wind, by itself, is not considered a source of baseload capacity. The inability of wind alone to be a dispatchable, baseload producer of electricity is inconsistent with the objectives for the RBS Unit 3 facility.

Finally, wind does have environmental impacts, in addition to the land requirements posed by large facilities. First, some consider large-scale commercial wind farms to be an aesthetic problem. In one case, residents opposing the Cordelia Hills wind project in Solano County, northeast of San Francisco, reportedly did not want to see turbines sited nearby, even though the hills chosen for the project already had numerous electronic relays and transmission lines.

Aesthetic impacts were also a key factor behind opposition to wind development at Tejon Pass, one of the most scenic areas close to Los Angeles (Reference 9.2-15). In yet another high profile case, this time involving the first large-scale effort to harness sea breezes (called the "Cape Wind" project), this effort has been stalled for more than 8 years as environmental impacts on birds, sea mammals, tourism, local fishermen, and a variety of other issues are being settled (Reference 9.2-16).

Second, high-speed wind turbine blades can be noisy, although technological advancements continue to lessen this problem. Finally, wind facilities sited in areas of high bird use can expect to have fatality rates higher than those expected if the wind facility were not there (Reference 9.2-17). Land use/water use and aesthetic impacts could be MODERATE to LARGE, while other impacts to human health and the environment would be SMALL.

The Applicant has concluded that, because of the inability of wind power to generate baseload power, the projected land use impacts, and the cost of additional transmission facilities to connect all of these turbines to the transmission system, wind by itself is not a reasonable alternative to the RBS Unit 3.

9.2.2.2 Solar Technologies

There are currently two practical methods to produce electricity from solar energy: photovoltaic and solar thermal power. Photovoltaics ("solar cells") convert sunlight directly into electricity using semiconducting materials. Solar thermal power systems convert sunlight into electricity using heat as an intermediate step. These systems generate electricity from this heat through various methods. For this discussion, the different methodologies of nonphotovoltaic systems are grouped together.

Some solar thermal systems can also be equipped with a thermal storage tank to store heated transfer fluid. These solar thermal plants can then dispatch electric power on demand using this stored heat.

Solar technologies produce more electricity with more intense and direct sunlight. Cloudy days can significantly reduce output. To work effectively, solar installations require consistent levels of sunlight (solar insolation). The lands with the best solar resources are usually arid or semi-arid. While photovoltaic systems use both diffuse and direct radiation, solar thermal power plants can only use the direct component of the sunlight. This makes solar thermal power less suitable for areas like the south-central United States, with high humidity and frequent cloud cover, both of which diffuse solar energy and reduce its intensity. The solar power resource potential at the RBS site is approximately 4 kWh/m^2/day for concentrated solar power and 5 to 6 kWh/m^2/day for photovoltaic solar power (Reference 9.2-18).

Like wind, the capacity factors of solar are too low to meet baseload requirements. Average annual capacity factors for solar power systems are relatively low (24 percent for photovoltaics and 30 to 32 percent for solar thermal power) compared to 90 to 95 percent for a baseload plant such as a nuclear plant.

Land use requirements (and associated construction and ecological impacts) are also much greater for solar technologies than for a nuclear plant. The area of land required depends on the available solar insolation and type of plant, but is about 8 ac/MW for photovoltaic systems and 3.8 ac/MW for solar thermal power plants.

Assuming capacity factors of 24 percent for photovoltaics and 32 percent for solar thermal power, facilities that have a 1520 MW net capacity are estimated to require 50,667 ac. (79 sq. mi.), if powered by photovoltaic cells, and 18,050 ac. (28 sq. mi.), if powered by solar thermal power. The total construction area of a nuclear plant the size of RBS Unit 3 is expected to require about 364 ac., of which approximately 43 ac. would be required for permanent facilities. This is equivalent to 0.03 ac/MWe.

Solar-powered technologies (photovoltaic cells and solar thermal power) do not currently compete with conventional technologies in grid-connected applications because of higher capital costs per kilowatt of capacity. Capital costs for photovoltaic installations range from $3000/kW to $4000/kW, and capital costs for solar thermal installations range from $2000/kW to $3000/kW. Recent estimates indicate that in areas with good solar insolation, the levelized cost of electricity produced by photovoltaic cells is $0.18/kWh to $0.23/kWh, and electricity from solar thermal systems can be produced for a cost of $0.09/kWh to $0.12/kWh (References 9.2-19 and 9.2-20). Solar energy costs are expected to be much higher in areas like the south-central United States, which have lower solar insolation. For the reasons discussed above, solar power cannot generate baseload power; therefore, it is not a reasonable alternative proposed project. Additionally, because of the land commitments (with associated environmental and aesthetic impacts), solar power is not an environmentally preferable alternative to the proposed project.

9.2.2.3 Hydropower

Hydroelectric or hydropower has the ability to produce higher capacity factors than wind and solar technologies. The NRC (Reference 9.2-3) indicated that capacity factors approaching approximately 50 percent could be expected from hydropower, but this cannot meet the baseload requirement. Louisiana has an estimated 226 MW of developable hydroelectric resources (Reference 9.2-21).

Land use for a large-scale hydropower facility is estimated to be quite large. To meet the 1600 MWe target for the proposed project, a hydropower facility is estimated to require approximately 1,600,000 ac. The NRC also notes that such facilities are difficult to site as a result of public concerns over flooding, destruction of natural habitats, and alteration of natural river courses. Hydropower is not a reasonable alternative to the proposed project because it cannot produce baseload power; there are insufficient undeveloped hydroelectric resources in the region to supply the amount of power to be produced by the proposed project, and hydropower is not environmentally preferable to the proposed project.

9.2.2.4 Geothermal

Geothermal energy has an average capacity factor of 90 percent and can be used for baseload power where available. However, geothermal energy is not widely used for baseload power generation because of the limited geographical availability of the resource and immature status of the technology (Reference 9.2-3). Geothermal plants are likely to be sited in the western continental United States, Alaska, and Hawaii, where hydrothermal reservoirs are prevalent. Louisiana 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 direct heat or geothermal heat pumps (Reference 9.2-22). There is no feasible eastern location where geothermal capacity could serve as an alternative to a baseload nuclear power plant.

For the preceding reasons, it was concluded that a geothermal energy facility at or in the vicinity of the RBS site would not be a reasonable alternative to construction of a 1600 MWe nuclear power generation facility operated as a baseload plant.

9.2.2.5 Biomass Related Fuels

Biomass combustion is a current significant energy source for electrical generation. Supplying almost 850 gigawatt-hours (GWh) (2.9 quadrillion British thermal units [Btu] [quads]) of energy in 2003 (including municipal solid waste), it has surpassed hydropower as the largest domestic source of renewable energy. In Louisiana in fiscal year 2006, wood and woodwaste and other biomass fuels contributed 525 total net summer MWe or 2 percent of the state total net summer renewable capacity (Reference 9.2-23). Biomass fired facilities generate electricity using commercially available equipment and well-established technology. This energy is dispatchable on demand because it is combustion based.

Energy crops such as switchgrass could be grown to ensure a reliable supply of biomass feedstocks for electricity generation. Detrimental environmental impacts can result from converting large tracts of land for the production of energy crops. These include changes to wildlife habitat and biodiversity, reduced soil fertility, increased erosion, and reduced water quality. The net environmental impacts vary as a result of many factors, including previous land use, the particular energy crop, and how the crop is managed. Displacing natural land cover with energy crops would likely have negative impacts.

Biomass is the largest renewable energy resource in Louisiana. Approximately 3031 thousand megawatt-hours (MWh) were generated in fiscal year 2006 (approximately 3.3 percent of the total renewable net generation) (Reference 9.2-23). The energy content of dry biomass ranges from 7000 Btu per pound (Btu/lb) for straws to 8500 Btu/lb for wood. However, currently, the cost of switchgrass and other energy crops is almost twice the cost of coal on an energy basis. Furthermore, the lack of adequate infrastructure, along with transportation and handling costs, are primary obstacles when considering the economic and technical feasibility of this renewable energy source.

Most of the biomass-fueled generation facilities in the United States use steam turbine conversion technology and can accept a wide variety of biomass fuels. However, at the scale appropriate for biomass (the largest biomass power plants are 40 to 50 MW in size), the technology is expensive and inefficient. Biomass is much less dense than coal, requiring a greater volume of fuel to be handled per MW. Greater areas of biomass storage and additional handling are required to accommodate the lower-density materials. Therefore, the technology is relegated to more cost-effective applications where there is a readily available supply of low-, zero-, or negative-cost delivered feedstocks (Reference 9.2-24).

The levelized cost of electricity from a new biomass power plant generating electricity for sale only lies in the range of $0.052/kWh to $0.067/kWh.

Construction of a biomass-fired plant would have an environmental impact that would be similar to that for a coal-fired plant, although facilities using wood waste and agricultural residues for fuel would be built on smaller scales. Like coal-fired plants, biomass-fired plants require areas for fuel storage, processing, and waste (i.e., ash) disposal. Additionally, operation of biomass-fired plants has environmental impacts, including potential impacts to the aquatic environment and air.

In NUREG-1817, Section 8.2.3.8, the NRC evaluated other biomass-derived fuels for the purposes of alternative energy source analysis. These included burning crops, converting crops to a liquid fuel such as ethanol, and gasifying crops (including wood waste). The NRC concluded that none of these technologies had progressed to the point of being competitive on a large scale or of being reliable enough to replace a baseload plant. This conclusion applies to this analysis. The other biomass-derived fuels do not represent an acceptable alternative to the project.

Because of the small scale of biomass generating plants, high cost, and lack of an obvious environmental advantage, biomass energy is not a reasonable alternative for baseload power.

9.2.2.6 Municipal Solid Waste

Municipal solid waste (MSW) can be used to fuel electrical generation similar to biomass or coal. MSW would be delivered to the plant by collection trucks and shredded or processed to ease handling. After the removal of recyclable material, the remaining waste would be fed into a combustion chamber to be burned. The resulting heat of combustion is used to produce steam, which turns a steam turbine to generate electricity.

Specialized waste separation and handling equipment increases initial capital costs over other technologies. Recent estimates indicate that capital costs for MSW plants range from $2500/kW to $4600/kW. The levelized cost of electricity produced from MSW plants is $0.035/kWh to $0.153/kWh. Currently, approximately 89 waste-to-energy plants are operating in the United States. These plants generate approximately 2700 MWe, or on average 30 MWe per plant (Reference 9.2-25).

The decision to burn MSW to generate energy is usually driven by the need for an alternative to landfills, rather than by energy considerations. MSW power plants reduce the need for landfill capacity because the disposal of ash created by MSW combustion requires less volume and land area as compared to unprocessed MSW. Many landfills are unlikely to begin converting waste to energy because of obstacles to MSW power generation, primarily environmental regulations and public opposition to siting MSW facilities near feedstock supplies (i.e., people).

MSW power plants also concentrate the toxins from the feedstock within the smaller ash volume. Current regulations require MSW ash sampling on a regular basis to determine its hazardous status. Hazardous ash must be managed and disposed of as hazardous waste. Depending on state and local restrictions, nonhazardous ash may be disposed of in a MSW landfill or recycled for use in roads, parking lots, or as daily covering for sanitary landfills.

The construction and operational (i.e., aquatic environment, air, and waste disposal) impacts for an MSW plant are similar to a conventional fossil fuel-fired unit.

Because of the high costs and lack of obvious environmental advantages, other than reducing landfill volume, burning MSW to generate electricity is not a reasonable alternative for baseload power.

9.2.2.7 Fuel Cells

Fuel cell technology offers a number of very attractive characteristics from an environmental impact standpoint, because fuel cells work without combustion and its associated environmental impacts. Power is produced electrochemically by passing a hydrogen-rich fuel over an anode, air over a cathode, and then separating the two through a reaction in the presence of an electrolyte. The only byproducts are heat, water, and carbon dioxide (CO_2). Hydrogen fuel can come from a variety of hydrocarbon resources that are subjected 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 (Reference 9.2-26). Currently, the most widely marketed fuel cells cost about $4500 per kW of installed capacity. In contrast, a diesel generator costs $800 to $1500 per kW of installed capacity, and a natural gas turbine can be even less (Reference 9.2-26).

The DOE initiated a program - the Solid State Energy Conversion Alliance - to bring about dramatic reductions in fuel cell costs. The 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 (Reference 9.2-26).

For the preceding reasons, it was concluded that a fuel cell energy facility located at or in the vicinity of the RBS site would not be a reasonable alternative to the construction of a 1600 MWe nuclear power generation facility operated as a baseload plant.

9.2.2.8 Petroleum Liquids

In this discussion, petroleum liquids include distillate fuel oil, residual fuel oil, jet fuel, kerosene, petroleum coke converted to liquid petroleum, and waste oil. The high cost of this fuel group has prompted a steady decline in its use for electricity generation in recent decades, and no new petroleum liquids-fired units have been constructed in the United States since 1981. From a peak of 17 percent of total U.S. net electricity generation in 1978, petroleum liquids accounted for about 3 percent of net electricity generated in 2005. With the combination of the decline of domestic petroleum production since 1970, rising import quantities, increasing global prices, plus competition from the transportation sector and petrochemical industry, the downward trend for using petroleum to generate electricity is likely to continue.

Comparing costs in dollars per MWh ($/MWh) (dollars per million Btu [$/MBtu]) (September 2006 values), coal was $0.50/MWh ($1.72/MBtu), natural gas was $1.82/MWh ($6.22/MBtu), and petroleum liquids were $2.39/MWh ($8.14/MBtu).

While capital costs for new petroleum-fired plants are similar to those of new natural gas-fired plants, operation is more expensive due to the high cost of petroleum. Future increases in petroleum prices are expected to make petroleum-fired generation increasingly more expensive.

Also, construction and operation of a petroleum-fired plant would have identifiable environmental impacts. For example, NUREG-1437 estimates that construction of a 1000 MW petroleum-fired plant would require about 120 ac. Assuming a 95 percent capacity factor, a petroleum-fired power plant with a net output of 2234 MW would require about 282 ac. In contrast, RBS Unit 3 (operating at 95 percent capacity) would have an average annual output of 1520 MWe (1600 MWe x 0.95) and would only occupy approximately 43 ac. Additionally, operation of petroleum-fired plants would have environmental impacts (including impacts on the aquatic environment and air) that would be similar to those from a coal-fired plant (Reference 9.2-3).

Petroleum-fired generation is not a reasonable alternative for baseload power, based on the high cost of the fuel, combined with concerns related to availability, energy independence, and lack of obvious environmental advantage.

9.2.2.9 Coal-Fired Generation

Coal-fired steam electric plants provide the majority of electric generating capacity in the United States, accounting for about 50 percent of the electricity generated and about 32 percent of summer electric generating capacity in 2005. Conventional pulverized coal-fired boilers have been sized to take advantage of economies of scale, at more than 300 MW. In the Southeast (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee), pulverized coal-fired plants provide about 53 percent of the electricity generated and about 36 percent of its summer electric generating capacity. The environmental impacts of constructing a typical pulverized coal-fired steam plant on fish, wildlife, and their habitats are well known by the U.S. Fish & Wildlife Service (USFWS) and the DOE.

Both primary technologies for generating electrical energy from pulverized coal were evaluated: conventional pulverized coal boiler and fluidized bed combustion.

In conventional pulverized coal-fired plants, pulverized coal is blown into a combustion chamber of a boiler and ignited. The released heat converts water in the boiler into steam. This high-pressure steam is applied in a steam turbine to produce electricity. Flue gas is cleaned of significant fractions of major pollutants such as oxides of nitrogen (NO_x), oxides of sulfur (SO_x), and particulates.

Fluidized bed combustion (FBC) is an advanced electric power generation process. The FBC method is similar overall to conventional pulverized coal-fired boilers, but differs in the combustion process and content. FBC reduces the formation of gaseous pollutants by better controlling coal combustion parameters and by injecting a sorbent (such as crushed limestone) into the combustion chamber along with the fuel. Crushed fuel mixed with the sorbent is fluidized on jets of air in the combustion chamber. Sulfur released from the fuel as sulfur dioxide (SO_2) is captured by the sorbent in the bed to form a solid compound that is removed with the ash. The resultant byproduct is a dry, benign solid that is potentially a marketable byproduct for agricultural and construction applications. More than 90 percent of the sulfur in the fuel is captured in this process. NO_x formation in FBC power plants is lower than that for conventional pulverized coal boilers because the operating temperature range is below the temperature at which thermal NO_x is formed.

FBC units are currently limited to a maximum size of approximately 265 MW. Although a multi-unit facility could be built, it would not be able to benefit from the economies of scale associated with a 1600 MWe project. Also, the lower operating temperature of the FBC system lowers efficiency levels as compared to conventional pulverized coal boilers. Because of the limited size of available units, and lower thermal efficiency, FBC is not a cost-effective alternative for the proposed project.

To improve the thermal efficiency of the FBC technology, a new type of FBC boiler is being proposed that encases the entire boiler inside a large pressure vessel (Reference 9.2-27). Burning coal in a pressurized fluidized bed combustion (PFBC) boiler results in a high-pressure stream of combustion gases that can spin a gas turbine to make electricity, then boil water for a steam turbine. It is estimated that efficiencies for PFBC systems would eventually exceed 50 percent. The PFBC technology is currently in the demonstration phase in most of the world and is not a feasible alternative for the RBS project at this time. Barriers in commercial deployment opportunities of second-generation PFBC systems arise because of slow progress in hot gas filter development, high turbine costs, and complex plant integration. With the current state of technology development and projections for the future, it remains uncertain whether advanced PFBC systems can achieve the DOE goal of 20 to 25 percent reductions in electricity cost, as well as capital cost reductions relative to current pulverized coal plants.

The United States has abundant low cost coal reserves, and the price of coal for electric generation should increase at a relatively slow rate. Pulverized coal-fired plants are likely to continue as a reliable energy source well into the future, assuming that environmental constraints do not cause the gradual substitution of other fuels. Even with recent environmental regulation, new coal capacity is expected to be an affordable technology for reliable, near-term development.

In NUREG-1817, Section 8.2.2.1, the NRC evaluated the air quality impacts, as well as other impacts, from coal-fired generation and stated that they would vary considerably from those of nuclear generation because of the emissions of SO_x, NO_x, CO, PM, and hazardous air pollutants such as mercury. A coal-fired plant would also have unregulated CO_2 emissions that could contribute to global warming. Overall, the NRC staff concluded that air quality impacts from coal-fired generation would be MODERATE as compared to SMALL for a nuclear facility.

Based on the well-known technology, fuel availability, and generally understood environmental impacts associated with constructing and operating a coal-fired power generation plant, it is considered a reasonable, cost-competitive alternative and is therefore examined further in Subsection 9.2.3.

9.2.2.10 Integrated Gasification Combined Cycle Generation

Integrated gasification combined cycle (IGCC) is an emerging, advanced technology that combines modern coal gasification technology with both gas turbine and steam turbine power generation (Reference 9.2-8). Compared to conventional pulverized coal plants, the technology is substantially cleaner because major pollutants can be removed from the gas stream prior to combustion.

The IGCC process generates much less solid waste than the pulverized coal-fired alternative. The largest solid waste stream produced by IGCC installations is slag, a marketable sand-like byproduct. Slag production is a function of the fuel ash content. The other large volume byproduct produced by IGCC plants is sulfur, which is extracted during the gasification process and can be marketed rather than placed in a landfill. IGCC units do not produce ash or scrubber wastes.

Today's IGCC technology still needs operating experience for widespread expansion into commercial-scale, utility applications. Each major component of IGCC has been broadly utilized in industrial and power generation applications, but the joining of coal gasification with a combined cycle power block to produce commercial electricity as a primary output is relatively new. This has been demonstrated at only a handful of facilities around the world, including five in the United States. Experience has been gained with the chemical processes of gasification and the impact of coal properties on the IGCC areas of design, efficiency, economics, etc. System reliability is still relatively low, when compared to conventional pulverized coal-fired power plants. There are also problems with the process integration between gasification and power production.

An IGCC facility is not a reasonable alternative to the proposed project, because current IGCC technology requires further research to achieve an acceptable level of reliability (Reference 9.2-3).

9.2.2.11 Natural Gas-Fired Generation

Natural gas-fired generation using simple cycle or combined cycle turbines is a technology that is available and economical.

Based on the well-known technology, fuel availability, and generally understood environmental impacts associated with constructing and operating a natural gas-fired power generation plant, it is considered a reasonable, cost-competitive alternative and is examined further in Subsection 9.2.3.

9.2.3 ASSESSMENT OF COMPETITIVE ALTERNATIVE ENERGY SOURCES AND SYSTEMS

In its SSRP, the Applicant considered a broad range of supply-side and customer service strategies to address power supply needs for the future. Subsection 9.2.2 discussed the pertinent options, presenting the particular need for power to be addressed by the RBS project. For the reasons discussed, these alternatives are coal-fired and natural gas-fired generation. The environmental impacts discussed in this subsection are summarized in Table 9.2-1.

9.2.3.1 Coal-Fired Generation

In general, the environmental impacts of constructing a typical coal-fired steam plant are well known because coal, as discussed earlier, is the most prevalent type of central generating technology in the United States. The impacts of constructing a large coal plant can be substantial, particularly if it is sited in a rural area with considerable natural habitat (Reference 9.2-3).

In NUREG-1817, the NRC evaluated the construction and operation of four standard coal-fired 508 MWe units (i.e., a total capacity of 2032 MWe). This coal-fired facility capacity is comparable to RBS Unit 3 capacity of 1600 MWe when taking in consideration the coal-fired facility's 80 percent capacity factor or approximately 1626 MWe effective output. Therefore, for discussion purposes, the NUREG-1817 analysis, which drew upon the Applicant's use of 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 (Reference 9.2-6), was used for comparison purposes to the RBS facility. Scaling to the RBS Unit 3 capacity of 1600 MWe was performed where appropriate, such as in land use.

9.2.3.1.1 Land Use and Related Impacts to Ecology

Since this alternative would involve new construction, one key environmental impact area is land use. The Generic Environmental Impact Statement (GEIS) estimates that approximately 1700 ac. would be needed for a new 1000 MWe coal-fired plant (Reference 9.2-3). This estimate would be scaled up for the approximately 1600 MWe capacity of the proposed coal-fired alternative (i.e., 2720 ac.), which is considerably larger than that required for the proposed project (approximately 43 ac.). The current RBS site is approximately 3330 ac. (refer to Section 2.2). However, a portion of the current site is used for RBS Unit 1 and cannot be used for a new facility.

Since large quantities of coal and lime (or limestone) would be delivered via rail line or by river barge, new construction would be required to support the barge and/or the railcar turnaround facilities. Given the substantial land use (relative to the proposed project), the associated impacts related to land clearing, erosion and sedimentation, air quality from construction vehicles, impact to ecology, etc., would be proportionally much greater for the coal-fired alternative.

The NRC estimated that approximately 22,000 ac. would be affected for mining the coal and disposing of the waste to support a 1000 MWe coal plant during its operational life (Reference 9.2-3). Thus, the equivalent land usage requirement for 1600 MWe coal-fired production would be approximately 35,200 ac.[b] Based on NRC estimates, the uranium mining and processing required to supply fuel during the operating life of a nuclear facility of 1600 MWe capacity would be approximately 215 ac.

The impact of the coal-fired alternative on land use is considered SMALL, similar to the proposed project.

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b. The NRC does not explicitly relate the 22,000-ac. value to a 1000 MWe coal plant, but this is inferred. Thus, the land use estimate for a 1600 MWe coal plant would be 1.6 times that value (Reference 9.2-3).

9.2.3.1.2 Waste Generation and Emissions

In NUREG-1817, it was estimated that the proposed plant would consume approximately 6.6 million tons per year of pulverized bituminous coal, with an ash content of approximately 11.9 percent. After combustion, this would result in 784,000 tons (711,000 MT) to be collected and disposed of at the plant site. Lime or limestone, used in the scrubbing process to control SO_2 emissions, is injected as a slurry into the hot effluent combustion gases to remove entrained SO_2. The lime-based scrubbing solution reacts with SO_2 to form calcium sulfite, which precipitates and is removed from the process as sludge. It is estimated that approximately 728,000 tons (660,000 MT) of scrubber sludge would be disposed of at the plant site based on annual lime usage of approximately 246,000 tons (223,000 MT) for flue gas desulfurization. Provisions would be made to store fly ash, bottom ash, and scrubber byproducts on-site indefinitely unless the ash can be recycled or marketed as some Entergy facilities currently do. Waste impacts to groundwater and surface water could extend beyond the operating life of the plant, if leachate and runoff from the waste storage area occurs (Reference 9.2-6).

For the preceding reasons, the appropriate characterization of impacts from waste generated from the coal-fired alternative is MODERATE (refer to NUREG-1817); the impacts would be clearly noticeable, but would not destabilize any important resource.

9.2.3.1.3 Air Quality and Human Health

Air quality impacts from a coal-fired plant vary considerably from those of nuclear generation. Typical emission levels from coal plants include sulfur oxides, nitrogen oxides, particulates, carbon monoxide, carbon dioxide, hazardous air pollutants such as mercury and naturally radioactive materials. A coal-fired plant would also have unregulated CO_2 emissions that could contribute to global warming, and substantial future costs for CO_2 emissions controls or for participation in a market-based CO_2 emissions cap-and-trade program are expected.

While the operation of a new nuclear facility does include relatively small quantities of such emissions, typically from auxiliary boilers, the amount of air quality impact for the coal plant is substantially greater. Emissions predicted for the proposed project and other alternatives for SO_x, NO_x, particulates, carbon monoxide, and carbon dioxide are addressed in Table 9.2-1.

The acid rain requirements of the Clean Air Act capped the nation's SO_2 emissions from power plants. An owner 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 SO_2 emissions is not used for NO_x emissions although similar programs exist in some localized nonattainment areas. 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 1.6 lb/MWh (200 ng/J) 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 60 Subpart Da. The standards establish emission limits for PM and opacity (40 CFR 60.42a), SO_2 (40 CFR 60.43a), and NO_x (40 CFR 60.44a).

The EPA has various regulatory requirements for visibility protection in 40 CFR 51, Subpart P, including a specific requirement for review of any new major stationary source in an area designated as in attainment or unclassified for criteria pollutants under the Clean Air Act (40 CFR 51.307(a)). Criteria pollutants under the Clean Air Act include lead, ozone, particulates, CO, NO_x, and SO_2. Ambient air quality standards for criteria pollutants are included in 40 CFR 50. The RBS site is in an area designated as in attainment or unclassified for criteria pollutants (40 CFR 81.319), although the area is very near and may be regulated as contributing to the Baton Rouge nonattainment area for ozone.

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, the EPA regulations provide that, for each mandatory Class 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 in 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. The Breton Wilderness is located approximately 100 mi. (160 km) southeast of the RBS site. A portion of Breton has federal wilderness status and is classified as a mandatory Class I federal area. Because of this classification, it is afforded visibility protection by the Clean Air Act as amended in 1977.

The GEIS for license renewal (Reference 9.2-28) 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 CO_2 emissions and acid rain from SO_2 and NO_x emissions as a potential impact (Reference 9.2-28). Adverse human health effects, such as cancer and emphysema, have been associated with the products of coal combustion. Additionally, the recent issuance of two major EPA regulations concerning air emission controls required at fossil fuel generating facilities has created significant uncertainty as to the future cost of environmental controls at these facilities.

Overall, it was concluded that air quality impacts from coal-fired generation would be MODERATE. The impacts would be clearly noticeable, but would not destabilize air quality.

9.2.3.1.4 Cooling System Considerations, Water Use, and Related Impacts to Ecology

The NRC evaluated coal plants with both open and closed cycle cooling systems. In general, in either case, intake and discharge would be designed to comply with state and federal standards. The closed cycle system would require slightly more land, but the difference is insignificant relative to the overall land use requirement noted above. The open cycle system, with a higher intake and discharge flow rate, could have greater potential impacts (e.g., impingement and entrainment of fish and thermal impacts to the aquatic ecosystem). The closed cycle system would typically rely on large natural draft cooling towers or mechanical fan-cooled cooling towers.

The trade-off in this case would be the evaporation, drift, and other impacts from the cooling tower, including discharge of dissolved solids to the river from cooling tower blowdown (Reference 9.2-6). The decreased intake flow rate of the closed cycle system would have less impact on the aquatic ecosystem (e.g., impingement and entrainment mortalities) and less thermal impact on the receiving water body (Reference 9.2-3). Water use impacts depend on the volume of water required and the characteristics of the receiving body (Reference 9.2-6).

The bulk of the coal plant's raw water makeup is assumed to come from the Mississippi River. A new cooling system intake structure on the river would be required, resulting in temporary impacts during construction. However, as evaluated for the proposed project, neither the construction nor operation of the coal plant's intake would be expected to have significant impact on surface water (i.e., the Mississippi River). The coal plant's discharge to the river would be expected to have impacts comparable to those of the proposed project (i.e., not significant).

If the coal plant were placed on an alternate site, there could be impacts depending on available surface water and groundwater sources. In any case, appropriate permits would govern and limit surface water and groundwater use and impacts. For additional site-specific information on the RBS cooling water system, refer to Subsection 5.2.1.1. Overall, the impacts are expected to be SMALL (Reference 9.2-6).

9.2.3.1.5 Socioeconomics

A coal plant would require an estimated peak construction workforce of 2500 workers over a 4- to 5-year period. Given this workforce size, surrounding communities would experience an increase in the demand for housing and public services during construction and, following the conclusion of construction, the communities would then experience the loss of some portion of these construction jobs. With this workforce, area roads would also experience increased traffic, and this would be especially noticeable near the construction site, in accordance with the Chapter 4 discussion. The proposed project is expected to require a construction workforce of 3150 over a 5- to 6-year period.

With a slightly smaller construction workforce (2500 versus 3150), the socioeconomic impacts of a coal unit could be expected to be slightly smaller in comparison to the proposed project. However, as was the case during the construction of RBS Unit 1, any negative effects related to the housing of the workforce would likely be dispersed over a relatively large geographic area that includes Baton Rouge, Louisiana. The respective parishes for Baton Rouge (East Baton Rouge Parish and West Baton Rouge Parish) have a total population of about 434,453 (Reference 9.2-29). While the commuting workforce would come from parishes surrounding the construction site, many would likely originate from the Baton Rouge area because of the services available there. Based on an assessment of current highway capacities around the RBS site and considering reasonable assumptions regarding carpooling and management of shift changes, there would be little overall difference in impacts between the coal alternative and the proposed project.

Providing some offset to the impacts would be benefits related to construction and operation. In the short-term, during construction, some portion of the surrounding communities could be expected to find employment in construction jobs at the site. Over the long-term, the tax base would increase for affected communities. Both of these benefits would be proportionally larger for the proposed project. Thus, while the proposed project's workforce is greater than that of the coal plant, the impacts would be short-term and mitigated by dispersion over several relatively populous counties and improved transportation routes. Impacts would be offset, to some degree, by proportionally larger employment opportunities and the tax base associated with the proposed project. Overall, socioeconomic impacts resulting from construction and operation of a coal-fired plant can be considered SMALL.

9.2.3.1.6 Other Impacts

Human Health - Coal-fired power generation introduces worker risks from coal and limestone mining, worker and public risks from coal and lime/limestone transportation, worker and public risks from disposal of coal combustion wastes, and public risks from inhalation of stack emissions.

Emission impacts can be widespread and health risks are difficult to quantify. The coal alternative also introduces the risk of coal-pile fires and attendant inhalation risks. In the GEIS, the NRC staff stated that there could be human health impacts (cancer and emphysema) from the inhalation of toxins and particulates from a coal-fired plant, but did not identify the significance of these impacts. 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.

Regulatory agencies, including EPA and state agencies, set air emission standards and requirements to protect human health and the environment. These agencies also impose site-specific emission limits as needed to meet the health standards. The EPA has recently concluded that certain segments of the U.S. population (e.g., subsistence fish eating populations), as well as developing human fetuses, are believed to be at potential risk of adverse health impacts because of mercury exposure from sources such as coal-fired power plants. However, in the absence of more quantitative data, and with the limits imposed for the regulated constituents of air emissions, human health impacts from radiological doses and inhaling toxins and particulates generated by burning coal at a newly constructed coal-fired plant are considered SMALL.

Aesthetics - Visual impacts of a new coal-fired plant could be mitigated by landscaping and color selection for buildings that is consistent with the environment. Visual impact at night could be mitigated by reduced use of lighting, provided the lighting meets Federal Aviation Administration (FAA) requirements, and the appropriate use of shielding. Overall, the addition of the coal-fired unit would likely have some aesthetic impact. There could be a significant aesthetic impact if construction of a new rail spur were needed.

Coal-fired generation would introduce mechanical sources of noise that could be audible off-site. Sources contributing to total noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment associated with normal plant operations. 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. The noise impacts of a coal-fired plant would be slightly greater than those of expected operation of the RBS Unit 3 project. Noise associated with barge transportation of coal and lime/limestone would be minimal. Noise and light from the pulverized-coal-fired power plants could be detectable off-site. Aesthetic impacts at the plant site would be mitigated if the plant were located in an industrial area adjacent to other industrial facilities.

Overall, the aesthetic impacts associated with new pulverized coal-fired power plants can be considered SMALL, but greater than those of RBS Unit 3.

Historic and Archaeological Resources - The potential impacts of new plant construction on historic and archaeological resources have been discussed and evaluated for the proposed RBS Unit 3 nuclear site in Sections 2.5 and 4.1. Historic and archaeological resource impacts can generally be effectively managed and, as such, are considered SMALL.

Environmental Justice - Environmental justice impacts would depend upon the sites chosen for the coal-fired power plants and the nearby population distribution. Similar to the discussion and evaluation for nuclear construction at the RBS Unit 3 site in Sections 2.5 and 4.1, the impacts on minority populations resulting from the construction and operation of coal-fired power plants would not be disproportionate.

9.2.3.1.7 Conclusion for Coal-Fired Generation

A coal-fired plant is not environmentally preferable to the proposed project, due primarily to the impacts on air quality, land use, and waste disposal.

9.2.3.2 Gas-Fired Generation

The environmental impacts of the natural gas-fired alternative are examined in this subsection, considering the RBS site. The analysis assumes a closed cycle cooling system, because the once-through system is considered to have greater overall environmental impacts (for the reasons discussed in the preceding analysis of the coal-fired alternative).

Similar to the NRC analysis of coal-fired generation, the NRC considered four standard sized, gas-fired units of 508 MWe, representing a total capacity of 2032 MWe, which with an 80 percent capacity factor, is proportionately equivalent to the proposed RBS Unit 3 project of 1600 MWe. The plant was assumed to use combined cycle technology. It is possible that when the demand for natural gas is high, fuel oil may be used, incurring relatively higher costs and more emissions than gas. However, this analysis does not quantify that scenario. Impacts were determined on the basis of a 40-year operating lifetime for the gas-fired facility (Reference 9.2-3).

9.2.3.2.1 Land Use and Related Impacts to Ecology

As reported in Subsection 2.2.1.7, the closest natural gas pipeline is 2.1 mi. from the RBS site (Figure 2.2-2). If the gas plant is built at (or near) the RBS site, there would be an associated impact related to pipeline construction.

The gas plant would require 110 ac. for the power block and support facilities and could be sited on land that was previously disturbed in the construction of RBS Unit 1.[c] Assuming that the gas plant would use a closed cycle cooling system (as discussed below), an additional land area of up to 30 ac. would be required for cooling towers and support systems, bringing the total estimated footprint to 140 ac. If the plant is sited at the RBS, construction of the gas "branch"

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c. The NRC did not specify land requirements for temporary use during construction (References 9.2-8 and 9.2-3).

pipeline could require approximately 85 ac.[d] Thus, the total land use commitment for siting the gas plant at the RBS would be approximately 225 ac.

The proposed project is expected to require about 43 ac.; therefore, the gas plant's footprint (if sited at the RBS) would be somewhat larger than the proposed project's land use (225 ac. versus 43 ac.). It can be assumed that the gas plant would, therefore, require a proportionally higher use of land not previously disturbed by the construction of RBS Unit 1, with associated higher impacts to wildlife habitat, etc. From this perspective, the gas plant would not be considered environmentally preferable to the proposed project.

In addition to the proposed project's use of 43 ac. for permanent structures, up to 321 additional acres could be affected (temporarily) during construction of the proposed project (364 ac. total [refer to Table 2.2-1]). Land used temporarily during construction would be subject to standard mitigation procedures to minimize impact, as described in Section 4.6. Appropriate measures would also be taken to restore the land, and long-term impact is not expected. Temporary land use information during construction of the gas plant was not available. The estimated total gas plant operational footprint (225 ac.) would be larger than that associated with the proposed project. As noted earlier, the gas plant operational footprint could be larger if placed at another site, requiring additional gas supply pipeline ROW and construction. Without specific data on land temporarily affected during gas plant construction, further assessment is not possible.

Additional land could be required for natural gas wells and collection stations. Based on NRC estimates, this could amount to 5760 ac. to support a gas-fired plant of approximately 1600 MWe (Reference 9.2-8). Uranium mining and processing could require approximately 215 ac. for the operating life of a nuclear facility of 1600 MWe capacity. Given this consideration and the relatively larger land use related to the fuel source (and the related impacts to the ecology), the gas plant alternative would not be environmentally preferable to the proposed project.

Overall, land use impacts for construction and operation of a natural gas-fired alternative plant are considered SMALL.

9.2.3.2.2 Cooling System Considerations, Water Use, and Impact to Ecology

The gas-fired plant is assumed to use a closed cycle cooling system, with the bulk of raw water makeup coming from the Mississippi River (for siting at the RBS). A new cooling system intake structure on the river would be required, resulting in a temporary impact during construction. However, as evaluated for the proposed project, neither the construction nor the operation of the gas plant's intake would be expected to have a significant impact on surface water (i.e., the Mississippi River). The gas plant's discharge to the river would be expected to have impacts comparable to those of the proposed project (i.e., not significant).

If the gas plant were placed on an alternate site, there could be other impacts, depending on available surface water and groundwater resources. In any case, appropriate permits would govern and limit surface water and groundwater use and impacts. Overall, the impacts are expected to be SMALL.

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d. The 85-ac. impact is scaled up from the value used in Reference 9.2-8, because the connection line to the RBS would be 4.75 mi. versus the 3-mi. distance assumed in Reference 9.2-8.

9.2.3.2.3 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 60, Subparts Da and GG. These regulations establish emissions limits for particulates, opacity, SO_2, and NO_x. The estimated emissions for SO_x, NO_x, CO, CO_2, and particulates for the gas plant are addressed in Table 9.2-1 and are greater than those associated with the proposed project.

The EPA has various regulatory requirements for visibility protection in 40 CFR 51, Subpart P, including a specific requirement for the review of any new major stationary source in areas designated as attainment or unclassified under the Clean Air Act. The RBS site is in an area designated as attainment or unclassified for criteria pollutants (40 CFR 81.325). However, a gas-fired plant likely would be required to control NO_x emissions to avoid contributing to nonattainment in the Baton Rouge area.

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.

Louisiana has one Class I federal area, the Breton Wilderness. The Breton Wilderness is located approximately 100 mi. (160 km) southeast of the RBS site. A portion of Breton has federal wildnerness status; because of this classification, it is afforded visibility protection by the Clean Air Act as amended in 1977.

The combustion turbine portion of a combined cycle plant would also be subject to the EPA's National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines (40 CFR 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 effects of emissions from a natural gas-fired power generation plant would be clearly noticeable, but would not be sufficient to destabilize air resources. Overall, it was determined that air quality impacts resulting from the construction and operation of new natural gas-fired power generation at the RBS site would be SMALL to MODERATE.

9.2.3.2.4 Human Health

In the GEIS, the NRC identified cancer and emphysema as potential health risks from natural gas-fired plants (Reference 9.2-3). The risks may be attributable to NO_x emissions that contribute to ozone formation, which, in turn, contribute to health risks. Air emissions from a natural gas-fired power generation plant located at the RBS site would be regulated by the LDEQ.

The human health effects are expected to be either undetectable or sufficiently minor. Overall, the impacts on human health from natural gas-fired power generation would be SMALL.

9.2.3.2.5 Socioeconomics

The socioeconomic impact would be of a similar nature to that described above for the coal plant alternative, except that the estimated gas plant workforce would be smaller and would have a shorter projected construction period (3 years). The peak construction workforce is estimated to be approximately 1200 workers (Reference 9.2-8). With the smaller construction workforce and shorter construction period, socioeconomic impacts are expected to be smaller in comparison to the larger-scale construction effort predicted for the proposed project. However, as previously discussed regarding the coal plant alternative, these impacts are expected to be distributed over a relatively large geographic area and two mature population centers. In addition, key transportation routes have been or are being improved, which would help mitigate impacts of higher construction traffic loads. Road capacities are considered to be generally adequate to support the larger construction workforce assumed for the proposed project; therefore, the differences regarding transportation impact between the gas plant alternative and the proposed project are not expected to be significant.

These socioeconomic impacts (in general) are short-term, during construction. Providing some degree of offset to these impacts are benefits related to increased job opportunities during construction (short-term) and an increased tax base (long-term). Therefore, 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. Impacts would be offset, to some degree, by proportionally larger employment opportunities and tax base associated with the proposed project.

Overall, socioeconomic impacts resulting from construction and operation of natural gas-fired plants can be considered SMALL.

9.2.3.2.6 Other Impacts

Aesthetics - Natural gas-fired plants would alter the visual landscape character at each location. The tallest structures would be the 150 ft. high auxiliary boiler and two heat recovery steam generator stacks, as well as the 100 ft. high steam turbine building. Some portion of these structures would likely be visible for 1 mi. or more.

Cooling tower plumes from any cooling towers constructed could also be visible. The natural draft towers would likely be highly visible in daylight hours for distances greater than 10 mi. There would be more lighting visible across the night landscape, and sky brightness would increase somewhat. Noise from the plant may be detectable off-site, depending on the location.

The gas pipeline compressors also would be visible. Aesthetic impacts would be mitigated if the plant were located in an industrial area adjacent to other power plants. Overall, the aesthetic impacts associated with replacement natural gas-fired plants are categorized as SMALL, with site-specific factors determining the final categorization.

Historic and Archaeological Resources - The potential impacts of new plant construction on historic and archaeological resources would be similar to those for construction of one nuclear unit, which have been discussed and evaluated for the RBS Unit 3 site in Sections 2.5 and 4.1. Impacts to cultural resources can be effectively managed under current laws and regulations and kept SMALL.

Environmental Justice - Environmental justice impacts would depend upon the sites chosen for the natural gas-fired power plants and the nearby population distribution. Similar to the discussion and evaluation for nuclear construction at the RBS Unit 3 site in Sections 2.5 and 4.1, the impacts on minority populations resulting from the construction and operation of natural gas-fired power plants would not be disproportionate.

9.2.3.2.7 Conclusion for Gas-Fired Generation

A gas-fired power plant is not environmentally preferable to RBS Unit 3, due primarily to impacts on air quality.

9.2.3.3 Combination of Alternatives

This subsection examines combinations of alternatives that could generate baseload power in an amount equivalent to the proposed RBS Unit 3.

As previously discussed in this section, the capacity of the RBS Unit 3 is 1600 MWe. There are a number of combinations of alternatives that have the potential of producing this baseload capacity.

Because of the intermittent nature of the resource and the lack of cost-effective technology, wind and solar are not sufficient on their own to generate the equivalent baseload capacity or output of the RBS Unit 3, as discussed in Subsections 9.2.2.1 and 9.2.2.2. As described in Subsections 9.2.2.9 and 9.2.2.10, fossil-fired generation generates baseload capacity, but the environmental impacts are greater than that of the proposed RBS Unit 3. It is conceivable, however, that a combination of alternatives (renewables in combination with fossil-fired generation) might be cost-effective and have less environmental impact than RBS Unit 3.

There are numerous potential combinations when considering the power sources and the output of each source. For the renewal of licenses pursuant to 10 CFR 54, the NRC has already determined that expansive consideration of combinations would be too unwieldy, given the purposes of the alternative analysis (Reference 9.2-3). However, the combination alternative analysis should be sufficiently complete to aid the NRC in its analysis of alternative sources of energy pursuant to the NEPA. The following analysis provides the basis for an evaluation of a reasonable combination of alternative energy sources to the RBS Unit 3 that is required by NEPA.

9.2.3.3.1 Determination of Alternatives

Many possible combinations of alternatives could satisfy the baseload capacity requirements of RBS Unit 3. Some combinations can include renewable sources, such as wind and solar. As discussed earlier in Subsections 9.2.2.1 and 9.2.2.2, wind and solar do not, by themselves, provide a reasonable alternative energy source to the baseload power to be produced by RBS Unit 3. However, wind and solar, in combination with fossil fuel-fired plant(s), may be a reasonable alternative to the nuclear energy produced by RBS Unit 3.

RBS Unit 3 is to operate as a baseload power producer and would be regulated under applicable provisions of Entergy’s utility operations within its designated service area. The ability to generate baseload power in a consistent, predictable manner meets the business objectives of RBS Unit 3. Therefore, when examining combinations of alternatives to RBS Unit 3, the ability to generate baseload power must be the determining feature when analyzing the reasonableness of the combination. This subsection reviews the ability of the combination alternative to have the capacity to generate baseload power equivalent to RBS Unit 3.

When examining a combination of alternatives that would meet the business objectives similar to that of RBS Unit 3, any combination that includes a renewable power source (either all or part of the capacity of RBS Unit 3) must be combined with a fossil-fueled facility equivalent to the generating capacity of RBS Unit 3. This combination would allow the fossil-fueled portion of the combination alternative to produce the needed power if the renewable resource is unavailable and to be displaced when the renewable resource is available. For example, if the renewable portion is some amount of potential wind generation and that resource became available, the output of the fossil-fueled generation portion of the combination alternative could be lowered to offset the increased generation from the renewable portion. This facility, or facilities, would satisfy business objectives similar to those of RBS Unit 3 in that it would be capable of supporting fossil-fueled baseload power.

Coal- and gas-fired generation have been examined in Subsections 9.2.2.9, 9.2.2.10, 9.2.2.11, 9.2.3.1, and 9.2.3.2 as having environmental impacts that are equivalent to or greater than the impacts of RBS Unit 3. Based on the comparative impacts of these two technologies, a gas-fired facility would have less environmental impact than a comparably sized coal-fired facility. In addition, the operating characteristics of gas-fired generation are more amenable to the kind of load changes that may result from the inclusion of renewable generation so that the baseload generation output of 1600 MWe is maintained. "Clean coal" power plant technology could decrease the air pollution impacts associated with burning coal for power. Demonstration projects show that clean coal programs reduce NO_x, SO_x, and particulate emissions. However, the environmental impacts from burning coal using these technologies, if proven, are still greater than the impacts from natural gas (Reference 9.2-30). Therefore, for the purpose of examining the impacts from a combination of alternatives to RBS Unit 3, a facility equivalent to that described in Subsection 9.2.3.2 (gas-fired generation) was used in the environmental analysis of combination alternatives. The analysis accounts for the reduction in environmental impacts from a gas-fired facility when generation from the facility is displaced by the renewable resource. The impacts associated with the combined cycle natural gas-fired unit were based on the gas-fired generation impact assumptions discussed in Subsection 9.2.3.2. Additionally, the renewable portion of the combination alternative would be any combination of renewable technologies that could produce power equal to or less than RBS Unit 3 at a point when the resource was available. The environmental impacts associated with wind and solar generation systems are outlined in Subsections 9.2.2.1 and 9.2.2.2, respectively. This combination of renewable energy and natural gas-fired generation represents a viable mix of non-nuclear alternative energy sources.

For the purpose of the economic comparison of a combination of alternatives, a gas plant in combination with the renewable resource was analyzed.

9.2.3.3.2 Environmental Impacts

The environmental impacts associated with a gas-fired facility that is sized to produce power equivalent to RBS Unit 3 have already been analyzed in Subsection 9.2.3.2. Depending on the level of potential renewable output included in the combination alternative, the level of impact of the gas-fired portion would be comparably lower. If the renewable portion of the combination alternative were not enough to displace the power produced by the fossil-fueled facility, there would be some level of impact associated with the fossil-fueled facility. Consequently, if the renewable portion of the combination alternative were enough to fully displace the output of the gas-fired facility, then, when the renewable resource is available, the output of the fossil-fueled facility could be eliminated, thereby eliminating its operational impacts. The lower the output of the renewable portion of the combination alternative, the closer the impacts approach the level of impact described in Subsection 9.2.3.2 for gas-fired generating facilities.

Determination of the types of environmental impacts of these types of "hybrid" plants or combination of facilities can be surmised from an analysis of past projects.

For instance, in 1984, Luz International, Ltd. built the Solar Electric Generating System (SEGS) plant in the California Mojave Desert. The SEGS technology consists of modular parabolic-trough solar collector systems, which use oil as a heat transfer medium. One unique aspect of the Luz technology is the use of a natural gas-fired boiler as an oil heater to supplement the thermal energy from the solar field or to operate the plant independently during evening hours. SEGS I was installed at a total cost of $62 million (~$4500/kW) and generates power at 24 cents/kWh (in 1988 real levelized dollars). The improvements incorporated into the SEGS III-VI plants (~$3400/kW) reduced generation costs to about 12 cents/kWh, and the third-generation technology, embodied in the 80 MW design at an installed cost of $2875/kW, reduced power costs still further to 8 to 10 cents/kWh. Because solar energy is not a concentrated source, the dedicated land requirement for the Luz plants is large compared to conventional plants - on the order of 5 ac/MW (2 ha/MW) (Reference 9.2-31), compared to 0.03 ac. per MWe for RBS Unit 3.

In Louisiana, the average solar thermal source is approximately 4.0 kWh/m^2 per day; the SEGS units were built in an area where the solar source is 5.5 kWh/m^2 per day. Using the above metrics for land use and the solar source of 4.0 kWh m^2 per day in Louisiana, a similar SEGS unit within the region of interest would require dedicated land of approximately 6 ac. per MWe

(Reference 9.2-32), compared to 0.03 ac. per MWe for RBS Unit 3. Land use for generating baseload equivalent to RBS Unit 3 would require approximately 18,288 ac. Additionally, given the lower thermal source in Louisiana, the capital costs for the solar portion of the hybrid plant would be proportionally greater than for the SEGS.

In the case of parabolic trough plants, all plants of this type of solar technology are configured in combination with a fossil-fueled generation component. A typical configuration is a natural gas-fired heat or a gas steam boiler/reheater coupled to the trough system. Troughs also can be integrated with existing coal-fired plants. Parabolic trough plants require a significant amount of land; typically, the use is preemptive because parabolic troughs require the land to be graded level. A report, developed by the California Energy Commission (CEC), notes that 5 to 10 ac. per MWe is necessary for concentrating solar power technologies such as trough systems (Reference 9.2-33).

The environmental impacts associated with a solar and a wind facility equivalent to RBS Unit 3 have already been analyzed in Subsections 9.2.2.1 and 9.2.2.2, respectively. It is reasonable to expect that the impacts associated with an individual unit of a smaller size would be similarly scaled. None of the impacts would be greater than those discussed in Subsections 9.2.2.1 and 9.2.2.2. If the renewable portion of the combination alternative is unable to generate an equivalent amount of power as RBS Unit 3, then the combination alternative would have to rely on the gas-fired portion to meet the equivalent capacity of RBS Unit 3. Consequently, if the renewable portion of the combination alternative has a potential output that is equal to that of RBS Unit 3, the impacts associated with the gas-fired portion of the combination alternative would be lower, but the impacts associated with the renewable portion would be greater. The greater the potential output of the renewable portion of the combination alternative, the closer the impacts would approach the level of impact described in Subsections 9.2.2.1 and 9.2.2.2.

The gas-fired facility alone has impacts that are greater than those of RBS Unit 3; some environmental impacts of renewables are also greater than or equal to RBS Unit 3.

The combination of a gas-fired plant and wind or solar facilities would have environmental impacts that are equal to or greater than those of a nuclear facility:

- All of the environmental impacts of a new nuclear plant at RBS Unit 3 and all of the impacts from a gas-fired plant are SMALL, except for air quality impacts from a gas-fired facility (which are MODERATE). Use of a gas-fired facility in combination with wind and solar facilities would reduce the air quality impacts from the gas-fired facility. However, at best, these impacts would be SMALL and, therefore, would be equivalent to the air quality impacts from a nuclear facility.

- All of the environmental impacts of a new nuclear plant at RBS Unit 3 and all of the impacts from wind and solar facilities are SMALL, except for land use and aesthetic impacts from wind and solar facilities (which range from MODERATE to LARGE). Use of a gas-fired facility in combination with wind and solar facilities would reduce the land usage and aesthetic impacts from the wind and solar facilities. However, at best, those impacts would be SMALL and, therefore, would be equivalent to the land use and aesthetic impacts from a nuclear facility.

Therefore, the combination of wind and solar facilities and gas-fired facilities is not environmentally preferable to RBS Unit 3.

9.2.3.3.3 Economic Comparison

As noted earlier, the combination alternative must generate power equivalent to the capacity of RBS Unit 3. From the discussion presented in Section 9.2, the cost of generating electricity from a new gas-fired facility is approximately 5.5 cents per kWh and from a new coal-fired facility is 5.36 cents per kWh. As discussed previously, wind generation costs are estimated at 5 cents per kWh, and solar costs are estimated at 9 to 23 cents per kWh. The cost for a gas-fired facility in combination with a renewable facility would increase, because the facility would not be operating at full availability when it is displaced by the renewable resource. As a result, the capital costs and fixed operating costs of the gas facility would be spread across fewer kWh, thereby increasing its cost per kWh. The projected cost associated with the operation of a new nuclear facility similar to RBS Unit 3 is 4.78 cents per kWh. The projected costs associated with a gas-fired facility in combination with a renewable facility are greater than those of RBS Unit 3. Therefore the cost associated with the operation of the combination alternative would not be competitive with respect to RBS Unit 3.

9.2.3.3.4 Summary

Wind and solar facilities in combination with fossil facilities could be used to generate baseload power and would serve the purpose of RBS Unit 3. However, wind and solar facilities in combination with fossil facilities would have equivalent or greater environmental impacts relative to a new nuclear facility at RBS Unit 3. Similarly, wind and solar facilities in combination with fossil facilities would have higher costs than a new nuclear facility at RBS Unit 3. Therefore, wind and solar facilities in combination with fossil facilities are not preferable to RBS Unit 3.

9.2.4 CONCLUSIONS

The preceding alternatives analysis considered alternatives involving new generating capacity that would also supply baseload power. A wide variety of potential alternative energy sources was considered. The majority of these sources were eliminated because of high land use impacts; low capacity factors; geographic availability of the resource; or the emergent, unproven nature of the technology. Key environmental impact areas were identified, and the viable alternatives were analyzed to determine if they could be considered environmentally preferable to the proposed project. Table 9.2-1 summarizes the results of this analysis.

Permanent land use for the generating facility (proposed project or otherwise) represents unavoidable environmental impacts. None of the viable, alternatives were determined to provide an appreciable reduction in overall impact. In addition, the proposed project was estimated to require less land use commitment for obtaining the fuel source (by mining or wells, depending on the source). The coal alternative was substantially inferior because of relatively large construction and operational land use requirements.

Ecological impacts can vary depending on whether the alternative plants are sited at the RBS. As in the assessment of land use, none of the viable alternatives were found to provide an appreciable reduction in overall impact to the environment. In addition, these alternatives were expected to have greater impacts to the environment because of fuel source-related land use. No environmentally preferable alternatives were identified.

Closed cycle cooling systems were considered for the alternatives (as is intended for the proposed project). In evaluating surface and groundwater impact, no environmentally preferable alternatives were identified.

Air quality impacts are primarily related to airborne emissions. The proposed project was expected to provide the lowest amount of key contaminants into the atmosphere. The coal alternative, with substantially greater emissions, was considered environmentally inferior for this impact area. No environmentally preferable alternatives were identified.

Impacts related to waste generation, transportation, and human health were assessed. No environmentally preferable alternatives were identified.

Socioeconomic impacts related to coal and gas alternatives were considered, relative to that of the proposed project. The size of the construction workforce and duration are key parameters. While the proposed project is estimated to have a larger workforce and longer construction duration (in comparison to the gas-fired alternative), the associated increased socioeconomic impacts are temporary (during construction) and should be mitigated by the distribution of these impacts over a larger, more populous area and by improved transportation routes. These impacts could be offset to some degree by the opportunity for increased employment during construction. In the long-term, surrounding communities could also benefit from a relatively higher tax base. Environmental justice was considered in this analysis. The proposed project has no significant adverse environmental or human health impacts; therefore, no disproportionate impacts to special population groups are expected. No environmentally preferable alternatives were identified.

This analysis concludes that, for the key environmental impact areas evaluated, there is no alternative energy source identified as environmentally preferable to the proposed project.

9.2.5 REFERENCES

9.2-1 Plan Summary Document, Entergy Electric System Strategic Supply Resource Plan for the Planning Period 2007 - 2016, October 20, 2006.

9.2-2 U.S. Department of Energy, *Annual Energy Outlook 2007 with Projections to 2030,* Energy Information Administration, Washington, D.C., 2007.

9.2-3 U.S. Nuclear Regulatory Commission, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants,* NUREG-1437, Vol. 1, Washington, D.C., 1996.

9.2-4 U.S. Department of Energy, "Form EIA-861 Database, Final Data File for 2006," Website, http://www.eia.doe.gov/cneaf/electricity/page/eia861.html, accessed December 11, 2007.

9.2-5 American Wind Energy Association, Wind Web Tutorial, Website, http://www.awea.org/faq/wwt_environment.html#How much land is needed for a utility-scale wind plant, accessed August 25, 2008.

9.2-6 U.S. Nuclear Regulatory Commission, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Peach Bottom Atomic Power Station Units 2 and 3,* NUREG-1437, Supplement 10, Washington, D.C., 2003.

9.2-7 U.S. Department of Energy/Renewable Resource Data Center/National Renewable Energy Laboratory, *Wind Energy Resource Atlas of the United States*, Golden, Colorado, Website, http://rredc.nrel.gov/wind/pubs/atlas/maps/Chap3/3-43m.html, accessed July 1, 2008.

9.2-8 French, M., "Evaluating Wind Energy Potential in Louisiana," report prepared for the Louisiana Department of Natural Resources, Baton Rouge, September 1981, Website, http://dnr.louisiana.gov/sec/execdiv/techasmt/energy_sources/wind/windreport1981.html, accessed July 1, 2008.

9.2-9 California Energy Commission, "Renewable Resources Development Report," Contract No. 500-03-080F, Sacramento, California, November 2003, Website, http://www.energy.ca.gov/reports/2003-11-24_500-03-080F.PDF, accessed July 1, 2008.

9.2-10 Environmental Law and Policy Center, "Repowering The Midwest: A Clean Energy Development Plan for the Heartland," Chicago, Illinois, 2001, Website, http://www.repowermidwest.org/repoweringthemidwest.pdf, accessed July 2, 2008.

9.2-11 U.S. Department of Energy, "Business Case for New Nuclear Power Plants," Final Draft, Office of Nuclear Energy, Washington, D.C., July 2002, Website, http://www.ne.doe.gov/home/bc/businesscase.html, accessed July 1, 2008.

9.2-12 U.S. Department of Energy, "The Economic Future of Nuclear Power," Office of Nuclear Energy, Washington, D.C., 2004, Website, http://www.ne.doe.gov/np2010/reports/NuclIndustryStudy.pdf, accessed July 1, 2008.

9.2-13 U.S. Department of Energy/ Energy Information Administration, "Table FE2, Typical Costs and Capacity of New Transmission Lines," Washington D.C., 2004, Website, http://www.eia.doe.gov/cneaf/pubs_html/feat_trans_capacity/table2.html, accessed July 1, 2008.

9.2-14 U.S. Department of Energy/ Energy Information Administration, *Renewable Energy Annual 1995*, DOE/EIA-0603(95), Washington D.C., 1995, Website, http://tonto.eia.doe.gov/FTPROOT/renewables/060395.pdf, accessed July 1, 2008.

9.2-15 National Wind Coordinating Committee, "Wind Energy Series: Wind Energy Environmental Issues," No. 2., Washington D.C., January 1997, Website, http://www.nationalwind.org/pubs/wes/wes02.htm.

9.2-16 *Business Week*, "The War Over Offshore Wind is Almost Over," Special Report, June 26, 2008, Website, http://www.businessweek.com/magazine/content/08_27/b4091052403644.htm, accessed August 2, 2008.

9.2-17 National Wind Coordinating Committee, "Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to Other Sources of Avian Collision Mortality in the United States," Washington D.C., August 2001, Website, http://www.nationalwind.org/pubs/avian_collisions.pdf, accessed July 2, 2008.

9.2-18 U.S. Department of Energy Report, "Energy Consumption and Renewable Energy Development Potential on Indian Lands," April 2000, Website, http://www.eia.doe.gov/cneaf/solar.renewables/ilands/toc.html, accessed July 2, 2008.

9.2-19 Solar Energy Industries Association, "Our Solar Future: The U.S. Photovoltaics Industry Roadmap Through 2030 and Beyond," September 2004, Website, http://www.seia.org/roadmap.pdf, accessed July 2, 2008.

9.2-20 U.S. Department of Energy, National Renewable Energy Laboratory, "The Potential for Low-Cost Concentrating Solar Power Systems," May 1999, Website, http://www.nrel.gov/docs/fy99osti/26649.pdf, accessed July 2, 2008.

9.2-21 Idaho National Engineering and Environmental Laboratory, *Hydropower Resource Assessment for Louisiana,* DOE/ID-10430(LA), Idaho Falls, Idaho, December 1993.

9.2-22 U.S. Department of Energy, "Louisiana Geothermal Resources," Website, http://www.eere.energy.gov/states/alternatives/geothermal.cfm, accessed December 12, 2007.

9.2-23 U.S. Department of Energy, Energy Information Administration, "State Renewable Electricity Profiles," 2006 Edition, Website, http://www.eia.gov/cneaf/solar.renewables/page/state_profiles/r_profiles_sum.html, accessed July 2, 2008.

9.2-24 Massachusetts Division of Energy Resources & Massachusetts Department of Conservation & Recreation, “Advanced Biopower Technology Assessment," January 2008, Website, http://www.mass.gov/doer/programs/renew/bio022808-adv-biopower-assess.pdf, accessed August 13, 2008.

9.2-25 Integrate Waste Services Association, "Energy," Washington, D.C., Website, http://www.wte.org/energy/, accessed August 8, 2008.

9.2-26 U.S. Department of Energy, "Future Fuel Cells," Website, http://www.fossil.energy.gov/programs/powersystems/fuelcells/, accessed July 2, 2008.

9.2-27 U.S. Department of Energy/National Energy Technology Laboratory, "Tidd PFBC Demonstration Project A DOE Assessment, Morgantown, West Virginia, August 2001, Website, http://www.osti.gov/bridge/servlets/purl/786183-HMtEXL/native/786183.pdf, accessed August 13, 2008.

9.2-28 U.S. Nuclear Regulatory Commission, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Arkansas Nuclear One,* NUREG-1437, Supplement 3, Washington, D.C., 2001.

9.2-29 U.S. Census Bureau, "State and County Quick Facts," Website, http://quickfacts.census.gov/qfd/states/22000.html, accessed November 29, 2007.

9.2-30 U.S. Department of Energy/National Energy Technology Laboratory, "Topical Report 18: Environmental Benefits of Clean Coal Technologies," Washington, D.C., April 2001, Website, http://www.netl.doe.gov/technologies/coalpower/cctc/topical reports/pdfs/topical18.pdf, accessed July 2, 2008.

9.2-31 U.S. Department of Energy/National Renewable Energy Laboratory, "Profiles in Renewable Energy: Case Studies of Successful Utility-Sector Projects," Washington D.C., 2004, Website, http://www.osti.gov/accomplishments/NRELprofiles.html, accessed July 2, 2008.

9.2-32 U.S. Department of Energy/Office of Energy Efficiency and Renewable Energy, "Concentrating Solar Power," Washington, D.C., 2004, Website, http://www.eere.energy.gov, accessed August 2, 2008.

9.2-33 California Energy Commission, "Potential Health and Environmental Impacts Associated with the Manufacture and Use of Photovoltaic Cells," Sacramento, California, 2004, Website, http://www.energy.ca.gov/reports/500-04-053.pdf, accessed July 2, 2008.

Table 9.2-1 (Sheet 1 of 6)
Alternative Energy Sources: Comparison of Key Environmental Impacts[a]

Environmental Impact Area	Proposed Project[b]	Combined Cycle Natural Gas	Coal
Site	RBS	RBS	RBS
Assumed Generating Capacity (MWe)	1600[c]	1626[d]	1626[e]
Land Use - Plant Footprint	Plant would use approx. 43 ac. for offices, parking lots, permanent support facilities, power block, and protected area. The land use impact for the proposed project is SMALL.	Total of 225 ac. estimated. 140 ac. estimated for power block and support facilities. Additional 85 ac. for new gas pipeline (if sited at the RBS). The land use impact for the natural gas alternative is SMALL.	Estimated requirement of 2720 ac. for plant infrastructure and waste disposal, transmission line, and rail spur. The land use impact for the coal alternative is SMALL.
Land Use - Construction	An additional 150 ac. required to support construction laydown areas and temporary construction facilities. Standard mitigation procedures employed for this land, temporarily affected during construction.	An additional 321 additional acres could be affected (temporarily) during construction of the proposed project. Standard mitigation procedures employed for this land, temporarily affected during construction.	Data not available for additional land use requirement, temporarily used during construction.
Land Use - Fuel Source	Uranium mining and reprocessing requires approx. 215 ac.	5760 ac. required for natural gas wells and collection stations.	35,200 ac. estimated for the mining of coal and limestone for 40 yr. plant lifetime.

Table 9.2-1 (Sheet 2 of 6)

Alternative Energy Sources: Comparison of Key Environmental Impacts[(a)]

Environmental Impact Area	Proposed Project[(b)]	Combined Cycle Natural Gas	Coal
Ecology	Impact would be to a combination of undisturbed and previously undisturbed land. Overall permanent impact is SMALL. Cooling tower drift impact would be minimal. Additional ecological impact is expected because of land use related to uranium mining and reprocessing. The ecology impact for the proposed project is SMALL to MODERATE.	Current RBS site has adequate land with possible impact to some combination of disturbed and undisturbed land. Impact is roughly comparable to that of the proposed project. New pipeline would affect undisturbed land. Overall impact at alternate site depends on ecology at alternate site. Cooling tower drift minimal. Additional ecological impact will occur because of land use related to gas wells and collection stations; expected to be proportionally higher than that related to uranium mining and reprocessing. The ecology impact for the natural gas alternative is SMALL to MODERATE.	Additional ecological impact would occur because of land use related to mining of coal and limestone. Substantially greater impacts expected, relative to that required for uranium mining and reprocessing. The ecology impact for the coal alternative is SMALL to MODERATE.

Table 9.2-1 (Sheet 3 of 6)

Alternative Energy Sources: Comparison of Key Environmental Impacts[(a)]

Environmental Impact Area	Proposed Project[(b)]	Combined Cycle Natural Gas	Coal
Water Use and Quality Surface Water and Groundwater	Bulk of new water use would come from Mississippi River intake; considered small fraction of river flow. No significant impact to resource. One additional groundwater well anticipated during construction and to remain during operations. No significant impact to area groundwater resource. The water use impact for the proposed project is SMALL.	Closed cycle cooling may involve cooling tower blowdown discharge containing dissolved solids (regulated by the Louisiana Pollutant Discharge Elimination System [LPDES]). Impact would depend on water volume required and characteristics of receiving body. LPDES would regulate discharge. The water use impact for the natural gas alternative is SMALL.	Closed cycle cooling may involve cooling tower blowdown discharge containing dissolved solids (regulated by LPDES). Impact would depend on water volume required and characteristics of receiving body. Appropriate state and/or permitting authority would regulate intake and discharge. The water use impact for the coal alternative is SMALL.
Air Quality	Emissions from auxiliary boilers and standby diesel generators[(f)]	Products and residues of combustion	Products and residues of combustion[(g)]
Sulfur oxides	22 tons (20 MT) per year	120 tons (109 MT) per year	13,340 tons (12,100 MT) per year
Nitrous oxides	30 tons (27 MT) per year	460 tons (417 MT) per year	12,800 tons (11,600 MT) per year
Particulates	2 tons (2 MT) per year	70 tons (63 MT) per year[(h)]	390 tons (350 MT) per year
Carbon monoxide	3 tons (3 MT) per year	610 tons (553 MT) per year	1650 tons (1500 MT) per year
Carbon dioxide	Not available for auxiliary boilers or standby diesel generators. The air quality impact for the proposed plant is SMALL.	Not quantified in LRGEIS; however, expected to be substantially greater than that associated with proposed project. The air quality impact for the natural gas alternative is SMALL to MODERATE.	Not quantified in LRGEIS; however, expected to be substantially greater than that associated with proposed project. The air quality impact for the coal alternative is MODERATE.

Table 9.2-1 (Sheet 4 of 6)

Alternative Energy Sources: Comparison of Key Environmental Impacts[(a)]

Environmental Impact Area	Proposed Project[(b)]	Combined Cycle Natural Gas	Coal
Waste	Solid nonradioactive waste includes typical office trash, aluminum cans, glass, paper etc.; disposed of off-site meeting federal, state, local regulations. Impacts related to waste (and transportation of wastes) are consistent with 10 CFR 51.52, Tables S-3 and S-4. Refer to Sections 3.8 and 5.7. The waste impact for the proposed project is SMALL.	Waste generation is minimal; comparable to nonradioactive waste for proposed project. The waste impact for the natural gas alternative is SMALL.	784,000 tons/yr of ash, spent catalyst; 728,000 tons/yr of scrubber sludge requiring approximately 800 ac. for disposal during the 40-year life of the plant. The waste impact for the coal alternative is MODERATE.
Human Health	Releases during normal operation are within regulatory limits, and the risks from accidents are SMALL. The human health impact for the proposed project is SMALL.	Overall impacts considered small. The human health impact for the natural gas alternative is SMALL.	Impacts lead to numerous areas of risks to workers and/or public related to mining and transportation of coal and limestone, waste disposal, and inhalation of stack emissions. Regulations are set to minimize health impacts. Impacts are uncertain, but are considered small in the absence of more quantitative data. The human health impact for the coal alternative is SMALL.

Table 9.2-1 (Sheet 5 of 6)

Alternative Energy Sources: Comparison of Key Environmental Impacts[(a)]

Environmental Impact Area	Proposed Project[(b)]	Combined Cycle Natural Gas	Coal
Socioeconomic	Construction workforce estimated at 3150, with construction period of 5 to 6 years. Temporary impact to community housing, services, and traffic. Mitigated by distribution over relatively large multiple county area and improved transportation routes. Some degree of offsetting benefits due to proportionally larger construction jobs opportunities and increased tax base during operations. The socioeconomic impact for the proposed plant is SMALL but beneficially LARGE to the community.	Construction workforce estimated at 1200 with construction period of 3 years. Temporary impact to community housing, services, and traffic. The socioeconomic impact for the natural gas alternative is SMALL but beneficially MODERATE to the community.	Up to 2500 workers during the peak of the 5-year construction period. Temporary impact to community housing, services, and traffic. The socioeconomic impact for the coal alternative is SMALL but beneficially LARGE to the community.
Historical and Archaeological Resources	No impacts of significance expected from proposed project. The historical and archaeological impacts for the proposed plant are SMALL.	Given projected land use, no significant impact from plant footprint. Land use for gas wells is larger and, therefore, has potential for impact; depends on nature of land on which wells are constructed. Studies of potentially affected resources would be required and, typically, impacts can be managed. The historical and archaeological impacts for the natural gas alternative are SMALL.	Substantial land use for plant footprint and fuel mining. Large potential for some degree of impact. Studies of potentially affected resources would be required and, typically, impacts can be managed. The historical and archaeological impacts for the coal alternative are SMALL.

Table 9.2-1 (Sheet 6 of 6)

Alternative Energy Sources: Comparison of Key Environmental Impacts[a]

Environmental Impact Area	Proposed Project[b]	Combined Cycle Natural Gas	Coal
Environmental Justice	In accordance with Subsection 4.4.3, impacts on minority populations resulting from plant construction and operation would not be disproportionate. Therefore, impacts are expected to be SMALL.	In accordance with Subsection 4.4.3, impacts on minority populations resulting from plant construction and operation would not be disproportionate. Therefore, impacts are expected to be SMALL.	In accordance with Subsection 4.4.3, impacts on minority populations resulting from plant construction and operation would not be disproportionate. Therefore, impacts are expected to be SMALL.

a) Refer to Subsection 9.2.3 for the source of impact values for coal and gas alternatives.

b) Unless otherwise noted, the impacts presented are based on ESBWR values for the proposed project. Refer to Chapter 3 of this report.

c) The "target site capacity" for the proposed project is 1600 MWe. Refer to Subsection 9.2.2 for additional discussion.

d) Based on 80 percent of four 508 MWe net gas-fired units.

e) Based on 80 percent of four 508 MWe net coal-fired units.

f) The proposed project could utilize gas turbine generators for standby power as well. However, because of generally greater emissions from diesel generators, emissions estimates were based on using all diesel generators.

g) The coal facility's air quality impact would also include small amounts of mercury and other hazardous air pollutants and naturally occurring radioactive materials - primarily uranium and thorium.

h) The value listed is for PM_{10} (particulates of a size less than 10 micrometers). Data for total suspended particulates were not provided in NUREG-1437, Supplement 10 (Reference 9.2-8).

9.3 ALTERNATIVE SITES

9.3.1 INTRODUCTION

As described in detail in Chapter 8, Entergy has determined that construction and operation of a single-unit new nuclear power plant may be in the best interests of its ratepayers; preparation of a COLA is the first step in maintaining this option. The new plant would be regulated under applicable provisions of Entergy's utility operations within its designated service area.

As required by 10 CFR 52.17(a)(2), this section provides an analysis of alternatives to the proposed RBS COL site for the construction and operation of a new nuclear facility. The NEPA mandates that reasonable alternatives to an action be evaluated.

Overall process guidance for consideration of alternative sites was taken from NUREG-1555, Section 9.3. The overall decision-making process for analyzing the potential sites was derived from the Electric Power Research Institute (EPRI) "Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application" (Siting Guide) (Reference 9.3-1).

9.3.2 SITE SELECTION PROCESS OVERVIEW

The process for selection of a proposed site for the RBS COLA is depicted in Figure 9.3-1; this process is summarized in the paragraphs below and is discussed in Subsections 9.3.3 through 9.3.6. A comparison of the potential environmental impacts of a new nuclear power plant unit at the alternative sites is provided in Subsection 9.3.7.

The region of interest (ROI) was defined as the Entergy service territory (refer to Subsection 9.3.3). The ROI was examined from the perspectives of known characteristics and advantages of the multiple existing nuclear power plant sites versus the additional sites that are available within the ROI. Based on this analysis, it was determined (refer to Subsection 9.3.4) that the fleet of four existing nuclear power plant sites was a reasonable set of potential sites for evaluation of an additional nuclear plant unit in the Entergy service territory. For balance and perspective, two greenfield sites owned by Entergy have also been considered in the evaluation process. Evaluation of these alternatives provides a perspective on environmental trade-offs available at greenfield sites that potentially could satisfy the schedule objectives of the RBS project (i.e., allow submittal of a COLA by the end of 2008).

The six sites were evaluated using criteria derived from those presented in Chapter 3.0, General Siting Criteria, of the Siting Guide (refer to Subsection 9.3.5).

9.3.3 DEFINE REGION OF INTEREST

Because the business plan for the nuclear power plant unit anticipated in this application would be for a regulated plant (i.e., approval from the applicable public utility commission would be sought to include costs associated with plant development in the rate base), the ROI for this site selection study was defined to be the Entergy service territory. Entergy's service territory encompasses portions of the states of Arkansas, Louisiana, Mississippi, and Texas (Figures 8.1-2 and 8.1-3).

9.3.4 CONDUCT REGIONAL SITING REVIEW AND IDENTIFY POTENTIAL SITES

A review of the ROI was conducted to identify any unsuitable areas. The necessary infrastructure, cooling water supply, and transmission lines are generally well-supported in the ROI. Thus, the candidate areas encompass much of the ROI. The candidate areas were reviewed to determine whether any sites other than Entergy's current fleet of operating nuclear power plant sites would be significantly environmentally superior or would better satisfy the business objectives for the new unit. This review was based on company knowledge of the following:

- The existing nuclear power plant sites.
- Other (non-nuclear) power plant and greenfield sites owned by Entergy.
- Previous siting studies.
- General knowledge of the ROI, based on operating experience.

It was expected that, from an environmental perspective, developing an entirely new (greenfield) site would result in higher impacts because of the imposition of construction and operational activities on otherwise undisturbed areas. However, two greenfield sites are included as potential sites to validate this hypothesis. Existing non-nuclear power plants or other industrial sites in the ROI are not typically large enough to accommodate a new nuclear power plant and would require the acquisition of new land. The potential sites and related facilities are controlled by Entergy and site access is readily available.

In addition, Entergy's existing nuclear plant sites enjoy multiple advantages characteristic of sites with currently licensed operating nuclear facilities. In particular, the following apply with regard to timely preparation of a COLA:

- Site characterization data have been collected and are available to support the COL analysis.
- NRC previous review and approval for nuclear plant construction and operation has been completed.
- Site infrastructure appropriate specifically for nuclear plant operation is already in place.
- Programs, procedures, and arrangements have been established and are in place with state and local governmental agencies.
- Company liaisons with local communities exist, and there is known local support for the plants.
- Operational impacts of the existing nuclear plants have been monitored and shown to be small.

These aspects of the existing nuclear power plant sites provided a high level of confidence that the sites would prove acceptable for a nuclear power plant and that a compliant COLA could be prepared in the time frame required to submit it to the NRC in 2008 and qualify the project for financial incentives under the 2005 National Energy Policy Act. These considerations, taken collectively, also serve to minimize uncertainty in the licensing process and to improve the likelihood that the selected site would meet the siting requirements of 10 CFR 52, eventually resulting in an approved COL. No other sites in the ROI would have these advantages.

Thus, it was judged to be very unlikely that sites in the ROI could be found that would be environmentally preferable or obviously superior to Entergy's existing nuclear power plant sites for this project. However, because two Entergy-owned greenfield sites could potentially satisfy the business objectives of the RBS project, they were included as potential sites. Accordingly, for this study, the following set of potential sites was selected:

- Arkansas Nuclear One (ANO).
- Grand Gulf Nuclear Station (GGNS).
- RBS.
- Waterford Unit 3 (W3).
- Blue Hills (greenfield, southeast Texas).
- Wilton (greenfield, southwest Louisiana).

9.3.5 EVALUATE POTENTIAL SITES

General siting criteria used to evaluate the six potential sites were derived from those presented in Chapter 3.0 of the Siting Guide; criteria from the Siting Guide were tailored to reflect issues applicable to, and data available for, the Entergy potential sites. A list of the criteria appears in Table 9.3-1.

The overall process for applying the general site criteria consisted of the following elements:

Criterion Ratings - Each site was assigned a rating of 1 to 5 (1 = least suitable, 5 = most suitable) for each of the potential site evaluation criteria using the rationale and technical basis described in Appendix 9A. Information sources for these evaluations included publicly available data, information available from licensing documentation for the candidate sites, and U.S. Geological Survey (USGS) topographic maps.

Weight Factors - Weight factors reflecting the relative importance (1 = least important, 5 = most important) of these criteria were synthesized from those developed for previous nuclear power plant siting studies. The weight factors were originally derived using a methodology consistent with the modified Delphi process specified in the Siting Guide.

Composite Suitability Ratings - Ratings reflecting the overall suitability of each site were developed by multiplying criterion ratings by the criterion weight factors and summing over all criteria for each site, as summarized in Table 9.3-1 and depicted in Figure 9.3-2.

9.3.6 IDENTIFY PROPOSED AND ALTERNATIVE SITES

The results of applying the evaluation process described above to the six potential sites are summarized in Table 9.3-1 and Figure 9.3-2.

Based on the evaluations of general site criteria using currently available information (Appendix 9A), each of the four candidate sites appears to be a suitable and licensable site for a new nuclear power plant. The RBS ranked highest in the overall composite ratings, supporting its selection as the proposed site and the subject of this application. In addition, compared to the alternative sites, the RBS site offers the following:

- Provides better proximity to loads in southern Louisiana.
- Has system reliability advantages in terms of overall voltage support and contingency mitigation.
- Most effectively fosters the regional goal of reducing reliance on natural gas in south Louisiana.

For these reasons, the RBS was selected as the proposed site for Entergy's second COLA. ANO, GGNS, and W3 were identified as alternative candidate sites. Based on the general site criteria evaluations, the RBS, GGNS, ANO, and W3 sites were found to be more favorable, based on their higher composite scores, than the two greenfield potential sites. Accordingly, the two greenfield sites were deferred from further consideration. A comparison of the proposed and alternative sites from an environmental impact perspective appears in the following subsection.

9.3.7 ENVIRONMENTAL COMPARISON OF ALTERNATIVE SITES

This subsection provides a comparative evaluation of the environmental impacts of constructing and operating a new single-unit nuclear power plant at the proposed location, RBS, and three alternate locations, ANO, GGNS, and W3. The environmental impacts of several impact categories were evaluated, and a level of significance (SMALL, MODERATE, or LARGE) was assigned for each category at each site, based on the following:

- SMALL: Environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the NRC has concluded that those impacts that do not exceed permissible levels in the NRC's regulations are considered small.
- 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.

Environmental effects were evaluated and predicted, based on the existing information available for the sites under consideration. Where feasible, these impact analyses were developed using the methodology and approach used in recent NRC environmental reviews of new reactor license applications (e.g., the Grand Gulf Early Site Permit Application [Reference 9.3-2]). Thus, the impact levels reflect the guidelines of the Council on Environmental Quality (CEQ) (Reference 9.3-3) and those set forth in the footnotes to Table B-1 of 10 CFR 51, Subpart A, Appendix B; the impact categories evaluated are the same as those used in NUREG-1437 (Reference 9.3-4), with the additional impact category of environmental justice.

In summary, the environmental impacts analysis shows that the overall environmental impacts (from both construction and operation activities) at the proposed site (RBS) are generally SMALL, and none of the alternate sites is environmentally preferred to the proposed site.

Results of the analysis of construction and operational impacts are summarized in Tables 9.3-2 and 9.3-3, respectively. The technical basis for these results is described in Appendix 9B.

9.3.8 REFERENCES

9.3-1 Electric Power Research Institute, "Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application," March 2002.

9.3-2 System Energy Resources, Inc., "Grand Gulf Site Early Site Permit Application," October 2005.

9.3-3 40 CFR 1508.27, "Protection of Environment, Council on Environmental Quality," 2007.

9.3-4 U.S. Nuclear Regulatory Commission, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437, Supplements 3 and 19, Washington, D.C., 1996.

**Table 9.3-1 (Sheet 1 of 3)
General Siting Criteria Ratings**

	Criteria	Weight Factor	Blue Hills		Wilton		ANO		GGNS		RBS		W3	
			Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score
Health and Safety Criteria														
A.1.1.1	Geology/Seismology	3.77	4	15.1	4	15.1	4	15.1	4	15.1	4	15.1	4	15.1
A.1.1.2	Cooling System Requirements	3.27	2	6.5	5	16.4	2	6.5	5	16.4	5	16.4	5	16.4
A.1.1.3	Flooding	2.40	5	12.0	1	2.4	2	4.8	3	7.2	4	9.6	1	2.4
A.1.1.4	Nearby Hazardous Land Uses	3.35	5	16.8	1	3.4	3	10.1	5	16.8	3	10.1	1	3.4
A.1.1.5	Extreme Weather Conditions	2.36	3	7.1	2	4.7	4	9.4	3	7.1	2	4.7	2	4.7
A.1.2	Accident Effect Related	4.09	4	16.4	3	12.3	4	16.4	4	16.4	4	16.4	3	12.3
A.1.3.1	Surface Water - Radionuclide Pathway	2.50	4	10.0	4	10.0	4	10.0	5	12.5	5	12.5	4	10.0
A.1.3.2	Groundwater Radionuclide Pathway	2.55	5	12.8	4	10.2	4	10.2	4	10.2	4	10.2	5	12.8
A.1.3.3	Air Radionuclide Pathway	2.50	4	10.0	5	12.5	4	10.0	4	10.0	4	10.0	5	12.5
A.1.3.4	Air-Food Ingestion Pathway	2.50	4	10.0	3	7.5	3	7.5	3	7.5	3	7.5	5	12.5
A.1.3.5	Surface Water-Food Radionuclide Pathway	2.41	5	12.1	5	12.1	5	12.1	5	12.1	5	12.1	5	12.1
A.1.3.6	Transportation Safety	2.14	4	8.6	4	8.6	4	8.6	4	8.6	4	8.6	4	8.6
Environmental Criteria														
A.2.1.1	Disruption of Important Species/Habitats	2.64	4	10.6	4	10.6	4	10.6	4	10.6	4	10.6	4	10.6
A.2.1.2	Bottom Sediment Disruption Effects	2.14	3	6.4	2	4.3	4	8.6	3	6.4	3	6.4	2	4.3

Table 9.3-1 (Sheet 2 of 3)
General Siting Criteria Ratings

	Criteria	Weight Factor	Blue Hills		Wilton		ANO		GGNS		RBS		W3	
			Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score
A.2.2.1	Disruption of Important Species/Habitats and Wetlands	3.18	3	9.5	3	9.5	4	12.7	3	9.5	3	9.5	2	6.4
A.2.2.2	Dewatering Effects on Adjacent Wetlands	2.77	4	11.1	3	8.3	5	13.9	4	11.1	4	11.1	3	8.3
A.2.3.1	Thermal Discharge Effects	3.64	4	14.6	5	18.2	4	14.6	5	18.2	5	18.2	5	18.2
A.2.3.2	Entrainment/Impingement Effects	3.23	5	16.2	5	16.2	5	16.2	5	16.2	5	16.2	5	16.2
A.2.3.3	Dredging/Disposal Effects	2.36	3	7.1	3	7.1	4	9.4	3	7.1	3	7.1	3	7.1
A.2.4.1	Drift Effects on Surrounding Areas	2.36	4	9.4	3	7.1	5	11.8	4	9.4	4	9.4	2	4.7
Socioeconomic Criteria														
A.3.1	Socioeconomics - Construction-Related Effects	2.00	2	4.0	4	8.0	3	6.0	3	6.0	4	8.0	4	8.0
A.3.3	Environmental Justice	1.95	5	9.8	5	9.8	5	9.8	5	9.8	5	9.8	5	9.8
A.3.4	Land Use	N/A	2	N/A	4	N/A	5	N/A	5	N/A	5	N/A	5	N/A
Engineering and Cost-Related Criteria														
A.4.1.1	Water Supply	3.70	5	18.5	5	18.5	5	18.5	4	14.8	5	18.5	5	18.5
A.4.1.2	Pumping Distance	3.05	3	9.2	5	15.3	5	15.3	4	12.2	4	12.2	5	15.3
A.4.1.3	Flooding	2.90	5	14.5	1	2.9	2	5.8	3	8.7	4	11.6	1	2.9
A.4.1.4	Seismic Design	N/A		N/A		N/A		N/A		N/A		N/A		N/A
A.4.1.5	Civil Works	3.40	3	10.2	1	3.4	5	17.0	4	13.6	4	13.6	1	3.4
A.4.2.1	Railroad Access	2.60	2	5.2	4	10.4	5	13.0	3	7.8	5	13.0	5	13.0
A.4.2.2	Highway Access	2.80	3	8.4	4	11.2	5	14.0	5	14.0	5	14.0	5	14.0

Table 9.3-1 (Sheet 3 of 3)
General Siting Criteria Ratings

Criteria		Weight Factor	Blue Hills		Wilton		ANO		GGNS		RBS		W3	
			Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score
A.4.2.3	Barge Access	2.85	1	2.9	5	14.3	5	14.3	5	14.3	5	14.3	5	14.3
A.4.2.4	Transmission Access	4.80	2	9.6	5	24.0	1	4.8	3	14.4	4	19.2	5	24.0
A.4.3.1	Topography	2.55	4	10.2	5	12.8	4	10.2	4	10.2	4	10.2	5	12.8
A.4.3.2	Land Rights	2.75	3	8.3	4	11.0	5	13.8	5	13.8	5	13.8	5	13.8
A.4.3.3	Labor Rates	3.30	4	13.2	3	9.9	4	13.2	4	13.2	3	9.9	3	9.9
Composite Site Rating			**346.3**		**348.0**		**374.2**		**381.2**		**389.8**		**358.3**	

Table 9.3-2
Comparison of the Construction Impacts at the Proposed and Alternative Sites

	Proposed Site	Alternative Sites		
Impact Area Category	**RBS**	**ANO**	**GGNS**	**W3**
Land Use				
Site and vicinity	SMALL	SMALL	SMALL	SMALL
Power transmission line right-of-way (ROW) and off-site areas	SMALL to MODERATE	MODERATE	SMALL to MODERATE	SMALL to MODERATE
Air Quality	SMALL	SMALL	SMALL	SMALL
Water-Related				
Water use	SMALL	SMALL to MODERATE	SMALL	SMALL
Water quality	SMALL	SMALL	SMALL	SMALL
Ecological				
Terrestrial ecosystems	SMALL	MODERATE	MODERATE	SMALL
Aquatic ecosystems	SMALL	SMALL	MODERATE	SMALL
Threatened and endangered species – terrestrial and aquatic	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL
Socioeconomic				
Physical impacts	SMALL	SMALL	SMALL	SMALL
Demography	SMALL	MODERATE to LARGE	MODERATE to LARGE	SMALL
Social and economic	BENEFICIAL	BENEFICIAL (LARGE to local economy)	BENEFICIAL (LARGE to local economy)	BENEFICIAL
Infrastructure and community services	SMALL to MODERATE	MODERATE to LARGE	MODERATE to LARGE	SMALL to MODERATE
Historic and Cultural Resources	SMALL	MODERATE	SMALL	SMALL
Environmental Justice	SMALL	SMALL	SMALL to MODERATE	SMALL
Nonradiological Health	SMALL	SMALL	SMALL	SMALL
Radiological Health	SMALL	SMALL	SMALL	SMALL

Table 9.3-3
Comparison of the Operational Impacts at the Proposed and Alternative Sites

Impact Area Category	Proposed Site	Alternative Sites		
	RBS	ANO	GGNS	W3
Land Use				
Site and vicinity	SMALL	SMALL	SMALL	SMALL
Power transmission line ROW and off-site areas	SMALL	SMALL	SMALL	SMALL
Air Quality	SMALL	SMALL	SMALL	SMALL
Water-Related				
Water use	SMALL	SMALL to MODERATE	SMALL	SMALL
Water quality	SMALL	SMALL	SMALL	SMALL
Ecological				
Terrestrial ecosystems	SMALL	SMALL	SMALL	SMALL
Aquatic ecosystems	SMALL	SMALL	SMALL	SMALL
Threatened and endangered species – terrestrial and aquatic	SMALL	SMALL	SMALL	SMALL
Socioeconomic				
Physical impacts	SMALL	SMALL	SMALL	SMALL
Demography	SMALL	SMALL to MODERATE	MODERATE to LARGE	SMALL
Social and economic	BENEFICIAL	BENEFICIAL	BENEFICIAL	BENEFICIAL
Infrastructure and community services	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL
Historic and Cultural Resources	SMALL	SMALL	SMALL	SMALL
Environmental Justice	SMALL	SMALL	SMALL to MODERATE	SMALL
Nonradiological Health	SMALL	SMALL	SMALL	SMALL
Radiological Health	SMALL	SMALL	SMALL	SMALL
Impact of Postulated Accidents	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE

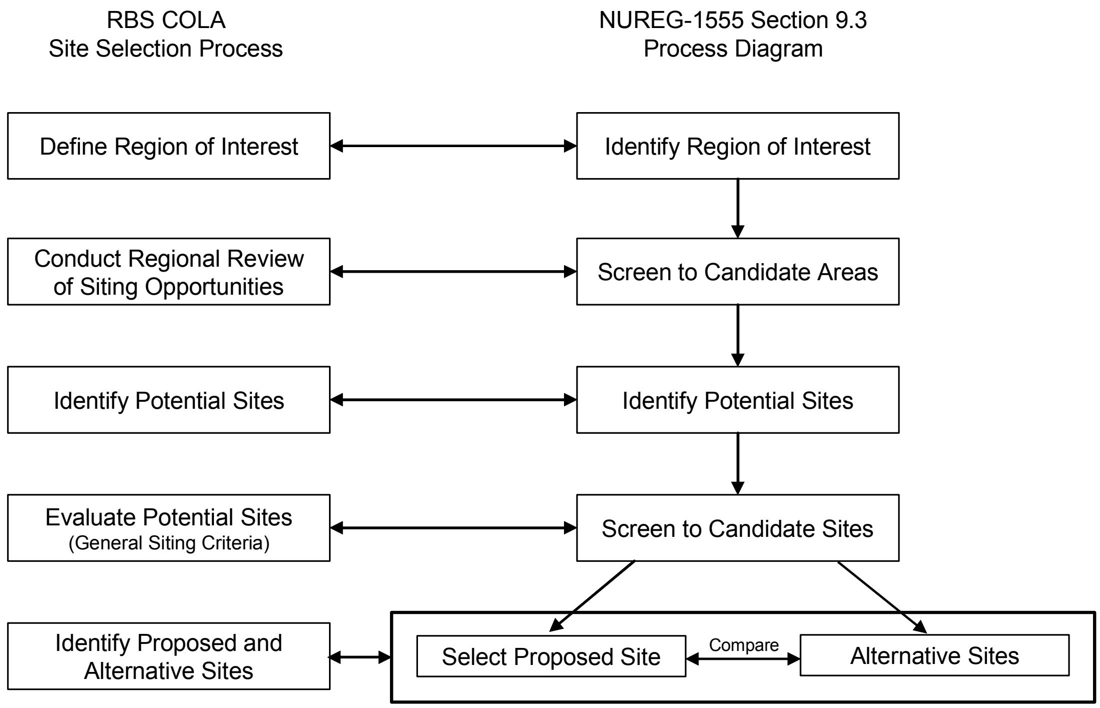

Figure 9.3-1. RBS COLA Site Selection Process Diagram

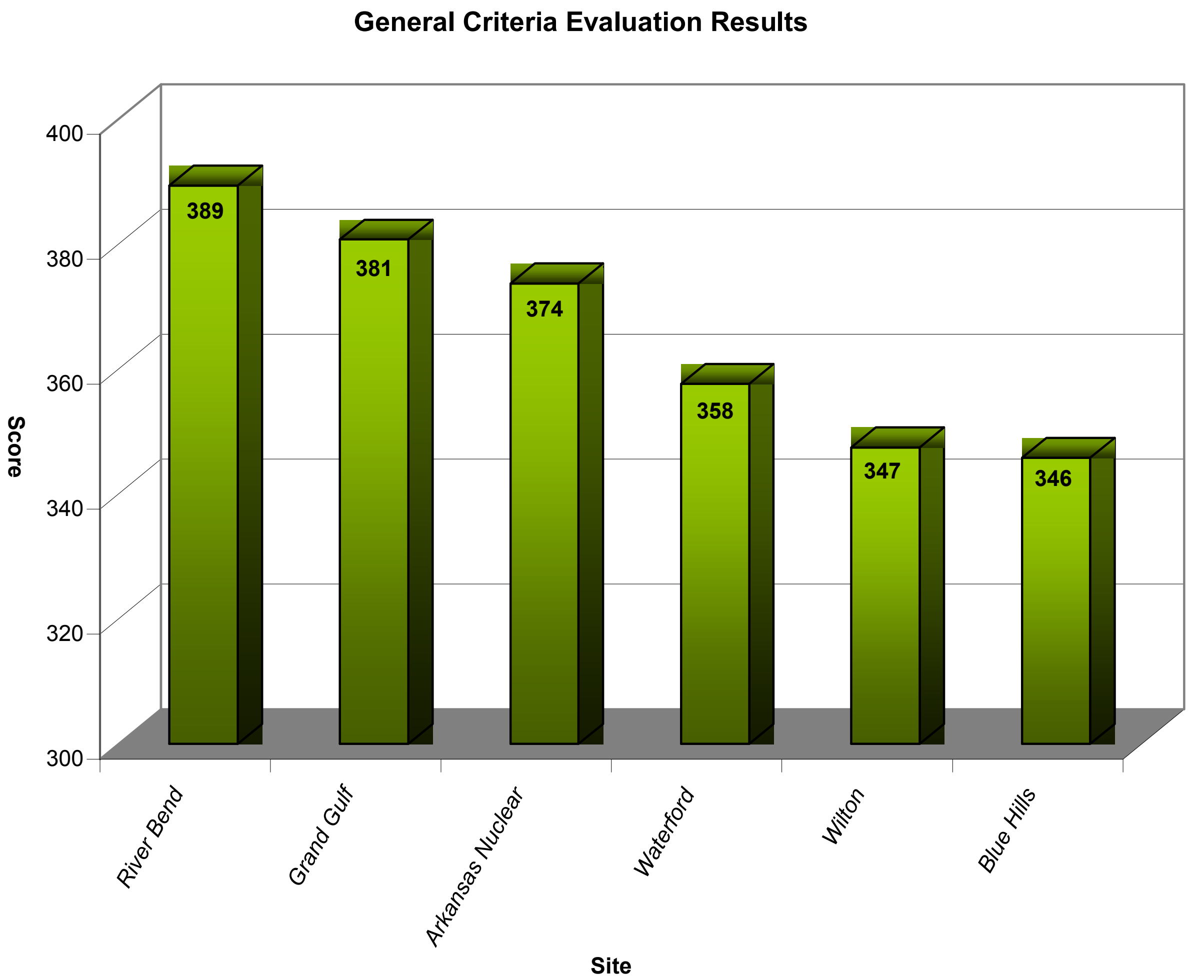

Figure 9.3-2. Composite Site Suitability Ratings

9.4 ALTERNATIVE PLANT AND TRANSMISSION SYSTEMS

This section discusses alternatives in each of three system areas for RBS Unit 3. This information is provided to enable a comparison of the environmental impact on each alternative to those of the proposed system.

Subsection 9.4.1 presents alternatives to the plant heat dissipation system. Subsection 9.4.2 evaluates alternatives to the circulating water system. These are presented as alternatives in the areas of intake design and location, discharge designs and locations, water supplies, and water treatment. Subsection 9.4.3 presents alternatives to the proposed transmission system design, construction and maintenance practices:

- Heat Dissipation Systems (Subsection 9.4.1).
- Circulating Water Systems (Subsection 9.4.2).
- Transmission Systems (Subsection 9.4.3).

9.4.1 HEAT DISSIPATION SYSTEMS

This subsection discusses alternatives to the proposed heat dissipation system (described in Subsection 5.3.3), based on guidance provided in NUREG-1555. Alternatives considered are those generally included in the broad categories of "once-through" and "closed cycle" systems. The once-through method involves the use of a large quantity of cooling water, withdrawn from a water source and returned to that source (i.e., receiving water body) following its circulation through the normal power heat sink (NPHS) (i.e., the main condenser only). Closed cycle cooling systems involve substantially less water intake because the water performing the cooling is continually recirculated through its NPHS (i.e., water system, including pumps, water basin, and two cooling towers consisting of a hyperbolic NDCT and MDCT), and only makeup water for evaporative losses and blowdown is required. Included in the closed cycle category are the following types of heat dissipation systems/components:

- Mechanical draft wet cooling towers.
- Natural draft wet cooling towers.
- Wet dry cooling towers.
- Dry cooling towers.
- Cooling ponds.
- Spray canals.

An initial environmental screening of the above alternative designs was performed to eliminate those systems that are obviously unsuitable for use in a new facility at the RBS site. The screening criteria included on-site land use requirements and terrain conditions, water use requirements, and legislative restrictions that might preclude the use of any of the alternatives. The screening criteria and results are also presented in Table 9.4-1.

As shown in Table 9.4-1, three of the alternatives are not suitable for the RBS site. The RBS site includes approximately 3330 ac. of land within West Feliciana Parish, Louisiana, approximately 24 mi. north-northwest of Baton Rouge. Approximately 950 ac. of the site are considered wetlands, according to U.S. Army Corps of Engineers (USACE) guidelines. Approximately 830 ac. of the site are Mississippi River floodplain (Reference 9.4-1).

As described below, given the size of the site, the layout, and the amount of land required for implementation, the following alternatives were not given further consideration in this section:

- Dry cooling towers.
- Cooling ponds.
- Spray canals.

A dry cooling tower uses significantly less water than a wet cooling tower. These systems use air-flow to cool water flowing inside finned tubes. It is essentially a closed loop system where air is passed over large heat exchange surfaces. While air cooling is a reliable and proven technology, it has some technical and economic drawbacks in comparison to a wet mechanical cooling system. The principal drawbacks of air cooling include increased noise levels, higher capital costs, and larger physical dimensions. The EPA has determined that dry cooling does not create any environmental benefit that is worth the extra cost of the technology as compared to "wet" closed cycle cooling at new generating facilities (Reference 9.4-2).

A cooling pond is undesirable at the RBS, principally because of the very large surface area required, as well as the unsuitability of the soil and topography. A cooling pond would require approximately 2 ac. per megawatt of installed electrical capacity, or some 3000 ac. This acreage exceeds the space available on the RBS site and would result in substantial terrestrial destruction and permanent loss of productivity, either in the ecologically sensitive bottomlands or in the upland forest area.

A conceptual design for a spray canal heat dissipation system was previously evaluated by the Applicant in its initial construction permit submittal to the Atomic Energy Commission (AEC) in Reference 9.4-3. In this submittal, the Applicant identified that a channel about 3 mi. in length, containing 404 floating power spray modules, would be required to dissipate the station heat to the atmosphere, at an estimated cost that was $66 million greater than the cost of mechanical draft cooling towers (in 1974 dollars). Based on the larger size of the ESBWR proposed for RBS Unit 3, the required size would be increased by approximately 20 percent. Because of the general arrangement of the site, the only feasible location for such a spray canal system would be to the south and west of the plant. Operating experience with spray systems indicates that drift losses are high in comparison to natural draft cooling towers and the potential for fogging and icing is greater. Because of the permanent destruction of this amount of wetlands habitat and their aquatic habitat, and the significant cost associated with providing flood protection for the canals, this alternative was not considered further.

Based on the screening results of Table 9.4-1, the following alternatives were given further consideration as alternatives for use at the RBS site:

- Mechanical draft cooling towers (MDCTs).
- Natural draft cooling towers (NDCTs).
- Wet/dry (hybrid) cooling towers.

Wet/dry (hybrid) cooling towers are primarily used in areas where plume abatement is necessary to address aesthetics or to minimize the fogging and icing produced by the tower plume. Wet/dry (hybrid) cooling towers use approximately one-third to one-half less water than wet cooling towers (Reference 9.4-4). Because of the rural setting of the RBS site, neither of these advantages/features is significant. Additionally, somewhat more land is required for the wet dry cooling tower because of the additional equipment (fans and cooling coils) required in the tower assembly. This alternative could be utilized at the RBS site; however, it is not considered to be environmentally preferable to the wet cooling towers proposed for the new facility.

The RBS Unit 1 facility currently utilizes mechanical draft wet cooling towers. The environmental impacts from mechanical draft wet cooling towers and natural draft wet cooling towers are discussed in detail in Subsection 5.3.3. The primary differences relative to impact between these two types of systems are the potential for fogging, icing, and salt deposition. These impacts are slightly greater for an MDCT because the plume is lower to the ground. In addition, the MDCT requires slightly more land area than an NDCT. These differences are considered minor, with regard to the use of either at the RBS site. Therefore, they are considered environmentally equivalent, and either could be used for a new facility.

9.4.2 CIRCULATING WATER SYSTEMS

The circulating water system is an integral part of the heat dissipation system discussed in Subsection 9.4.1. The circulating water system provides the interface between (1) the NPHS, where waste heat is discharged from the steam cycle and is removed by the circulating water, and (2) the heat dissipation system (cooling tower(s) in this case), where the heat energy is then dissipated or transferred to the environment.

Essentially, there are two alternative circulating water systems available for the removal of this waste heat: once-through (open loop) and recycle (closed loop) systems. In once-through cooling systems, water is withdrawn from a cooling source, passed through the condenser once, and then returned to the source (receiving water body). In a recycle cooling system, heat picked up from the condenser by the circulating water is dissipated through auxiliary cooling facilities, after which the cooled water is recirculated to the condenser.

As discussed in Sections 3.4 and 5.3, the NPHS for the RBS comprises a closed loop circulating water system, including pumps, water basin, and two cooling towers consisting of a hyperbolic NDCT and MDCT. Water from the circulating water system (NPHS) is pumped through the condenser and then to the cooling tower(s) where heat, transferred to the cooling water in the condenser, is dissipated to the atmosphere by evaporation, cooling the water before its return to the condenser. The main condenser for RBS Unit 3 would reject heat to the atmosphere at a rate of approximately 10.43 x 10^9 Btu/hr during normal full power operation.

NUREG-1555 indicates that this section should consider alternatives to the following components of the plant circulating water system:

- Intake systems.
- Discharge systems.
- Water supply.
- Water treatment.

NUREG-1555 also indicates that this section should consider only those alternatives that are applicable at the proposed RBS Unit 3 site and are compatible with the proposed heat dissipation system. Closed loop systems utilizing a cooling pond or a system of cooling/spray canals were discussed in Subsection 9.4.1. Heat dissipation with a wet cooling tower relies on evaporation for heat transfer. Therefore, half or more of the water would be lost to the atmosphere and would need to be replaced. In addition, this evaporation would result in an increase in the level of solids in the circulating water. To control solids, a portion of the recirculated water must be removed, or blown down, and replaced with "clean" water. In addition to the blowdown and evaporative losses, a small percentage of water in the form of droplets (drift) is lost from the cooling tower(s). Water pumped from the Mississippi River (Subsection 9.4.2.1) intake structure would be used to replace water lost by evaporation, drift, and blowdown from the cooling tower(s). Blowdown water is returned to the Mississippi River via an outfall on the river shoreline (Subsection 5.3.2). A portion of the waste heat is thus dissipated to the Mississippi River through the blowdown process. The maximum Unit 3 blowdown is expected to be 6422 gpm. The Unit 3 blowdown is combined with the Unit 1 blowdown flow of 2612 gpm. The maximum temperature of the combined blowdown is 101°F at the discharge to the river.

9.4.2.1 Intake Systems

The installation configuration of the original two-unit RBS station water system (SWS) provides an opportunity for minimal environmental impact by using existing structures for a combined raw water supply for the existing RBS Unit 1 and the new ESBWR (Unit 3). The new combined SWS would use three 50 percent capacity pumps, with two common intake lines and separate discharge lines for each unit.

The SWS consists of four river water intake screens, three pumps, piping, valves, and four clarifiers, and provides makeup water to RBS Units 1 and 3 through separate discharge lines and clarifiers. The total flow rate for Unit 3 is approximately 25,524 gpm. The total flow for both units would be 40,927 gpm.

Alternative intake schemes were evaluated by the Applicant for the RBS site in its initial construction permit submittal to the AEC in Reference 9.4-3. In this submittal, the Applicant considered the construction of a reservoir on Thompson Creek, in addition to its current intake, which is recessed into the Mississippi River bank. The reservoir was considered the more expensive alternative and would have required the flooding of a large area of wildlife habitat.

The AEC staff, in its Final Environmental Statement (Reference 9.4-5), considered three basic locations for the primary intake location: submerged in deep water, flush with the riverbank, and recessed into the riverbank. A deepwater intake was deemed not feasible because of the unstable bottom conditions. An intake flush with the bank appeared practical, although it required some protection from river traffic and floating debris. The recessed intake, as proposed by the Applicant, also seemed practical because it had the advantage of ease of construction, and avoidance of swift and deep waters. Silt deposition was considered the primary problem with this choice, since the river would drop a fraction of its silt load in a low velocity region such as an intake cove. However, the Applicant believed that the load on the water clarifiers would be correspondingly reduced. The AEC staff determined that there was no important difference between the latter two intake locations.

The Applicant also proposed, in its construction permit submittal, an alternative to its protecting the intake pump suctions with basket screens to minimize the intake of material other than water. The alternative was to construct a pump well protected by a traveling screen. The AEC staff determined that there was no environmental impact in either of these methods. The AEC staff subsequently concluded that the proposed intake location, which is now the current location, was adequate when compared with the other intake alternatives.

9.4.2.2 Discharge Systems

As noted above, the circulating water system for the RBS would be a closed loop system, utilizing wet cooling tower(s) for heat dissipation.

RBS Unit 1 utilizes a cooling tower/circulating water system blowdown discharge to the river. The blowdown discharges 610 ft. downstream of the intake structure with 36-in. diameter outlet pipe. The discharge from the RBS Unit 3 cooling tower blowdown would be combined with the discharge from RBS Unit 1 through a resized wastewater blowdown line and outfall utilized by RBS Unit 1.

The discharge facility was designed to minimize the thermal effects of a winter extreme condition during times of maximum temperature differential. In view of the relatively small flow rate of the discharge, an exit pipe with a diameter of 3 ft. is considered adequate.

Alternative discharge systems were evaluated by the Applicant in its initial construction permit submittal to the AEC in Reference 9.4-3. In this submittal, the Applicant considered a deepwater jet or a surface discharge to its current discharge method of a single submerged jet discharge that is essentially flush with the Mississippi River bank. The deepwater jet was deemed not feasible because of the unstable river bottom conditions. If installed today, construction of this pipeline and discharge in the river would cause significant temporary impact to the river biota and might cause navigation hazards. Therefore, this alternative was not considered further for the RBS site.

The surface discharge alternative would, in general, not provide as adequate dispersion of the discharge as that of a submerged jet. A more elaborate discharge system, such as multiple jets, was also considered during the construction permit stage, but it was deemed not warranted since adequate dispersion could be obtained with a single jet. The AEC staff considered the proposed submerged discharge to be basically a sound choice (Reference 9.4-5).

The planned 36-in. diameter outlet pipe of single-port, submerged, shoreline discharge jet design is similar to the existing discharge design that would include the combined discharge for RBS Units 1 and 3. A submerged discharge provides a smaller thermal plume than an exposed (above water) discharge. The submerged jet mixes rapidly with the ambient river water, accompanied by a reduction of momentum and kinetic energy through turbulent action.

9.4.2.3 Water Supply

As noted above, the circulating water system for RBS Unit 3 would be a closed loop system, utilizing cooling tower(s) for heat dissipation. Cooling towers typically have a storage basin or flume from which water is recirculated by the circulating water system to provide the condenser cooling. As discussed above, there would be a need for continuous makeup water to the closed loop circulating water system. The maximum makeup water flow to the cooling towers in the NPHS is 25,112 gpm.

The only viable alternative that could be used as a source of makeup water (other than the Mississippi River) would be wells in the alluvial aquifer. This alternative would not be considered to be environmentally preferable because of the amount of water required, which would have a potential impact on the water table and groundwater wells used by the residents in the vicinity of the RBS. Details on groundwater supply, water use, and water quality can be found in ER Section 2.3. Therefore, the Mississippi River should be used for makeup to the circulating water system.

9.4.2.4 Water Treatment

Water evaporation from the cooling towers in the circulating water system leads to an increase in chemical and solids concentrations in the circulating water, which, in turn, increases the scaling tendencies of the water. The circulating water system would be operated so that the concentration of solids in the circulating water would typically approximate four times the concentration in the makeup water (i.e., four cycles of concentration). The concentration ratio would be sustained through blowdown of the circulating water from the cooling system(s) to the Mississippi River and the addition of makeup water.

Similar to that for RBS Unit 1, two methods of circulating water system chemistry control are anticipated to be used to prevent biological fouling (e.g., accumulation of algae growth in the cooling tower(s) and the main condenser/heat exchangers). These anticipated methods are the addition of a non-oxidizing biocide and/or a hypochlorite solution. The final choice of methods or combination of methods will be dictated by makeup water conditions, economics, and discharge permit requirements.

A non-oxidizing biocide, if used, would be added to achieve a concentration at or below the allowable LPDES permit (environmental) discharge limits. Discharge of free available chlorine to the river is typically minimized by controlling the addition of hypochlorite solution and the addition of a dechlorinating agent prior to final discharge. This is controlled so that the free available chlorine concentration in the cooling tower blowdown would not exceed LPDES permit limits. Chlorine residuals would be monitored to ensure that LPDES permit limits are not exceeded in the discharge. A surfactant-based biodispersant may also be added to the circulating water system, as required, to prevent scaling and deposition of iron oxides and suspended solids in the NPHS condenser tubes.

Sulfuric acid (or similar additive) may be used to control pH in the system. The circulating water blowdown flow would be controlled to maintain proper circulating water system conductivity and chemical content.

Two 100 percent full-flow clarifiers for Unit 1 and four 33 percent clarifiers planned for Unit 3 remove suspended solids from the Mississippi River water. The clarified effluent is discharged over a weir into the circulating water flume. Each clarifier is designed to satisfactorily treat the entire requirement of makeup water for the normal cooling towers of the RBS in the event that one clarifier is out of service. Polyelectrolyte is added to the raw water to enhance the flocculation and settling of suspended solids. A 5000-gal. storage tank and three metering pumps are provided for the storage and feeding of polyelectrolyte. A 5000-gal. storage tank and two metering pumps are provided for the storage and feeding of sodium hypochlorite. The chemical feed rate(s) may vary with changing influent conditions, and the metering pumps are provided with manual stroke control to maintain a proper treatment rate. The solids that settle are intermittently discharged to the sludge dilution tank, where the solids concentration is adjusted to a level suitable for pumping to the river. Clarified water under pressure is used to remove any buildup of solids in either clarifier sludge discharge pipe during a sequence of backflushing prior to each discharge of sludge. Two backflush pumps that take suction from each clarifier clear water zone are provided for this purpose.

One sludge dilution tank is provided near the clarifiers to receive clarifier bottom sludge blowdown. The blowdown from the clarifiers flows to the dilution tank, where river water from the makeup water pipeline is continuously fed and mixed in the sludge dilution tank. The dilution tank is equipped with two full-capacity vertical mixers and two 100 percent capacity centrifugal pumps. Each mixer is capable of mixing dilution water with the maximum clarifier bottom underflow for the two reactor units. The diluted clarifier underflow is pumped through one pipeline to an outfall in the Mississippi River, as described in Subsection 9.4.2.2.

Alternatives to chemical treatment and disposal of chemical wastes to the river were investigated in Reference 9.4-3, Section 10.4. Instead of discharging chemical wastes from the plant into the cooling tower blowdown, the applicant had considered installation of an evaporative treatment system. Use of this alternative procedure would eliminate discharge of liquid chemical wastes from the demineralizer regeneration system. Such wastes would have been converted to solids (about 100 tons/year) that would require disposal either on- or off-site. Because of the significant cost of operation and maintenance of such a system for a relatively minor impact of discharges from the planned system, the Applicant and the AEC (Reference 9.4-5) did not consider that the small benefit to be derived from this alternative would warrant its additional expense. The Applicant also considered the use of microstrainers and filters instead of clarifiers for the cooling tower makeup water system. Clarifiers were selected because they are a proven technology used by industries all along the Mississippi River. The AEC also agreed with the Applicant's selection.

Alternative, non-chemical, station makeup water treatment systems were also previously considered and eliminated. These included evaporation, reverse osmosis, and electrodialysis. The last two systems were eliminated because current technology does not ensure reliable use of these systems for requirements of the station. Evaporative systems are not economically competitive with the ion-exchange method.

The Applicant previously considered the use of the contact stabilization modification of the activated sludge process. This alternative was rejected because of difficulties associated with its operation and maintenance, particularly under conditions where input flow is variable. The AEC staff concurred with the Applicant's selection for a sanitary waste treatment system.

As alternative biocides for control of fouling in the condenser cooling water systems, the Applicant previously considered use of ozonation and treatment with ultraviolet light for sterilization (Reference 9.4-3, Section 10.5). These two systems were found not commercially proven for systems of this size.

The Applicant is currently utilizing a sponge ball condenser tube cleaning system to circulate through and maintain condenser tube side cleanliness. Although mechanical treatment systems provide some assistance in maintaining the cleanliness of the main condenser/heat exchanger tubes, the rest of the system would still require chlorination to control fouling.

Alternative operating procedures have also been considered to provide for an effective "system" water quality control scheme. Application typically consists of adjustments to water chemistry using several chemicals: biocide, algaecide, pH adjuster, corrosion inhibitor, scale inhibitor, and silt dispersant. Water quality effects could occur from the concentration and discharge of chemicals added to the recirculating cooling water. However, these additives will be present in the blowdown. A detailed description of treatment system operating procedures, including plant operational and seasonal variations, is discussed in Section 3.6. The frequency of treatment for each of the normal modes of operation is described, as well as the quantities and points of addition of the chemical additives. All methods of chemical use are monitored.

Based upon the discussion presented, no substitutions are proposed for the current chemical treatment amounts or methods for RBS Unit 3. The environmental impact on the use of this current water treatment is SMALL. Also as discussed above, mechanical cleaning or UV treatment are not practical or effective water treatment systems for cooling tower applications. Therefore, no effective alternative treatment is identified that is environmentally equivalent or superior.

9.4.3 TRANSMISSION SYSTEMS

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 the RBS. Refer to Sections 2.2 and 3.7 for additional details. A system impact study (Reference 9.4-6) was performed to assess the Entergy transmission system steady-state and transient stability performance to support a new proposed nuclear unit (PID-208) being installed at the RBS site that would have a maximum capacity of 1933 MVA when placed into service in the 2015 time frame. The system includes a new 500 kV transmission line from Fancy Point Substation to the customer load area. The scheduled gross power output of the plant is

1684 MW. An auxiliary/host load of approximately 90 MW is also expected at the site; therefore, the PID-208 anticipated the power injection of 1594 MW into the Entergy system. This study concluded that transmission reconfiguration would be required for a number of substations to support the new facility. A later facility study was planned to identify the impact at those substations; the facility study was completed in June 2008 (Reference 9.4-7).

The new 500 kV transmission line is planned to connect the Fancy Point Substation to an existing 500 kV transmission line routed from Hartburg to Mount Olive. A route selection study was performed, which recommends a 148-mi. route for this new transmission line that would connect to the 500 kV Hartburg-Mount Olive line in Natchitoches Parish near the community of Marthaville, Louisiana. Five potential switchyard locations along the existing Hartburg-Mount Olive 500 kV transmission line were identified through the GIS route selection process. Of the five switchyard sites identified in Figure 9.4-1 for the proposed interconnection, four are located in Louisiana and one in Texas. A transmission line routed to the Texas site would require a transmission line that crosses the Sabine River. Through the GIS scoring process, the three routes that generated the lowest environmental "score" or ranking were the following alignments:

1. Natchitoches Route - Preferred Route.

2. Sabine Route - Alternate Route.

3. Newton Route - Alternate Route.

Each of the final three options is described below.

Natchitoches Route Option

The Natchitoches Route option was identified as the preferred route, based on the GIS scoring process. It measures approximately 148 mi. in length and is the longest of the final three routes under consideration. It crosses the least amount of forested area and wetland, and maximizes the use of urbanized open spaces, barren lands, hayfields and pasture, and shrub and scrub lands. It crosses the least amount of wetlands of the three routes, and the fewest number of individual wetlands that are greater than 1,000 ft. in length. As such, many of the wetlands that occur within this route should be able to be spanned by the proposed 500 kV transmission line, thus avoiding direct impacts. Passing to the north of the cities of Alexandria and Pineville, this route crosses about 109 ac. of developed land, about the same as the Newton alternate route. It also crosses approximately 675 ac. of cultivated cropland, which is more than the Sabine route, but less than the Newton route.

Sabine Route Option

The Sabine Route's GIS environmental score was just a few points behind the route to the Natchitoches site. Thus, it was identified as an alternate route. However, because of the closeness of the GIS environmental scoring totals, the routes can be considered virtually the same relative to the scoring process. This route measures approximately 142 mi. in length, or about 6 mi. shorter than the preferred route. As can be expected, it crosses more identified forested areas and wetlands than the preferred route, and crosses the least amount of barren land, hayfields and pasture, and shrub and scrub land cover of the three routing options. It also crosses less urban open space than the preferred route. The route avoids urbanizing and developed areas and crosses the least amount of active agricultural lands.

The Sabine switchyard site is currently located south of State Route 473. The site elevation is lower than the surrounding area. In addition, the eastern side of the site is bordered by Bayou Toro. Because of the low elevation and the nearby bayou, consideration of this site must also address potential flooding during periods of high water in the bayou. Substantial fill may be required to reduce or eliminate the potential for flooding at this site. A complete flood analysis should be completed for this site before the route is finalized. Land to the north of State Route 473 appears to be higher and may be better suited for switchyard development.

Newton Route Option

The Newton Route was ranked third by the GIS environmental scoring process. It measures approximately 147 mi. in length, or about 1 mi. shorter than the preferred route and 5 mi. longer than the alternate. The route crosses the most forested areas and the most wetlands. The potential for adverse impacts to these sensitive environmental features from construction of the proposed transmission line is highest of the three routing options under consideration. It does cross the least amount of open water and urbanized development areas, but would offer the greatest potential to impact active cropland of the three routes.

With regard to avian interactions and threatened and endangered species, Entergy observes practices and processes intended to provide appropriate, prudent measures for protection of environmentally sensitive areas that could be involved in the planning and construction of transmission lines or substations (as discussed in Subsections 2.4.1 and 5.1.2.4). Given that these measures would apply equally to all alternatives, there is no reason to distinguish between the alternatives with regard to impacts to threatened and endangered species for this level of analysis. Therefore, the Natchitoches Option (Fancy Point to Hartburg-Mount Olive line) is the preferred option, as described in Section 3.7, and there are no other viable, environmentally preferable alternatives.

Entergy will provide the service to move the energy generated by Unit 3 to the regional transmission grid and the ultimate consumers. Entergy will construct a 500 kV line from a new 500 kV tap to the Unit 3 switchyard for the interconnection. As discussed in Section 2.2, the proposed new transmission corridor has not been finalized and is still subject to change. The final selection of a route will be the responsibility of Entergy, and the construction will be permitted by the Louisiana Public Service Commission (LPSC) in the form of a Certificate of Convenience and Necessity.

9.4.4 REFERENCES

9.4-1 Gulf States Utilities Company, "River Bend Station Environmental Report, Operating License Stage," Volumes 1-4, Supplements 1-9, p. 2.2-2, November 1984.

9.4-2 66 *Federal Register* 65256, 65282, December 18, 2001.

9.4-3 Gulf States Utilities Company, "River Bend Nuclear Power Station, Units 1 and 2, Environmental Report, Docket Nos. 50-458 and 50-459," September 1973; Supplement 1, February 1974; Supplement 2, April 1974; Supplement 3, June 1974; Supplement 4, August 1974.

9.4-4 U.S. Environmental Protection Agency, "Technical Development Document for the Final Regulations Addressing Cooling Water Intake Structures for New Facilities," EPA-821-R-01-036, Chapter 4, November 2001.

9.4-5 U.S. Atomic Energy Commission, *Final Environmental Statement Related to Construction of River Bend Nuclear Power Station Units 1 and 2*, NUREG-1073, Docket Nos. 50-458 and 50-459, September 1974.

9.4-6 Southwest Power Pool, "System Impact Study Report (PID 208)," 1594 MW (1684 MW Gross) Plant, Fancy Point, Mississippi, January 10, 2008.

9.4-7 Entergy Gulf States Louisiana, L.L.C., "PID-208 - Addition of Generation at Fancy Point (River Bend)," Revision 2, June 13, 2008.

Table 9.4-1
Screening of Alternative Heat Dissipation Systems

Factors Affecting System Selection	Mechanical Draft Wet Cooling Tower	Natural Draft Wet Cooling Tower	Wet Dry Cooling Tower	Dry Cooling Towers	Cooling Pond	Spray Canal
Land Use (acres); On-site land requirements; terrain considerations	30 - 40	30 - 40	More than wet tower	3 to 4 times acreage for wet towers	4000 to 6000 (~2 acre per MWe)	750; Construction in floodplain area
Water Use (gpm)	40,000	40,000	20,000 to 27,000[(a)]	Minimal	Similar to other evaporative losses	Evaporative losses similar; drift losses higher
Legislative Restrictions	None	None	None	None	None	Possible issue with destruction of wetlands
Alternative Suitable for the RBS Site and Proposed New Facility? (Yes/No)	Yes	Yes	Yes	No, insufficient land available	No, due to larger environmental impacts related to land use	No, insufficient land available

a) Water usage of wet dry cooling towers can be up to one-third to one-half of wet tower water usage.

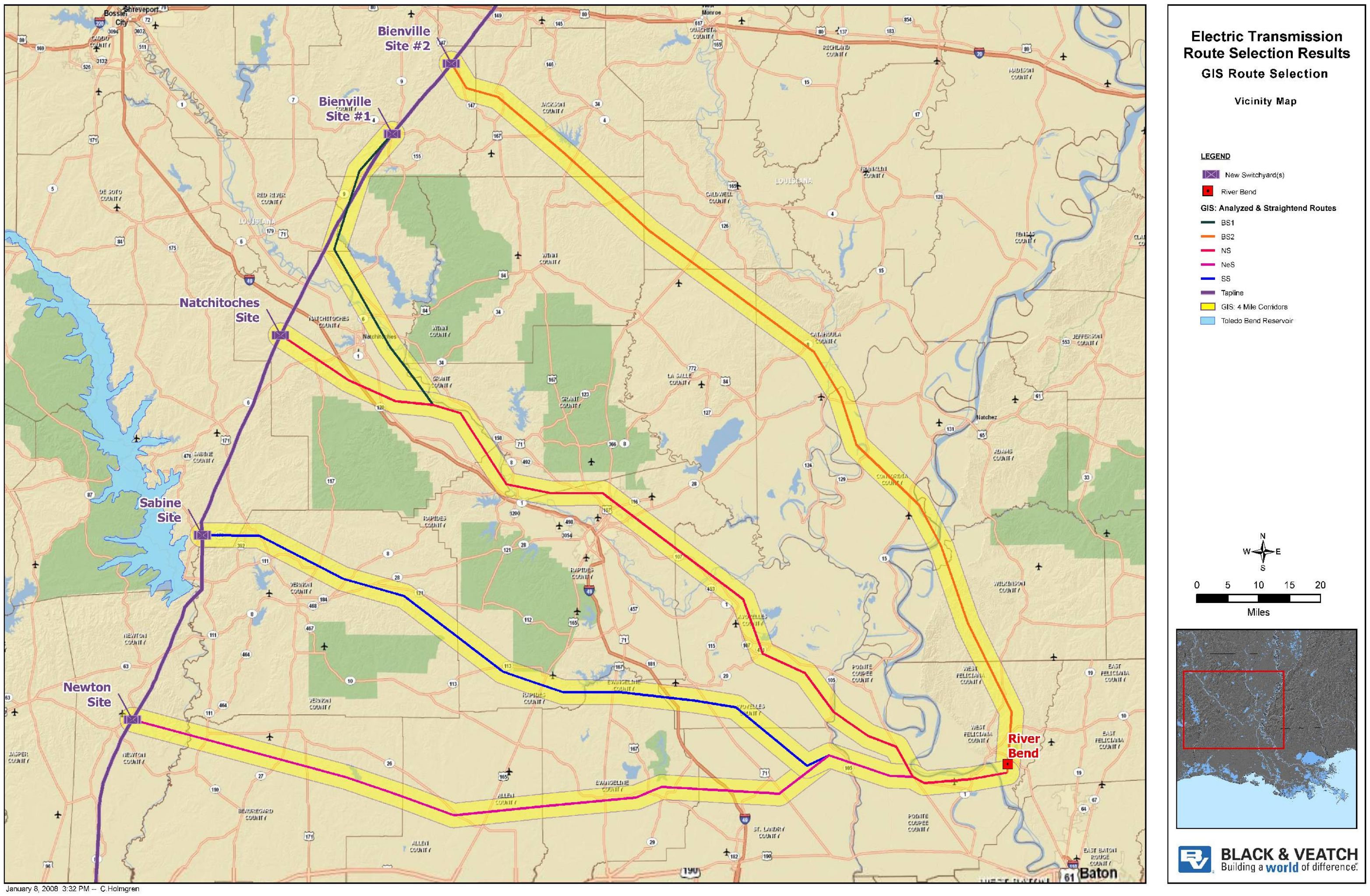

Figure 9.4-1. Electrical Transmission Route Selection Results, GIS Route Selection

Appendix 9A
Technical Basis for Candidate Site Ratings

Appendix 9A
Technical Basis for Candidate Site Ratings

General siting criteria used in the RBS COLA siting study were derived from those presented in Chapter 3.0 of the EPRI "Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application" (Siting Guide) (Reference 1).

The following information is provided in this appendix for each criterion:

- Objective – What aspect of site suitability is being measured.
- Evaluation Approach – Technical basis/methodology used to develop site ratings from available data.

The following candidate nuclear plant sites were evaluated: Arkansas Nuclear One (ANO), Grand Gulf Nuclear Station (GGNS), River Bend Station (RBS), and Waterford Unit 3 (W3). In addition, two Entergy-owned Greenfield sites, the Blue Hills site located in eastern Texas and the Wilton site located in southern Louisiana, were evaluated as potential sites.

The technical bases for the site ratings developed for each of the general site criteria are provided in the following sections. The criterion/section numbering is designed to reflect the section numbers in Chapter 3 of the EPRI Siting Guide where the criteria is discussed, e.g., Criterion A.1.1.1 – Geology/Seismology appears in Subsection 3.1.1.1 of the Siting Guide.

A.1 HEALTH AND SAFETY CRITERIA

A.1.1 ACCIDENT CAUSE-RELATED

A.1.1.1 Geology/Seismology

Objective – The purpose of this criterion is to rank the suitability of the candidate sites with respect to the geologic and seismic setting.

Evaluation Approach – A numerical system of weights and ratings, based upon suitability criteria, were assigned to each geologic/seismic category, including vibratory ground motion, capable structures or tectonic sources, surface faulting and deformation, geologic hazards, and soil stability (Subsections A.1.1.1.1 through A.1.1.1.5) and were used to compute (i.e., rate times weight) an index number for each category. (To enable the comparative evaluation of sites, the weights and rating schemes adopted herein are the same for all sites.) The index numbers for each site were summed to compute a GEOL index. The range of GEOL indexes was then used to develop a rating system for the sites (Subsection A.1.1.1.6). The sites were rated on a scale of 1 to 5, based on the GEOL scale, with the most suitable sites receiving an overall rating of 5. Weights and the basis for deriving correlating site ratings from the GEOL scale are discussed with respect to each of the subcriteria in the sections below. NOTE: Within the GEOL index subcriteria, an inverse rating basis is used, with lower numbers indicating the most suitable and 5 the least suitable; for the composite GEOL index, higher numbers indicate more suitable sites.

A.1.1.1.1 Vibratory Ground Motion

Objective – The purpose of this subcriterion is to rate sites according to the expected magnitude of ground motion that can be expected. As long as expected peak ground accelerations (PGAs) do not exceed those for the certified designs under consideration, there are no exclusionary or avoidance components to this subcriterion.

Evaluation Approach – PGA is a measure of the maximum force experienced by a small mass located at the surface of the ground during an earthquake and is an index of hazard for some structures. The units for PGA are in percent of gravity (%g); i.e. an acceleration of 0.30g is expressed as 30%g. PGA provided herein, as for other sites, is for a probability of exceedance (PE) of 2% in 50 years (once in 2500 years). PGA data for candidate sites were obtained from the USGS Earthquake Ground Motion Parameter Java Application (Reference 2).

The following table shows the assigned weight and rating scheme for vibratory ground motion.

Weight	Range PGA (%g)	Rating	Index Range
5	0 – 3	1	0 - 50
	3 – 6	2	
	6 – 9	3	
	9 – 12	4	
	12 – 15	5	
	15 – 18	6	
	18 – 21	7	
	21 – 24	8	
	24 – 27	9	
	27 – 30	10	

A.1.1.1.2 Capable Tectonic Structure or Source

Objective – No absolute exclusionary criteria have been identified. Capable tectonic structures are addressed as avoidance criteria; therefore, the objective of this subcriterion is to identify the existence of capable or potentially capable tectonic structures within 200 mi. of each site. Candidate sites that are farthest from capable or potentially capable tectonic structures are considered more suitable.

Evaluation Approach – A database compiled by the USGS (Reference 3) was utilized to identify capable and potentially capable tectonic sources within 200 mi. of each of the candidate sites. It was assumed that capable and potentially capable tectonic sources, which are Quaternary features that may generate strong ground motion, fall into two categories, as defined by Crone and Wheeler (Reference 4):

- Class A features have good geologic evidence of tectonic origin and are potentially seismogenic.
- Class B features have geologic evidence that supports the existence of a seismogenic fault or suggests Quaternary deformation, but the currently available geologic evidence for Quaternary tectonic activity is less compelling than for a Class A feature.

The following table shows the assigned weight and the rating scheme for capable tectonic sources.

Weight	Range (mi.)	Rating	Index Range
Class A	None within 200-mi. radius	0	0 – 10
2	Between 100 and 200 mi.	2	
	Between 50 and 100 mi.	3	
	Between 25 and 50 mi.	4	
	Within 25 mi.	5	
Class B	None within 200-mi. radius	0	0 – 5
1	Between 100 and 200 mi.	2	
	Between 50 and 100 mi.	3	
	Between 25 and 50 mi.	4	
	Within 25 mi.	5	

A.1.1.1.3 Surface Faulting and Deformation

Objective – The purpose of this subcriterion is to develop site ratings for site suitability, relative to surface faulting and deformation in the site vicinity.

Evaluation Approach – No absolute exclusionary criteria have been identified with regard to surface faulting and deformation. Suitability criteria have been established on the basis of the occurrence of surface faulting and tectonic and nontectonic structures within a 25-mi. and a 5-mi. radius of the candidate sites, as follows (Siting Guide, pp. 3-7) (Reference 1):

- Between 5 mi. and 25 mi.:
  - No such structures altogether (most suitable).
  - Potential noncapable structures.
  - Potential capable structures (least suitable).

- Within 5 mi.:
  - No such structures altogether (most suitable).
  - Potential noncapable structures.
  - Potential capable structures.
  - Fault exceeding 1000 ft. in length.
  - Capable fault exceeding 1000 ft. in length (least suitable).

The potential for surface faulting or deformation primarily concerns plant design; therefore, features identified within 5 mi. of a candidate site received a higher weight. The following are the assigned weights and ratings for surface faulting and deformation.

Weight	Range	Rating	GEOL Index Range
Between 5 and 25 mi. – 1	No structures Potential noncapable structures Potential capable structures	0 1 5	0 – 5
Within 5 mi. – 2	No structures Potential noncapable structures Potential capable structures Fault exceeding 1000 ft. in length Capable fault exceeding 1000 ft. in length	0 2 3 4 5	0 – 10

A.1.1.1.4 Geologic Hazards

Objective – Based on the Siting Guide (pp. 3-7) (Reference 1), sites having the following geologic and man-made conditions should be avoided:

- Areas of active (and dormant) volcanic activity.
- Subsidence areas caused by the withdrawal of subsurface fluids such as oil or groundwater, including areas which may be affected by future withdrawals.
- Potentially unstable slope areas, including areas demonstrating paleo landslide characteristics.
- Areas of potential collapse (e.g., karst areas, salt, or other soluble formations).
- Mined areas, such as near-surface coal mined-out areas, as well as areas where resources are present and may be exploited in the future.
- Areas subject to seismic and other induced water waves and floods.

Evaluation Approach – Sites farthest away from these features would be considered the most suitable sites; sites were rated in accordance with the presence of – and distance from – these features. The following are the assigned weight and rating used for geologic hazards.

Weight	Range	Rating	GEOL Index Range
1	Geologic hazard(s) present	1	0 - 1

A.1.1.1.5 Soil Stability

Objective – The purpose of this subcriterion is to evaluate the sites with respect to the difficulty of expected soil conditions.

Evaluation Approach – No absolute exclusionary criteria have been identified with respect to soil stability. Soil stability is addressed as an avoidance criterion. Certain soil properties have unfavorable characteristics in association with vibratory ground motion. These soil properties include poor mineralogy, low density soil (lack of compaction), and high water content (or high water table). Sites with the highest PGA values, in combination with deleterious site soils, would receive a relatively lower rating. Sites that have rock foundations or more suitable soil conditions are considered to be better sites.

The following are the assigned weights and ratings for soil stability.

Weight	Range	Rating	Index Range
2	Rock site	0	0 – 4
	Deep soil site; no known deleterious soil conditions	1	
	Deep soil site with potential stability issues, or insufficient information available to assign a rating of 1	2	

A.1.1.1.6 Overall Rating for Geology/Seismology

The index numbers for this ranking scheme range from 5 to 85. This range of indexes was used to develop a ranking system to compare the suitability of sites as follows.

Index Range	Rating
5 – 21	5
22 – 37	4
38 – 53	3
54 – 69	2
70 – 85	1

The index numbers for each site were summed. The resulting index was compared to the index ranges in the above table to determine the overall rating for each site.

A.1.1.2 Cooling System Requirements

Objective – Cooling system requirements are important siting guide considerations for new power generating facilities. The objective of this criterion is to rate the candidate sites with respect to specific cooling system quantity requirements.

Evaluation Approach – The principal requirements of interest are the quantity of cooling water available and the ambient air temperature (Siting Guide, Subsection 3.1.1.2.1) (Reference 1). Exclusionary and avoidance conditions apply to the evaluation of candidate sites with respect to these cooling system requirements. The water requirements for the site selection study are presented below.

Cooling System Type	Cooling System Requirement
Closed cycle	Maximum design consumption per single-unit plant (PPE [property, plant, and equipment] conditions for cooling water requirement) = 48,390 acre-ft/yr (30,000 gpm, 66.9 cfs)

Ambient air temperature characteristics of a potential site affect the design of heat removal systems. The candidate sites are all located within a region of similar ambient air characteristics; this aspect is evaluated in Subsection A.1.1.2.2.

A.1.1.2.1 Cooling Water Quantity Available

All of the candidate sites were found to have potential development capacity to support the requirements of a closed cycle cooling water system.

A.1.1.2.2 Ambient Temperature Requirements

Available data were obtained from the major weather reporting stations closest to each site. Meteorological data obtained from the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (Reference 5) indicated that the candidate sites meet the ambient temperature exclusionary and avoidance criteria addressed in the Siting Guide (Subsection 3.1.1.2.2) (Reference 1).

Maximum and minimum annual temperature values, as well as the highest and lowest average monthly temperature values and the annual average monthly mean values, were compared between sites. Actual meteorological conditions, however, may vary from the data collected and evaluated for the closest reporting (representative) weather stations.

A.1.1.2.3 Cooling System Summary Rating

The sites were assigned relative ratings for the suitability of the cooling system, based on the average of the ratings for cooling water supply (75 percent weight) and the ambient air temperature characteristics (25 percent weight).

A.1.1.3 Flooding

Objective – The purpose of this criterion is to evaluate the suitability of the candidate sites with respect to potential flooding.

Evaluation Approach – A comparative analysis was made of the site grade elevation and the 100-year flood elevation. The 100-year flood elevations were based on flood insurance rate maps (FIRM) from the Federal Emergency Management Agency (FEMA) (Reference 6) for the site locations. Primary emphasis was placed on the flood elevations for the main water bodies (rivers and reservoirs) and their major tributaries where flood elevations were identified. The flooding analysis also considered other potential flooding sources (e.g., upstream dam failure concerns).

A.1.1.4 Nearby Hazardous Land Uses

A.1.1.4.1 Existing Facilities

A.1.1.4.2 Projected Facilities

Objective – The purpose of this criterion is to include NRC guidance on considerations regarding the nature and proximity of man-related hazards (dams, airports, transportation routes, and military and chemical manufacturing and storage facilities).

Evaluation Approach – For the purposes of this evaluation, it was assumed that all sites could be developed to meet the exclusionary criteria outlined in 10CFR100. The suitability of the candidate sites was, therefore, evaluated on the basis of the relative number and distance of potential off-site, man-related hazards. The evaluation was limited to existing hazards within a 5-mi. radius of the sites.

A.1.1.5 Extreme Weather Conditions

A.1.1.5.1 Winds

A.1.1.5.2 Precipitation

Objective – The purpose of this criterion is to rate the suitability of the candidate sites with respect to extreme weather conditions. Extreme weather conditions of interest are related to specific PPE criteria regarding tornado design, wind, and precipitation (Siting Guide, Subsection 3.1.1.5) (Reference 1).

Evaluation Approach – During the review of available meteorological information about the sites, no information was found that indicated the sites could not meet the exclusionary and avoidance criteria specified for the PPE values. Available extreme weather data were obtained from government sources (References 7, 8, and 9).

With respect to the suitability of the candidate sites, extreme weather included the evaluation of extreme wind speed conditions. Extreme wind is a meteorological term for the maximum anticipated wind speed that is maintained over an interval of time in which the wind can travel 1 mi. This term is also referred to as the fastest-mile wind speed. In addition, data relating to tornado and hurricane frequencies were provided, given that the sites are located in areas potentially affected by these extreme weather events.

A.1.1.6 References

1. Electric Power Research Institute, "Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application," March 2002.

2. U.S. Geological Survey, Earthquake Ground Motion Parameter Java Application, Website, http://earthquake.usgs.gov/research/hazmaps/design/.

3. U.S. Geological Survey and Louisiana Geological Survey, Quaternary Fault and Fold Database for the United States, 2003, Website, http://earthquake.usgs.gov/regional/qfaults/, accessed November 19, 2007.

4. Crone, A. J., and R. L. Wheeler, *Data for Quaternary Faults, Liquefaction Features, and Possible Tectonic Features in the Central and Eastern United States, East of the Rocky Mountain Front*, U.S. Geological Survey Open File Report 00-260, 2000.

5. National Oceanic and Atmospheric Administration (NOAA), National Climatic Data Center, *NOAA Climatography of the United States No. 20, 1971-2000*, 2001, Website, http://cdo.ncdc.noaa.gov/climatenormals/clim20/state-pdf/.

6. Federal Emergency Management Agency, Flood Insurance Rate Maps, Website, http://www.msc.fema.gov.

7. National Oceanic and Atmospheric Administration, National Climatic Data Center, Website, http://www.ncdc.noaa.gov/documentlibrary.pdf/wind1996.pdf.

8. National Oceanic and Atmospheric Administration, National Climatic Data Center, Maximum Wind Speed (fastest mile, if shown as compass direction), Website, http://www.ncdc.noaa.gov/oa/climate/online/ccd/maxwnd.txt.

9. National Oceanic and Atmospheric Administration, National Climatic Data Center, Tornado Climatology (Extreme Weather), Website, http://www.ncdc.noaa.gov/oa/climate/severeweather/tornadoes.html.

A.1.2 ACCIDENT EFFECTS-RELATED

Objective – The overall purpose of this criterion is to evaluate sites with respect to design-related accidents and potential effects of accidents.

Evaluation Approach – Site ratings for this criterion were developed as a composite of three subcriteria that address site characteristics relevant to the consideration of accidents: population, emergency planning considerations, and atmospheric dispersion.

A.1.2.1 Population

The purpose of this subsection is to evaluate the suitability of the candidate sites with respect to the population density in the vicinity of the sites. For the purposes of this evaluation, it was assumed that the existing licensed units at the sites meet the population density conditions codified in 10CFR100.21, as follows:

- The sites have exclusion area authority.
- A low population zone exists beyond the exclusion area.
- Sufficient distance exists to high population centers.

As outlined in Regulatory Guide 4.7, low population areas are preferred and low population zones should have densities less than 500 people per square mile.

Available census data regarding total population, population densities, and population-center distances were reviewed for the candidate sites. Data were obtained from the U.S. Census Bureau (Reference 1).

A.1.2.2 Emergency Planning

Objective – The purpose of this criterion is to evaluate the relative suitability of the candidate sites with respect to emergency planning characteristics of the general area around each site. (No exclusionary or avoidance criteria apply to this issue.) In particular, this evaluation relied on information pertaining to the general population in the surrounding area, road conditions near the site, access to major traffic networks, terrain features, and climatic conditions.

Evaluation Approach – Sites with the least constrained evacuation planning issues (i.e., low population, good access from site to major traffic networks, and no terrain or climate limitations) were considered the most suitable and were assigned a score of 5. Ratings were based on a review of county Websites (transportation information), USGS topographic maps, and best professional judgment. Ratings relate to the extent of development in the general area, the number of roads providing egress from the site area, and proximity to major U.S. highway systems.

A.1.2.3 Atmospheric Dispersion

Objective – The purpose of this criterion is to evaluate the suitability of the candidate sites with respect to short-term atmospheric dispersion characteristics, as a measure of the relative level of concentrations that could occur during accident conditions. In general, areas with high winds and unstable atmospheric conditions (lower χ/Q values) provide greater dispersion of pollutants and are preferred power plant sites.

Evaluation Approach – The efficiency of atmospheric diffusion is primarily dependent on wind speed, wind direction, and the change in air temperature with height, which affects atmospheric stability. These factors were used to calculate an atmospheric dispersion function referred to χ/Q.

A.1.2.4 Accident Effects-Related Summary Rating

Composite ratings for this criterion (Accident Effects-Related) are a composite of those for Subcriteria A.1.2.1, A.1.2.2, and A.1.2.3.

A.1.2.5 References

1. U.S. Census Bureau, 2000 population data.

A.1.3 OPERATIONAL EFFECTS-RELATED

A.1.3.1 Surface Water – Radionuclide Pathway

A.1.3.1.1 Dilution Capacity

A.1.3.1.2 Baseline Loadings

A.1.3.1.3 Proximity to Consumptive Users

Objective – The purpose of this criterion is to evaluate candidate sites with respect to potential liquid pathway dose consequences. (No site exclusionary or avoidance criteria apply to this issue.) Besides potential source terms, dilution in the receiving surface water body is of primary importance. Three factors considered in evaluating the potential dilution for a receiving water body are dilution capacity, baseline loadings, and proximity to consumptive users.

Evaluation Approach – Site ratings for this criterion are developed as a composite of three subcriteria that address site characteristics relevant to consideration of operation: dilution capacity, baseline loadings, and proximity to consumptive users.

- Dilution Capacity – The purpose of this subcriterion is to rate sites based on the overall capacity of the receiving water body to dilute effluents from a nuclear power plant. Information on the radioactive source term dilution at a new power plant would be site-specific. For siting consideration where such information is not available, however, surrogate parameters, representing the dilution capacity of a stream, can be used. The greater the dilution capacity of the receiving water body, the shorter the mixing length downstream would be, defined as the zone within which complete mixing of a discharge contaminant occurs. Sites with higher dilution capacity are rated higher.

- Baseline Loadings – The capacity of a stream to affect the health and safety of downstream consumers is related to the existing, or baseline loadings of, radionuclides that are present in the system or can be anticipated in the future. The purpose of this subcriterion is to characterize sites in accordance with existing levels of radioactive contamination in the receiving water body. Sites were given a rating of 5 for no baseline loadings; proportionally lower ratings were assigned as higher existing levels of radionuclide contamination were identified.
- Proximity to Consumptive Users – The purpose of this subcriterion is to rate sites in accordance with the proximity of plant effluent release points to the location(s) of public water supply withdrawal(s). More proximal withdrawals present higher potentials for dose impacts from the surface water ingestion pathway and can require additional design and licensing efforts. Downstream locations of public water supply withdrawals and recreational contact were identified for each site. Sites with greater pathway lengths to users were more suitable and were assigned a score of 5.

A.1.3.2 Groundwater Radionuclide Pathway

Objective – The purpose of this subsection is to evaluate the candidate sites with respect to the relative vulnerability of shallow groundwater resources to potential contamination.

Evaluation Approach – EPA guidelines were used to assign a designation to candidate site aquifers (References 1 and 2). In addition, the relative vulnerability of these aquifers to groundwater pollution was evaluated using a standard numerical ranking system called DRASTIC (Reference 3). Sites considered most suitable were those that are least vulnerable to groundwater contamination within a 2-mi. radius of the site.

A.1.3.3 Air Radionuclide Pathway

A.1.3.3.1 Topographic Effects

A.1.3.3.2 Atmospheric Dispersion

Objective – The purpose of this criterion is to address the relative suitability of sites with respect to the potential for exposure to the public from routine airborne releases from a nuclear power plant.

Evaluation Approach – The criterion is composed of two suitability characteristics:

- Topographic Effects – Site ratings are based on whether there are any significant topographic features that would materially affect dispersion of the plume from plant releases (e.g., channeling of releases from a site located low in a high-banked river valley).

- Atmospheric Dispersion – This is measured through long-term (e.g., annual average χ/Q) dispersion characteristics. Sites with lower χ/Q values are rated higher than those with less favorable dispersion conditions.

A.1.3.4 Air-Food Ingestion Pathway

Objective – The purpose of this criterion is to rate candidate sites in terms of the relative potential for human exposure to radioactive emissions through the deposition of radioactive materials on food crops and pastures, with subsequent consumption of exposed foodstuffs by individuals or through the consumption of exposed livestock by individuals.

Evaluation Approach – A potential exposure pathway for nuclear power plants is the emissions of radionuclides into the food chain on local crops and pastures. Radiological doses and dose commitments resulting from a nuclear plant are well-known and documented. While the operational impacts to the public through food pathway exposures are negligible, sites with lower amounts of cropland and pastureland uses are considered to be more suitable. No exclusionary or avoidance criteria apply to this issue. Sites with less crop production nearby are rated higher than those with larger agricultural industries.

A.1.3.5 Surface Water – Food Radionuclide Pathway

Objective – The purpose of this criterion is to evaluate the relative suitability of the candidate sites in terms of the specific use of irrigation water by downstream locations as a potential pathway for potential exposure.

Evaluation Approach – Sites with the fewest number of downstream irrigation uses are more suitable and are rated higher than sites with a large number of downstream irrigation withdrawals. No exclusionary or avoidance criteria apply to this issue.

A.1.3.6 Transportation Safety

Objective – The objective of this criterion is to evaluate the suitability of the candidate sites with respect to the potential of plant cooling systems to create fog and ice hazards to local transportation. No exclusionary or avoidance criteria apply to this issue.

Evaluation Approach – Potential impacts from plant operations on transportation safety could occur as a result of increased hazards from cooling towers. Both natural draft and mechanical cooling towers can increase area fogging conditions and ice formation on local roads and highways. Sites with high frequencies of naturally occurring fog and ice events would likely be more adversely affected by cooling tower operations.

A.1.3.7 References

1. U.S. Environmental Protection Agency, “Guidelines for Groundwater Classification Under the EPA Groundwater Protection Strategy,” Office of Groundwater Protection, 1986.

2. U.S. Environmental Protection Agency, Source Water Protection, Sole Source Aquifer Program, 2005.

3. Aller, L., T. Bennett, J. Lehr, R. Pelty, and G. Hackett, *DRASTIC: A Standardized System for Evaluating Ground Water Pollution Potential Using Hydrogeologic Settings*, EPA/600/2-87/035, June 1987.

A.2 ENVIRONMENTAL CRITERIA

A.2.1 CONSTRUCTION-RELATED EFFECTS ON AQUATIC ECOLOGY

A.2.1.1 Disruption of Important Species/Habitats

Objective – The purpose of this criterion is to evaluate the candidate sites with respect to potential construction-related impacts on aquatic or marine ecology. Regulatory Guide 4.7 defines important plant and animal species if one or more of the following conditions apply:

- The species is commercially or recreationally valuable.
- The species is officially listed as endangered or threatened.
- The species effects the well being of another species within (1) or (2) above.
- The species is a critical component of the structure and function of a valuable ecosystem.
- The species is a biological indicator of radionuclides in the environment.

Of particular concern are potential impacts to habitat areas used by important species. These areas include those used for the following:

- Breeding and nursery.
- Nesting and spawning.
- Wintering.
- Feeding.

Evaluation Approach – The following siting criteria were used to evaluate the candidate sites:

- Exclusionary – Designated critical habitat of endangered species.
- Avoidance – Areas where threatened and endangered species are known to occur.
- Suitability – Areas where limited potential impact is expected.

No information was obtained that would indicate that any of the sites under consideration would exceed the exclusionary or avoidance criteria relative to ecology. Therefore, the evaluation focused on the relative suitability of the site based on the number of areas where limited potential impact is expected. The number of potential impact areas was directly correlated to the number of rare, threatened, and endangered (RTE) aquatic species that may occur at the site, their habitat (based on existing reports and the professional judgment of the amount and quality of habitat available for species), and flexibility (professional judgment of the amount of space within the site circle to avoid known locations of protected species during construction of the facility). It should be noted that the evaluation was limited to the plant site and not existing or potential (future) transmission corridors.

A.2.1.2 Bottom Sediment Disruption Effects

A.2.1.2.1 Contamination

A.2.1.2.2 Grain Size

Objective – The purpose of the criterion is to evaluate the potential short-term impacts to aquatic/marine resources resulting from construction-related dredging activities at the candidate sites.

Evaluation Approach – The evaluation sought available data on the amount of contaminated sediments near the candidate sites and the grain size of sediments in the area. In general, sites with the lowest concentration of heavy metals and toxic organic compounds and the highest sediment grain size were considered to be the most suitable.

Little information is available regarding the site-specific level of sediment contamination that exists in water bodies near the candidate sites. The majority of the available information was obtained from the EPA's National Sediment Quality Survey (Reference 1). Information in the EPA report addresses sediment contamination levels as Tier I (adverse impacts to aquatic life are probable) and Tier II (adverse impacts to aquatic life are possible but infrequent). Using best professional judgment, the following evaluation considered the EPA's Tier I/Tier II study results to determine the relative contamination potential for the candidate sites.

No information regarding sediment grain size was obtained for this evaluation. Because sediment grain size is highly variable, even within a small area of coastline or river reach, the following evaluation of potential bottom sediment disruption effects was limited to available information regarding sediment contamination levels in principal water bodies at the sites.

A.2.1.3 References

1. U.S. Environmental Protection Agency, "The Incidence and Severity of Sediment Contamination in Surface Waters of the United States," National Sediment Quality Survey, Office of Science and Technology, EPA 823-R-04-007, November 2004.

A.2.2 CONSTRUCTION-RELATED EFFECTS ON TERRESTRIAL ECOLOGY

A.2.2.1 Disruption of Important Species/Habitats and Wetlands

A.2.2.1.1 Important Species/Habitats

A.2.2.1.2 Groundcover/Habitat

A.2.2.1.3 Wetlands

Objective – The purpose of this criterion is to evaluate the candidate sites with respect to potential construction related impacts on important species and terrestrial ecology. Regulatory Guide 4.7 defines an important plant and animal species if one or more of the following conditions apply:

- The species is commercially or recreationally valuable.
- The species is officially listed as endangered or threatened.
- The species effects the well being of another species within (1) or (2) above.
- The species is a critical component of the structure and function of a valuable ecosystem.
- The species is a biological indicator of radionuclides in the environment.

Of particular concern are potential impacts to habitat areas used by important species. These areas include those used for the following:

- Breeding and nursery.
- Nesting and spawning.
- Wintering.
- Feeding.

Evaluation Approach – The following siting criteria were used to evaluate the candidate sites:

- Exclusionary – Designated critical habitat of endangered species.
- Avoidance – Areas where threatened and endangered species are known to occur.
- Suitability – Areas where limited potential impact is expected.

No information was obtained that would indicate that any of the sites under consideration would exceed the exclusionary or avoidance criteria relative to ecology. Therefore, the evaluation focused on the relative suitability of the site based on the number of areas where limited potential impact is expected. The number of potential impact areas was directly correlated to the number of rare, threatened, and endangered terrestrial species that may occur at the site, their habitat (based on existing reports and professional judgment on the amount and quality of habitat available for species), and flexibility (professional judgment on the amount of space within the site circle to avoid known locations of protected species during construction of the facility). It should be noted that the evaluation was limited to the plant site and not existing or potential (future) transmission corridors.

Another subcriterion evaluated was the total acreage of wetlands in the area, not including the lake or reservoir that would be the primary source of cooling water. This subcriterion was divided into three components: total wetlands (acres); total acreage of higher quality wetlands; and flexibility, or the ability to avoid wetlands during construction.

Wetland information was obtained from the National Wetlands Inventory (NWI) maps published by the USFWS. The extent of mapped wetland areas that occur within a 1 mi. (near field) radius of the sites was reviewed.

A.2.2.2 Dewatering Effects on Adjacent Wetlands

A.2.2.2.1 Depth to Water Table

A.2.2.2.2 Proximal Wetlands

Objective – The purpose of this criterion is to evaluate the sites with respect to potential impacts from construction-related dewatering activities on area wetlands.

Evaluation Approach – The evaluation included a review of information related to the depth of the water table and the distance to nearby wetlands. A determination of the extent of wetland acreage within the study area was limited to information found in existing reports. These documents may not necessarily reflect existing wetland conditions at the sites.

A.2.3 OPERATIONAL-RELATED EFFECTS ON AQUATIC ECOLOGY

A.2.3.1 Thermal Discharge Effects

A.2.3.1.1 Migratory Species Effects

A.2.3.1.2 Disruption of Important Species/Habitats

A.2.3.1.3 Water Quality

Objective – No exclusionary or avoidance criteria apply to condenser cooling water system thermal discharges on receiving water bodies (Siting Guide, Subsection 3.2.3.1) (Reference 1). The purpose of this criterion is to address the relative suitability of the four candidate sites with respect to potential thermal impacts. Two specific thermal impact issues were considered:

- Disruption of important species and habitats.
- Impact on water quality of the receiving water body.

Information on migratory species (also identified in the EPRI criteria) was not collected at each site and, therefore, was not evaluated as part of this criterion.

Evaluation Approach – In December 2001, the EPA published a final regulation, which affects the location, design, construction, and capacity of intake structures for new power plants (Reference 2). The EPA rule encourages the use of closed-cycle designs to reduce adverse cooling water system impacts, and it is assumed that new nuclear reactors at the four candidate sites would include closed cooling water systems. It is assumed that any new unit would be a closed-cycle design.

A.2.3.2 Entrainment/Impingement Effects

A.2.3.2.1 Entrainable Organisms

A.2.3.2.2 Impingable Organisms

Objective – No exclusionary or avoidance criteria apply to entrainment and impingement impacts from the operation of condenser cooling water systems (Siting Guide, Subsection 3.2.3.1) (Reference 1). The purpose of this criterion is to address the relative suitability of the candidate sites with respect to potential entrainment and impingement impacts.

When cooling water is pumped from water bodies, several environmental impacts can occur. Entrainment refers to the removal of small, drifting organisms with the cooling water. Small fish, fish eggs, phytoplankton, zooplankton, and other aquatic/marine organisms experience high mortality rates as they pass through cooling water pumps and heat exchangers. Impingement refers to larger organisms that are screened out of the cooling water at the intake structure. Impinged organisms can include large fish, crustaceans, turtles, and other aquatic/marine organisms that cannot avoid high intake velocities near the intake structure and are trapped on the intake screens.

Evaluation Approach – Concerns about entrainment and impingement losses are resource-dependent and vary on a site-to-site basis. Typically, power plants with once-through cooling water systems have higher entrainment and impingement impacts than power plants with closed-cycle cooling water systems. In December 2001, the EPA issued a final rule that affects the design of intake structures for new power plants (Reference 2). These rules encourage the use of closed-cycle systems, which is the type of system assumed to be used at these sites. Developers of new power plants who choose certainty and faster permitting over greater design flexibility would be encouraged to limit intake water capacities and velocities and incorporate specific intake screen designs to reduce entrainment and impingement losses. It is assumed that any new units built would be a closed-cycle system.

A.2.3.3 Dredging/Disposal Effects

A.2.3.3.1 Upstream Contamination Sources

A.2.3.3.2 Sedimentation Rates

Objective – The purpose of the subsection is to evaluate the sites for potential environmental impacts related to maintenance dredging at the intake structure. No specific exclusionary or avoidance criteria apply to this issue. The following evaluation, therefore, is a summary of available information related to the relative suitability of the sites.

Evaluation Approach – Sites with high levels of contaminated sediment deposition at the intake structure would experience higher maintenance costs for the removal and disposal of the dredged material. Two factors were considered in performing the evaluation:

- The level of upstream contamination.
- The rate of sedimentation at the site.

As addressed in Subsection A.2.1.2 , no site-specific information about the level of sediment contamination at the sites was identified. The results in Subsection A.2.1.2 were based on EPA data, which addressed general trends in the levels of contamination in the water bodies at the candidate sites and general water quality information for the major water bodies on which the candidate sites are located. Sedimentation rates were assumed to be the same at each site and were given a conservative rating of 3 based on incomplete information.

A.2.3.4 References

1. Electric Power Research Institute, "Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application," March 2002.

2. U.S. Environmental Protection Agency, "Fact Sheet: Cooling Water Intake Structures at New Facilities - Final Rule," EPA-821-F-01-017, 2001.

A.2.4 OPERATIONAL-RELATED EFFECTS ON TERRESTRIAL ECOLOGY

A.2.4.1 Drift Effects on Surrounding Areas

A.2.4.1.1 Important Species/Habitat Areas

A.2.4.1.2 Source Water Suitability

Objective – The purpose of this criterion is to evaluate the relative suitability of the candidate sites with respect to potential concerns with cooling tower drift effects. This evaluation considered the potential effects on surrounding areas and the suitability of the cooling water source (Siting Guide) (Reference 1). This issue does not apply to sites for which once-through cooling water systems are selected.

Cooling Tower Drift

In every cooling tower, there is a loss of water to the environment in the form of pure water, which results from the evaporative cooling process. This evaporated water leaves the tower in a pure vapor state, and thus, presents no threat to the environment. Drift, however, is the undesirable loss of liquid water to the environment, via small unevaporated droplets that become entrained in the exhaust air stream of a cooling tower. These water droplets carry with them minerals, debris and microorganisms, and water treatment chemicals from the circulating water, thus potentially affecting the environment. High drift losses are typically caused by fouled, inefficient, or damaged drift eliminators; excessive exit velocities; or imbalances in the water chemistry.

Minimizing drift losses in a cooling tower reduces the risk of affecting the environment. The principal environmental concern with cooling tower drift impacts are related to the emission and downwind deposition of cooling water salts. Salt deposition can adversely affect sensitive plant and animal communities through changes in water and soil chemistry.

Evaluation Approach – Sites considered to contain the most sensitive environments were assigned lower rating values. Sites with the highest concentrations of dissolved solids and other potential contaminants in the cooling tower makeup were also assigned lower rating values.

A.2.4.2 References

1. Electric Power Research Institute, "Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application," March 2002.

A.3 SOCIOECONOMICS CRITERIA

A.3.1 SOCIOECONOMICS - CONSTRUCTION RELATED EFFECTS

Objective – The purpose of this criterion is to evaluate the relative suitability of the site with respect to the number of construction workers who would move into the plant site vicinity with their families, and the capacity of the communities surrounding the plant site to absorb this new temporary (in-migrant) population.

Evaluation Approach – The number of in-migrant workers is dependent on labor availability within commuting distance of the plant site. If an adequate supply of workers is available within reasonable commuting distance, few, if any workers, would choose to relocate to the site. The capacity of communities to absorb an increase in population depends on the availability of sufficient resources, such as adequate housing and community services to support the influx.

Steps 1 and 2 (Exclusionary and Avoidance criteria) are not applicable to this criterion. The plant construction workforce is likely to be available at any of the sites under consideration. The issue in siting, therefore, is the potential socioeconomic impact associated with any temporary influx of construction workers who live too far away to commute daily from their residence.

With respect to suitability of the sites under consideration, socioeconomic impacts of nuclear power plant construction are directly related to two factors:

- Number of construction workers who would move into the plant site vicinity with their families.
- Capacity of the communities surrounding the plant site to absorb this new temporary (in-migrant) population.

The number of in-migrant workers is dependent on labor availability within commuting distance of the plant site. If an adequate supply of workers is available within reasonable commuting distance, few (if any) workers would choose to relocate to the site vicinity. The capacity of communities to absorb an increase in population depends on the availability of sufficient resources, such as adequate housing and community services (e.g., schools, hospitals, police, transportation systems, and fire protection) to support the influx without straining existing services. Impacts to a small community located along the commuter route(s) (e.g., food, lodging, gas, and congestion) can also be significant and should be considered. When rating sites from the perspective of construction impacts, labor requirements, location of labor pool, number of immigrants, and the economic structure of affected communities should be included.

Before the data could be compared between the sites and the sites rated, certain assumptions were made regarding the construction labor requirements and construction schedule, labor pool, and affected area. Many of these assumptions were made without the benefit of site-specific information and may warrant future revision when site-specific data become available (i.e., full NEPA documentation for original plant construction and operation can be reviewed, and/or site-specific plant personnel can be interviewed regarding actual impacts from original plant construction). For the purposes of this report, assumptions were based on professional judgment, the Siting Guide, and information contained in NUREG-1437 (Reference 1). NUREG-1437 included results of utility surveys, seven case studies, and plant-specific studies that examined socioeconomic impacts of original nuclear power plant construction and operation (e.g., kinds of impacts that have occurred; causal factors behind those impacts; and impact thresholds, if any). The cases included a range of plants in terms of size and population characteristics of the study areas (low, medium, high) and were supposed to represent the range of potential impacts for a nuclear power plant (NUREG/CR-2750, ORNL/NUREG/TM-22, and NUREG/CR-0916) (References 2 through 4).

<u>Assumptions</u>

According to the Siting Guide, plant workforce (construction) indicates a monthly maximum construction workforce requirement of 1000 persons per unit. Construction of a nuclear power plant is very labor-intensive and for the ESBWR, skilled and unskilled construction workers would likely be needed over a 4 to 5 year period. The following assumptions were used in this analysis:

- Ratings are based on the assumption that one unit would be constructed at a given site.

- Construction would require a peak construction workforce of 1000 workers per unit; this estimate is not necessarily the "worst-case" but is assumed to be a "realistic" estimate for the purposes of site comparison.
- Analysis assumes that no other major construction project would occur in the site vicinity concurrently with the plant construction and operation, with the exception of W3 and GGNS. Potential cumulative effects that take into account the ongoing rebuilding efforts in New Orleans (i.e., relative to the W3 site), and construction of planned Unit 2 (i.e., relative to a third unit at GGNS) have been taken into account to a limited extent. In the case of GGNS, it is assumed that there is at least 1 overlapping year of construction for Units 2 and 3.

Available population and economic data were obtained from the U.S. Census Bureau for each site. The data were collected by county to determine availability of an adequate labor force within commuting distance of the plant site (based on an assumed location of the labor pool). Data relating to population and labor force (primarily construction industry) were compared with the construction labor requirement to determine availability of labor.

The study of economic structure examines employment because of its pre-eminent role in determining economic well-being of an area. Specifically, impacts are determined by comparing the number of direct and indirect jobs created by plant's construction with total employment of the local study area at the time of construction. Sites were rated according to economic impacts based on the following criteria: economic effects were considered small if peak construction-related employment accounted for less than 5 percent of total study area employment; moderate if it accounted for 5 to 10 percent of total study area employment; and large if it accounted for more than 10 percent of total study area employment.

A.3.1.1 References

1. U.S. Nuclear Regulatory Commission, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437, Washington, D.C., May 1996.

2. Chalmers, J., D. Pijawka, K. Branch, P. Bergmann, C. Flynn, and J. Flynn, *Socioeconomic Impacts of Nuclear Generating Stations: Summary Report on the NRC Post-Licensing Studies*, NUREG/CR-2750, July 1982.

3. Purdy, B. J., E. Peele, D. J. Bjornstad, T. J. Mattingly, Jr., J. Soderstrom, and R. C. DeVault, *Post-Licensing Case Study of Community Effects at Two Operating Nuclear Power Plants*, Final Report, March 1975-March 1976, ORNL/NUREG/TM-22, June 1976.

4. Shields, M. A., J. T. Cowan, and D. J. Bjornstad, *Socioeconomic Impacts of Nuclear Power Plants: A Paired Comparison of Operating Facilities*, NUREG/CR-0916, July 1979.

A.3.2 SOCIOECONOMICS – OPERATION

Socioeconomic impacts of operation relate primarily to the benefits afforded to local communities as a result of the plant's presence (e.g., tax plans, local emergency planning support, educational program support). These benefits tend to be a function of the negotiations between the plant owner and local government; they are not indicative of inherent site conditions that affect relative suitability between sites. In addition, these existing sites have previously demonstrated that their local economies can support existing plant operations, and an additional unit will not adversely affect an area that has already shown its ability to support existing units.

As a result, this criterion is not applicable to comparison of the candidate sites considered in this study, and, in accordance with the Siting Guide, suitability scores were not developed.

A.3.3 ENVIRONMENTAL JUSTICE

Objective – The purpose of this criterion is to ensure that the effects of proposed actions do not result in disproportionate adverse impacts to minority and low-income communities. In comparing sites, this principle is evaluated on the basis of whether any disproportionate impacts to these communities are significantly different when comparing one site to another.

Evaluation Approach – The first step in this evaluation is to collect and compare population data for minorities and low-income populations across sites. However, the following questions comprising this evaluation also are relevant:

- Does the proposed action result in significant adverse impacts?
- Are impacts to minority or low-income populations significantly different between sites?

If the answer to the first question is "no" for all sites (i.e., no significant health and safety impacts are identified), then there would be no environmental justice concerns, regardless of the percentage of minority or low-income populations found within the surrounding communities of a site(s). If the answer to the first question is "yes" (i.e., significant health and safety impacts are expected), environmental justice concerns are relevant to site selection only if the answer to the second question is also "yes" (i.e., disproportionate adverse impacts on minority or low-income populations are identified at one or more sites, thereby resulting in significant differences between sites).

A.3.4 LAND USE

Objective – The purpose of this criterion is to evaluate the suitability of the candidate sites with respect to potential conflicts in existing land uses at each site. No exclusionary or avoidance criteria apply to this issue.

Evaluation Approach – The evaluation was based on the compatibility of a new nuclear station with existing land uses, including existing and future land uses and zoning ordinances, as well as any significant historic and ecological resources. Historic resources include those currently listed on the National Register of Historic Places (NRHP), or known (active) archaeological sites or Native American lands. This analysis was based on publicly available data.

It should be noted that this criterion was considered not applicable in the evaluation of existing nuclear power plant sites; however, it was evaluated with respect to the two Greenfield sites – assuming the four existing plant sites would all receive a rating of 5 for this criterion evaluation.

A.4 ENGINEERING AND COST-RELATED CRITERIA

A.4.1 HEALTH AND SAFETY-RELATED CRITERIA

A.4.1.1 Water Supply

Objective – The purpose of this criterion is to evaluate relative differences in the design and construction costs of developing water supply facilities.

Evaluation Approach – Design and construction costs for retrieving cooling water supplies from neighboring surface waters are not expected to differ significantly across the candidate sites.

A.4.1.2 Pumping Distance

Objective – The purpose of this criterion is to evaluate relative differences in the operational costs associated with pumping makeup water from the source water body to the plant.

Evaluation Approach – Sites located large distances from their makeup water supply source were rated lower than those located adjacent to the source. In general, the cost differential is expected to be a linear function of distance from the water source.

A.4.1.3 Flooding

Objective – The purpose of this criterion is to rate sites with respect to differential costs associated with construction of flood protection structures that are necessary to address probable maximum floods at the sites under consideration.

Evaluation Approach – Sites with the largest differences between site-grade elevation and likely flood elevations were rated highest; sites with the plant grade at or near flood level were rated lowest.

A.4.1.4 Vibratory Ground Motion – *Deleted from evaluation*

The purpose of this criterion is to provide a relative measure of the costs associated with designing to different seismic requirements at different sites. Because all of the sites under consideration are expected to meet the site parameters for seismic design of the standardized designs under consideration, this criterion is not applicable to the site selection process.

A.4.1.5 Civil Works

Objective – The purpose of this criterion (formerly titled “soil stability”) is to rate sites according to differences in the cost of civil works (e.g., nonflood-related berms, stabilizing of graded slopes and banks) necessary to prepare the site for nuclear plant development.

Evaluation Approach – Landslides are commonly defined as the downward and outward movement of earth materials on a slope. Typically, landslides involve falling, sliding, or flowing rock and/or soil. The causes of landslides may include earthquakes, reservoir draw-downs, heavy precipitation, and floods. Sites are rated highest to lowest, according to the estimated level of cost of civil works required at each site based on past incidence and future susceptibility of area landslides.

A.4.2 TRANSPORTATION OR TRANSMISSION-RELATED CRITERIA

A.4.2.1 Railroad Access

Objective – The purpose of this criterion is to rate sites according to the relative costs associated with providing rail access.

Evaluation Approach – Sites were rated from highest to lowest, in accordance with the estimated construction costs required to provide rail access to the site. The following unit cost estimates were assumed:

- ROW, Grading, and Rail Construction - $1.5M per mile.
- Large Open Deck Tressel (major river crossing) - $14M each.
- Small Open Deck Tressel (major stream crossing) - $100K each.
- Box Culvert (minor stream crossing) - $25K each.
- Crossing Protection with Lights and Gates - $150K each.
- Mainline Turnout - $65K each.

Sites may be located near abandoned rail lines. The site-specific condition of abandoned rail lines is unknown and could range from removed/revegetated to present and operable with minimal upgrade. Therefore, distances used in this analysis are to the nearest rail line in service and assume abandoned rail lines have been removed/revegetated. Should rail access become a sensitive criterion for site selection, site-specific conditions of abandoned rail lines should be more fully evaluated.

A.4.2.2 Highway Access

Objective – The purpose of this criterion is to rate sites according to the relative costs associated with providing highway access.

Evaluation Approach – Sites were rated from highest to lowest, in accordance with the length of additional or new highway construction required to provide car and truck access. New construction of an undivided, three-lane rural road (including center turn lane) from the nearest active roadway was assumed. New construction costs were estimated at $3M per mile, and existing road improvement costs were estimated at $1.5M per mile.

A.4.2.3 Barge Access

Objective – The purpose of this criterion is to rate sites according to the relative costs associated with utilizing existing barge access locations. Each of the candidate sites is located near existing barge facilities.

Evaluation Approach – Sites were rated from highest to lowest, in accordance with distance from existing barge access locations.

A.4.2.4 Transmission Cost and Market Price Differentials

Objective – The purpose of this criterion is to rate sites according to the relative costs associated with construction of power transmission systems and issues related to market price differentials.

Evaluation Approach – Sites were rated from highest to lowest in accordance with estimated transmission system construction costs and consideration of other identified issues related to power transmission. Because all candidate sites are located within the Entergy service area, no electricity market price differentials are expected between the sites, and this subcriterion was not evaluated.

A.4.3 CRITERIA RELATED TO LAND USE AND SITE PREPARATION

A.4.3.1 Topography

Objective – The purpose of this criterion is to rate sites according to the relative costs associated with site preparation (e.g., grading, blasting, and earth-moving) necessary to prepare the site for construction of a nuclear power plant.

Evaluation Approach – Ratings were based on the amount of topographic relief currently found at the site (approximately 500 ac.), with the most severe relief resulting in the highest estimated grading costs and, therefore, the poorest rating. Sites were rated from highest to lowest, in accordance with estimated grading costs. Areas with mean slopes greater than 12 percent or relief greater than 400 ft. were considered undesirable.

A.4.3.2 Land Rights

Objective – The purpose of this criterion is to rate sites according to the relative costs associated with purchasing land that would be required to construct and operate a nuclear station on the site.

Evaluation Approach – Sites are rated from highest to lowest, in accordance with estimated local land costs.

A.4.3.3 Labor Rates

Objective – The purpose of this criterion is to rate sites according to the relative costs associated with local labor costs that would be incurred during plant construction.

Evaluation Approach – Sites were rated from highest to lowest, in accordance with estimated local labor costs, with the lower cost resulting in higher ratings.

Appendix 9B
Candidate Site Comparative Impact Analysis

Appendix 9B
Candidate Site Comparative Impact Analysis

This appendix evaluates the environmental impacts of constructing and operating a new single-unit nuclear power plant at the proposed location, the RBS, and three alternate locations, ANO, GGNS, and W3. The environmental impacts of several main categories were evaluated, and a level of significance (SMALL, MEDIUM, or LARGE) was assigned for each category at each site, based on the following:

- SMALL: Environmental effects are not detectable or are so minor that they would 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.

Environmental effects were evaluated and predicted based on existing information available for the sites under consideration. Where feasible, these impact analyses were developed using the methodology and approach used in recent NRC environmental reviews of new reactor license applications (e.g., the Grand Gulf Early Site Permit Application). Thus, the impact levels reflect the guidelines of the CEQ and those set forth in the footnotes to Table B-1 of 10 CFR 51, Subpart A, Appendix B; the impact categories evaluated are the same as those used in NUREG-1437, with the additional impact category of environmental justice.

In summary, the environmental impacts analysis indicates that the overall environmental impacts (from both construction and operation activities) at the proposed RBS site are generally SMALL, and none of the alternate sites is environmentally preferred to the proposed site.

B.1 CONSTRUCTION IMPACTS AT THE PROPOSED AND ALTERNATIVE SITES

This section evaluates the potential environmental impacts associated with the construction of a new nuclear power plant at the RBS site (proposed site) and at the ANO site, the GGNS site, and the W3 site (alternative sites). Table 9B-1 summarizes the construction impacts of the proposed action.

B.1.1 LAND USE

Land use impacts associated with plant construction include both impacts to the site and immediate vicinity and impacts to off-site areas such as transmission and transportation ROW.

Table 9B-1
Comparison of the Construction Impacts at the Proposed and Alternative Sites

	Proposed Site	Alternative Sites		
Impact Area Category	**RBS**	**ANO**	**GGNS**	**W3**
Land Use				
Site and vicinity	SMALL	SMALL	SMALL	SMALL
Power transmission line ROW and off-site areas	SMALL to MODERATE	MODERATE	SMALL to MODERATE	SMALL to MODERATE
Air Quality	SMALL	SMALL	SMALL	SMALL
Water-Related				
Water use	SMALL	SMALL to MODERATE	SMALL	SMALL
Water quality	SMALL	SMALL	SMALL	SMALL
Ecological				
Terrestrial ecosystems	SMALL	MODERATE	MODERATE	SMALL
Aquatic ecosystems	SMALL	SMALL	MODERATE	SMALL
Threatened and endangered species – terrestrial and aquatic	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL
Socioeconomic				
Physical impacts	SMALL	SMALL	SMALL	SMALL
Demography	SMALL	MODERATE to LARGE	MODERATE to LARGE	SMALL
Social and economic	BENEFICIAL	BENEFICIAL (LARGE to local economy)	BENEFICIAL (LARGE to local economy)	BENEFICIAL
Infrastructure and community services	SMALL to MODERATE	MODERATE to LARGE	MODERATE to LARGE	SMALL to MODERATE
Historic and Cultural Resources	SMALL	MODERATE	SMALL	SMALL
Environmental Justice	SMALL	SMALL	SMALL to MODERATE	SMALL
Nonradiological Health	SMALL	SMALL	SMALL	SMALL
Radiological Health	SMALL	SMALL	SMALL	SMALL

B.1.1.1 Site and Vicinity

Construction of a new nuclear power plant would include clearing, dredging, grading, excavation, spoil deposition, and dewatering activities. The impacted area would generally be 400 ac.[a] and would be largely focused in one central location. Impacts would also be realized near, and in the surface water source for, cooling water makeup/blowdown. Following construction activities, impacted areas without constructed buildings or transportation infrastructure would be reclaimed to the greatest extent, and impacts would be temporary.

Because specific site locations and plant design layouts have not been finalized, specific acreage impacts cannot be determined for the sites under consideration. However, the lands to be developed are owned by Entergy, they are located adjacent to existing nuclear power plant operations, and impacts are expected to be minimized by co-locating plant components to the maximum extent possible (e.g., expansion of intake and discharge facilities rather than construction of new facilities). Land use impacts at the site and immediate vicinity are predicted to be SMALL for each site under consideration.

B.1.1.2 Power Transmission Line ROW and Off-Site Areas

Each site is the location of existing power generating facilities; therefore, transmission line ROWs exist and are directly accessible to each site. However, the feasibility of using the existing infrastructure is dependent on the available capacity remaining in the system. If sufficient capacity is not available, either existing ROW would be expanded to accommodate additional transmission lines or new ROW would be obtained and transmission lines constructed. Expansion of existing ROWs are expected to result in SMALL environmental impacts, while construction in new ROWs could result in MODERATE impacts. The ANO site is more than twice the distance from the primary load center in New Orleans, Louisiana (compared to the other sites), and greater impact is expected.

Because each site is the location of existing power generating facilities, roads providing site access exist in the vicinity of each site. Additional transportation volume could require the expansion of some local roads. Shift schedules could be planned so that shift changes at the co-located facilities would not coincide with each other. Impacts from constructing road access to each site would be SMALL.

The RBS, ANO, and W3 sites have existing rail access at the sites. Construction of additional rail access would be minimal. The GGNS site does not have existing rail access, and approximately 20 mi. of abandoned rail lines would need to be installed/reconditioned to provide site rail access. However, due to the site location near the Mississippi River, plant components are expected to be delivered via barge, and construction of rail access is not anticipated. Impacts from constructing rail access to each site would be SMALL.

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[a] This is consistent with the area of impact from a new unit or units at GGNS, as evaluated in NUREG-1817 (ESP EIS for GGNS).

In summary, impacts from transmission line construction and transportation infrastructure are predicted to be SMALL to MODERATE at the RBS, GGNS, and W3 sites, primarily depending on the amount of transmission line construction in previously undisturbed ROWs. Impacts at the ANO site are predicted to be MODERATE, because this site is the greatest distance from the primary load center in New Orleans, Louisiana.

B.1.2 AIR QUALITY

Air quality impacts associated with plant construction include both impacts from the construction activities themselves and transportation impacts from workers commuting to the worksite. Construction activities would require obtaining federal, state, and/or local permits and approvals prior to beginning activities.

B.1.2.1 Construction Activities

Air quality impacts from construction activities are similar to those for any large-scale construction effort and consist of fugitive dust emissions, emissions from equipment and machinery, and emissions from concrete batch plant operations. Fugitive dust emissions can be controlled through use of water sprays and postponing certain activities during windy conditions. Equipment emissions can be controlled through equipment inspections and regular maintenance. Concrete batch plant operations would employ equipment emissions controls to minimize air quality impacts. In total, air quality emissions from construction activities would be SMALL and temporary and can be mitigated to minimize any resulting impacts. Each site would experience similar air quality impacts.

B.1.2.2 Transportation

Air quality impacts would also result from the workforce commuting to the worksite. Vehicular emissions would increase as a result of the action. It is unlikely that air quality would be noticeably degraded beyond the immediate site vicinity. Air quality impacts would be more detrimental in areas already exceeding the National Ambient Air Quality Standards (NAAQS) for criteria pollutants. However, none of the sites are in the immediate vicinity of areas exceeding the NAAQS for criteria pollutants. Impacts associated with increases in vehicular transportation associated with the construction activity are expected to be SMALL.

In summary, air quality impacts from both construction activities and transportation increases are predicted to be SMALL, and there is no clear distinction between the sites in assessing air quality impacts.

B.1.3 WATER-RELATED

Water-related impacts associated with plant construction include both water use impacts and water quality impacts and are consistent with those caused by typical large-scale construction projects. Construction activities would require obtaining federal, state, and/or local permits and approvals prior to beginning activities.

B.1.3.1 Water Use

Construction activities requiring consumption of water include concrete batch plant operation, dust suppression, and sanitary needs. The source of the water requirements (surface water, groundwater, or imported water) has not yet been identified for each site. Additionally, specific quantity requirements have not been predicted.

Each site is located near a major river. The RBS, GGNS, and W3 sites are located near the Mississippi River, with low flow rates between 100,000 cfs and 140,000 cfs, and average flow rates between 450,000 cfs and 500,000 cfs. Surface water use from the Mississippi River for construction activities would have a SMALL impact.

The ANO site is located near the Arkansas River and Lake Dardanelle. The average flow rate is 42,000 cfs, and the average low flow is 416 cfs; however, the potential for a low flow of 0 cfs exists. Surface water use from the Arkansas River for construction activities would normally have a SMALL impact, although impacts could be MODERATE during times of low flow.
Groundwater sources could also potentially be used for plant construction activities at each of the sites. Previous plant construction efforts used approximately 350 gpm of water, and new plant construction is assumed to use a similar quantity. This quantity is not assumed to result in a significant impact to groundwater sources, especially if shallow sources not typically used for consumptive purposes are used. However, specific aquifer analyses would be required to accurately predict the impacts of the groundwater use.

In summary, because of the significant surface water volumes at the RBS, GGNS, and W3 locations, these sites would have a SMALL impact on water use. The lower surface water volumes at the ANO site would result in a SMALL to MODERATE impact on water use at this location.

B.1.3.2 Water Quality

Water quality impacts would primarily result from erosion and stormwater effects, and activity mitigation requirements would be stipulated through Louisiana Pollutant Discharge Elimination System (LPDES) permits obtained for the action. The RBS and GGNS sites have local drainages that could carry sediments to the Mississippi River, and the ANO site has local drainages that could carry sediments to the Arkansas River. The W3 site is largely isolated from surface water runoff to the Mississippi River because of levees constructed along the river. Standard best management practices (BMPs) could be implemented to minimize the impacts of erosion and stormwater runoff.

Any wastewater discharges from construction activities would be regulated and would require obtaining LPDES or other discharge permits. However, because of the large capacity of the neighboring surface waters, regulated discharges would be easily diluted in the receiving water bodies.

Therefore, because each site is located near a major surface water body and because of the regulatory conditions associated with the construction activities, impacts to water quality would be SMALL for each site.

B.1.4 ECOLOGICAL

B.1.4.1 Terrestrial Ecosystems

It was assumed that the proposed action is to construct one new unit at each site, and that construction of this unit would disturb 400 ac. of land, with 125 ac. required for permanent structures and facilities. All acreage not containing a permanent structure would be reclaimed to the maximum extent possible at each site.

The potential impacts from construction, such as erosion and dust generation, would be typical of large construction projects. These impacts could be mitigated by using standard industrial procedures and BMPs. 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. At all sites, the habitat loss impacts from the construction of a new unit would be SMALL to MODERATE. Site-specific details are provided as follows.

B.1.4.1.1 RBS

Three general vegetation types are found on-site: upland forests, bottomland hardwoods, and meadows and pastures. Following construction of the existing RBS plant, the remaining land cover for the three vegetation types were upland forests (858 ac.), bottomland hardwood (697 ac.), and meadows and pastures (259 ac.), totaling 1814 ac. In addition, approximately 25 percent of this land cover, within a 2-mi. radius of the site, has been mapped as wetlands. It was assumed that construction of a new generating facility would remove these three vegetation types in similar proportions to those removed during construction of the existing units at the RBS site: upland hardwood forests, 63.3 percent; bottomland hardwoods, 3 percent; and meadows and pastures, 33.7 percent. Therefore, construction of a new facility at the RBS site would disturb the following habitat areas:

- 253 ac. of upland hardwood forest, or 29 percent of the total upland hardwood forest remaining on-site; 79 ac., or 9.2 percent, would be permanently lost.
- 12 ac. of bottomland hardwoods, or 2 percent of the bottomland hardwoods remaining on-site; 4 ac., or 0.6 percent, would be permanently lost.
- 135 ac. of meadows and pastures, or 51 percent of the meadows and pastures remaining on-site; 42 ac., or 16.2 percent, would be permanently lost.

The combined loss of upland and bottomland hardwood forest would be about 265 ac., or approximately 17 percent of the total available acreage on-site, constituting a modest loss of forest habitat.

Impacts on terrestrial ecological resources from construction of a new generating facility and the possible expansion of the existing RBS transmission line ROWs would be MODERATE.

B.1.4.1.2 ANO

The ANO site currently includes two units (Units 1 and 2) that occupy 1164 ac. in a rural part of west-central Arkansas. The Applicant owns most of the property on the peninsula. The site and its associated transmission line ROW lie within the oak-hickory biome of the eastern deciduous forest. This biome ranges from dense forests of oaks (*Quercus* spp.) and hickory (*Carya* spp.) to more open savanna habitat. Eastern red cedar (*Juniperus virginiana*) and short-leaf pine (*Pinus echinata*) are common in the open habitats.

The land around the site is mostly meadow. Outside the property line, the land is mostly forest; the remaining land use is pasture and residential development. Recently, Entergy initiated an on-site reforestation project.

Land cover on the site itself includes mixed pine and hardwood and disturbed, early successional habitat; refer to the details in Table 9B-2. Approximately 5 ac. of wetlands are present on the site. The transmission line ROWs cross Dardanelle Reservoir and a number of small streams and wetlands, in addition to forests, savanna, and farmland.

Table 9B-2
Land Cover at ANO

Land Cover Class	Area, ha (ac.)	Percentage of Site
Mixed Pine-Hardwood Forest	184 (461)	40
Early Successional Habitats	194 (485)	41
Developed Areas	72 (180)	15
Open Water	12 (30)	3
Wetlands	2 (5)	1

The open water of Lake Dardanelle and emergent wetland habitat support a number of migrant waterfowl species, including common mergansers (*Mergus merganser*) and double-crested cormorants (*Phalacrocorax auritus*). Osprey (*Pandion haliaetus*) use the lake areas near the site. American white pelicans (*Pelecanus erythrorhynchos*) use the open-water habitats of the Reservoir. Great blue herons (*Ardea herodias*) nest in trees near the site.

Assuming that construction of a new generating facility would affect equal percentages of mixed pine-hardwood forest and early successional habitats, disturbance of 400 ac. for construction of a third unit would affect 43 percent of the mixed pine-hardwood forest (i.e., 62.5 ac., or 13.5 percent, would be permanently lost); and 41 percent of the early successional habitat (62.5 ac., or 12.9 percent, would be permanently lost). This represents a MODERATE loss of terrestrial habitat. Impacts on terrestrial ecological resources from construction of a new generating facility and possible expansion of the existing ANO transmission line ROW would be MODERATE.

B.1.4.1.3 GGNS

A total of 2100 ac. is located within the GGNS site boundary. The site was originally intended to contain two nuclear units. Unit 1 was completed, and Unit 2 was only partially completed. Approximately 465 ac. of the site were affected by construction of the existing Unit 1 site and partial completion of Unit 2. Currently, developed land occupies a total of 325 ac., or about 15 percent of the total site area, including about 270 ac. in the uplands and 55 ac. in the bottomlands. About half of this total consists of permanent structures and facilities (169 ac.). A COLA will soon be submitted to develop a second unit (i.e., first new unit), which, during construction, would affect an additional 400 ac. of land area at the site. It is estimated that 30 percent (120 ac.) of the proposed construction footprint for the first new unit 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 125 ac. would contain permanent structures (primarily a power block area, cooling tower area, and bottomland pipeline and intake areas).

It was assumed that construction of third unit (i.e., second new unit)[b] would disturb up to 400 ac., using a similar breakout to that proposed for the first new unit: 345 ac. in the uplands (hardwood forests, fields) and 55 ac. in the bottomlands (palustrine, forested, seasonally flooded wetland). However, in the case of a second new unit (unlike the first new unit), it was assumed that all 400 ac. would affect previously undisturbed lands. With respect to the total disturbance that would be dedicated to permanent structures and facilities, the breakout is also assumed to be similar to that for the first new unit: 100 ac. in the uplands (43 ac. of upland forest hardwood habitat, 31 ac. upland field habitat, and 26 ac. of previously disturbed areas) and 25 ac. in the bottomlands. However, unlike the first new unit, which had permanent construction impacts 26 previously disturbed acres in the upland area, it was assumed that construction of a second new unit would affect 100 ac. of undisturbed upland forest and field habitat (evenly split between the two).

Considering the permanent loss of terrestrial habitat expected from construction of Unit 2, the additional permanent loss from construction of a third unit was estimated as follows:

- 56 ac. of upland forest habitat, or 16 percent of the 357 ac. of upland hardwood forest habitat currently available on the site after construction of Unit 2 (400 - 43).
- 44 ac. of upland field habitat, or 35 percent of total 124 ac. of upland field habitat available on-site after construction of Unit 2 (155 - 31).
- 25 ac. of bottomland palustrine, forested, seasonally flooded wetland, or 3 percent of the 860 ac. of bottomland forested wetland currently available after construction of Unit 2.

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[b] The alternative site impact analysis for the RBS assumes construction of only one new unit at the GGNS. However, because there are plans already under way to develop a second unit (i.e., first new unit) at the GGNS, which is the subject of a separate NRC review, this analysis assumes that construction would be for a third unit (i.e., second new unit) at the GGNS. In addition, the analysis assumes that construction of the two new units would have potentially overlapping construction periods. An analysis of potential cumulative impacts from overlapping construction periods at the GGNS is also included.

The losses from Unit 3 represent a moderate loss of forest habitat. Impacts on terrestrial ecological resources from the construction of a new generating facility and the possible expansion of the existing GGNS transmission line ROWs would be MODERATE. However, the combined losses from construction of Units 2 and 3 would represent a MODERATE to LARGE loss of habitat.

B.1.4.1.4 W3

The W3 site currently occupies 3561 ac.. The W3 property consists of 52 percent wetlands, and 21 percent of the land is used for agriculture. The most extensive plant communities at the W3 sites are the cypress-gum swamp and agriculture (historically devoted to sugarcane production). A third community grouping includes the batture, wax myrtle, and marsh communities; this community occupies approximately 808 ac., or about 20 percent of the site.

Assuming that 100 percent of the permanent structures and facilities associated with a second nuclear unit at W3 would be constructed on land currently used for agriculture, and that agricultural land currently occupies 748 ac. of the site, the affected land areas would be as follows:

- 400 ac. for construction, or 53 percent of the remaining agricultural land;
- 125 ac. would be permanently lost for permanent structures and facilities, or 17 percent of the remaining agricultural land.

In general, the W3 site is located in a very industrialized area that is surrounded by development. Swampland and forested wetland lie to the south, and it was assumed that these areas would not be permanently affected by construction of a new unit. The agricultural area that would be affected by construction does not contain important or unique wildlife habitat. Though many game birds and animals occur in St. Charles Parish, because of the existing industrial activity around W3 and the presence of Louisiana Highway 3127 through the site, terrestrial wildlife are probably less abundant at the site than in less disturbed parts of St. Charles Parish. Therefore, despite comparable percentages in terms of acreage losses for the other three sites, the impacts from construction on terrestrial habitat in the area would be SMALL.

B.1.4.2 Aquatic Ecosystems

For the purposes of the evaluation, it was assumed that the new unit would employ a closed cycle cooling system with cooling towers. The existing units at each location are cooled as follows:

- The RBS plant currently employs cooling towers.
- GGNS Unit 1 is cooled by a natural draft cooling tower and auxiliary mechanical draft cooling tower located southwest of the Containment and Power Block Buildings. Makeup water for the cooling system is brought from radial wells along the Mississippi River via an underground pipeline; discharge water is also piped to the Mississippi via an underground pipeline. The proposed second new unit (in addition to the already planned first new unit) would use a closed cycle system with a cooling tower.

- ANO Unit 1 uses a once-through cooling water system; Unit 2 uses a closed cycle system with a cooling tower.
- W3 uses a once-through cooling water system.

At each site, impacts on the aquatic ecosystem from the construction of a new nuclear unit would be associated with the construction of a new cooling water intake and discharge structures (and widening of the transmission line ROWs). The construction activities for a new cooling water intake and discharge structures include dredging, construction of cooling towers and on-site impacts on water sources, and pipeline construction. Dredging should be localized and temporary. While it would result in increased turbidity, the effects would be temporary and the dredging operations would be in compliance with the USACE and state water quality requirements so that long-term water quality would not be degraded. Construction along the Mississippi River and Lake Dardanelle would result in the removal or reshaping of the shoreline. These activities would likely lead to the loss of benthic macroinvertebrates and some shoreline habitat, as well as the temporary displacement of other aquatic species. Construction of the trenches for the intake and discharge pipelines from the water to the site could lead to temporary soil erosion and increased turbidity in any on-site water sources. All impacts from construction related to cooling towers and on-site impacts on water resources (e.g., from dewatering effluent and runoff), such as erosion and sedimentation into the water resources, could be mitigated using standard industrial procedures and BMPs. Pipeline construction impacts would be temporary and would also incorporate BMPs. Pipes would be buried, so there would be no permanent alteration of water flow patterns in the floodplain. Site-specific information is provided in the following paragraphs.

B.1.4.2.1 RBS

The aquatic resources at the RBS site are associated with the Mississippi River and the watershed of Grants Bayou. Other water sources on the site within the Grants Bayou watershed include Alexander Creek, West Creek, Alligator Bayou, and 19 small farm ponds, including Grassy Lake and a constructed wildlife management lake. The RBS 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 RBS would be used for the operation of a new facility, and minimal construction activities are anticipated in upgrading these facilities to handle discharges from the new unit(s). Therefore, impacts from construction activities are expected to be SMALL.

B.1.4.2.2 ANO

Lake Dardanelle at the ANO site is a man-made lake. The lake is upstream of the Dardanelle Lock and Dam on the Arkansas River. In addition to providing water for ANO, Lake Dardanelle serves a variety of other uses. The lake is designated as suitable for the propagation of fish and wildlife, recreation, and public and industrial water supplies; the lake has a commercial fishing industry.

The various trophic communities of Lake Dardanelle have been surveyed and monitored over the years. Phytoplankton populations are diverse and fluctuate seasonally. The benthic community includes Chironomidae, Oligochaeta, and Spheriidae. Additional benthic organisms that have been introduced into Lake Dardanelle include the *Corbicula fluminea* and *Dreissena polymorpha*.

The fish community of the area varies with the current; it also changes seasonally. The cooling water intake canal provides habitat for numerous species of fish. During warm months, the intake flow mixes warm, less oxygenated surface water with cool, more highly oxygenated Illinois Bayou channel water. This provides a highly productive habitat within the canal. Numerous species of fish and waterfowl utilize the warm water effluent during cold water conditions. The use of the intake and discharge canals by fish communities provides a sports fishery for local sports fishermen. A small, inundated wetland south of the effluent bay provides habitat for mammals, fish, reptiles, amphibians, and waterfowl.

It was assumed that the intake and discharge systems for the existing ANO Unit 2 would be used for operation of a third unit; minimal construction activities are anticipated in upgrading these facilities to handle discharges from the new unit(s). Therefore, impacts from construction activities are expected to be SMALL.

B.1.4.2.3 GGNS

The aquatic resources at the GGNS site are the Mississippi River and the two on-site oxbow lakes: Gin and Hamilton. Also associated with the GGNS 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.

Dredging impacts on the Mississippi River would be minimal because of the localized area and temporary nature of construction of the intake and discharge structures. Construction activities would be restricted to periods when the Mississippi River water level was low. The exposed areas are expected to be sandy, and very little turbidity and siltation are expected from construction activities at the shoreline through the use of standard construction practices. During construction, the river may receive dewatering effluent from trenching in the floodplain, or runoff from the bluff area via on-site streams and Hamilton Lake. Site runoff reaching the river via Hamilton Lake is buffered by the lake and sedimentation ponds. Excavation for burial of the intake and discharge pipelines would directly affect wetlands in the floodplain, but construction would follow the existing haul road to reduce incremental impacts to wetlands. Construction impacts from the first new unit are expected to be SMALL. Construction impacts of a second new unit at GGNS would also be expected to be SMALL, assuming that it would utilize the same intake and discharge systems as constructed for the first new unit. In the event that the construction of a second new unit requires a new intake and discharge system, and the construction periods overlap at least partially with that of the first new unit, there is the potential for the combined construction impacts on aquatic resources to be MODERATE.

B.1.4.2.4 W3

Aquatic species found in the vicinity of W3 are associated with the Mississippi River. The river near the W3 site region supports aquatic biota ranging from microorganisms and various plankton to large commercial fish. The more abundant fish near the site area include blue catfish, channel catfish, freshwater drum, and striped mullet. There are no unique fish habitats in the river near W3. Common commercial and sport fish in the area include freshwater drum and freshwater catfish; gizzard shad are caught and sold as bait.

The W3 area does not contain any unique fish habitats in comparison to other areas in the Lower Mississippi River (LMR). It is anticipated that there would be no loss or alteration of significant habitat for these species from the construction of a new unit at W3. The only additional comment for the W3 site is that it is on a portion of the Mississippi River with potential water quality/contamination issues, given the high-level chemical and refinery industries in the area. Dredging activities in the Mississippi River could stir up contaminated sediments that could adversely affect existing aquatic resources. Presumably, however, those aquatic species currently living in or near the site are tolerant of lower water quality conditions and would not be adversely affected by construction of a new unit. Therefore, impacts to aquatic resources from construction activities are expected to be SMALL.

B.1.4.3 Threatened and Endangered (T&E) Species

The proposed construction schedule for GGNS Unit 3, in relation to that currently planned for Unit 2, is not known. For the purposes of this evaluation, it was assumed that construction periods for each unit would overlap by at least 1 year.

B.1.4.3.1 RBS

The only federally listed T&E terrestrial species that may occur in the RBS area is the threatened Louisiana black bear (*Ursus americanus luteolus*). The RBS site is located adjacent to the Atchafalaya River Basin breeding sub-population of Louisiana black bears. The proposed Atchafalaya River Basin Floodway critical habitat unit is located at least 10 mi. to the west of the RBS site. No occurrences of the bear are known within 10 mi. of the site. Therefore, no impacts are expected to this species from the construction or operation of a new generating facility. None of the transmission lines are located within 10 mi. of the Atchafalaya River Basin Floodway critical habitat unit.

State-listed species include the following:

- Three state plants within 2 mi.: silvery glade fern, intermediate enchanter’s nightshade (both are imperiled), and carpenter’s ground cherry (critically imperiled). These could potentially be affected by the construction of a new generating facility and possible expansion of the existing transmission ROW.
- Three state-listed imperiled or critically imperiled terrestrial animal species that are known to occur beyond 2 mi. but within 10 mi. of the site: long-tailed weasel, southeastern shrew, and eastern spotted skunk. These three species are habitat generalists

and could occur on the RBS site and along the transmission line ROW. Therefore, they could potentially be affected by the construction of a new generating facility at the RBS site and possible expansion of the existing transmission line ROW.

- Ten additional state-listed imperiled or critically imperiled terrestrial plant species that are known to occur beyond 2 mi. but within 10 mi. These 10 species are habitat generalists that could occur on the RBS site and along its transmission line ROW; therefore, they could be affected by the construction of a new generating facility and possible expansion of the transmission line.

There is one federally listed endangered aquatic species (pallid sturgeon) and two state-listed imperiled aquatic species, the bluntface shiner and rainbow darter, within 10 mi. of the RBS site. The RBS 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. Pallid sturgeons have not been caught in the vicinity of the site (RM 262). The closest and most recent catches have been at RMs 229 and 314.

The bluntface shiner is an imperiled or rare fish found within the tributaries of the Mississippi River. The LDWF the bluntface shiner as known to occur within 2 mi. of the site; however, past studies of the aquatic resources from on-site tributaries have not reported the fish. The rainbow darter is an imperiled or rare fish found within 10 mi. of the 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 has been found on the RBS site during past sampling programs.

No critical habitat has been identified for any of the terrestrial or aquatic species in the site vicinity. Based on this information, the construction impacts on T&E species could range from SMALL to MODERATE.

B.1.4.3.2 ANO

As part of the relicensing of Units 1 and 2 (in 2000 and 2006), the Applicant contacted the USFWS on two separate occasions requesting information about the presence of federally listed T&E species at the site. In the most recent response for Unit 2 (January 14, 2004), the USFWS identified the least tern and bald eagle (which has since been proposed for delisting) as present in the vicinity of the site and its transmission line. The interior least tern (*Sterna antillarum*) is listed as endangered by the USFWS. It breeds on sandbars in the Arkansas River near Atkins and Clarksville, Arkansas. Known nesting locations for this species are beyond a 10-mi. (16-km) radius from the site and the transmission line ROW. In addition to the above federally listed species, the Entergy Environmental Report identified the endangered gray bat (*Myotis grisescens*) as occurring in the vicinity of the Unit 2 site and its transmission line. The gray bat is known to occur downstream of ANO, where it resides in caves upstream of the Dardanelle Lock and Dam. However, these caves are 10 mi. (16 km) from the facility and 2 mi. (3.2 km) from the transmission line ROW. No critical habitat has been designated for any of the federally listed terrestrial species.

The USFWS also identified one federally threatened aquatic species, the Arkansas River shiner (*Notropis girardi*), with an historic occurrence in the river. Critical habitat has been designated for the Arkansas River shiner, but not in the state of Arkansas. Similarly, the NOAA Fisheries indicated that it had no listed species or critical habitat in its purview associated with the ANO units.

Finally, the Arkansas Natural Heritage Commission (ANHC) was contacted during relicensing regarding the presence of state-listed species at the site and along the transmission line ROW. No state-listed species were identified by the ANHC as occurring on or in the vicinity of the site or its transmission line ROW.

Based on the previouis information, there appear to be federal- and state-listed species that could occur on the site or in the site vicinity and could be potentially affected by construction of a third unit at ANO. Potential impacts on T&E species could be SMALL to MODERATE, and mitigation would likely be warranted.

B.1.4.3.3 GGNS

T&E species that could potentially occur on-site or in vicinity include the following:

- Federally threatened bald eagle – However, no occurrences have been reported on-site or in the vicinity.
- Federally endangered interior least tern – It occupies areas upstream and downstream but not in the immediate vicinity of the site, so impacts are expected to be minimal (observed upstream at RMs 405, 409.8, 413.6; downstream at RM 393.0; site is at RM 406).
- Threatened American alligator – It is known to inhabit the site, but listed only because of similarity of appearance to American crocodile; present in wetland habitats on-site.
- Federally endangered red cockaded woodpecker – It is not known to occur in Claiborne County. It was found on transmission line ROW for GGNS Unit 2; however, steps have been taken so that impacts would be beneficial.
- Federally threatened Louisiana black bear – It is likely to occur on or in the vicinity of the site. Bear could be affected by noise from cooling tower operation, especially with the cumulative impact of adding another tower. However, it is already likely acclimated to the noise produced by the existing towers at GGNS Unit 1.
- Federally threatened gulf sturgeon has not been collected in reach of the site. However, the Mississippi River is in its historic range, so it could pass by the site as it migrates up and down the river.
- Federally threatened Bayou darter – It is endemic to Bayou Pierre and its tributaries, which flow as close as 1.9 mi. east of the site. Plant operation is not expected to affect regions where the darter is found.
- Federally endangered fat pocketbook mussel – It is historically found throughout the Mississippi River, from Minnesota to Louisiana. In 2003, mussels were found near Vicksburg and also to the south of the site. Also, the potential impact area is very small compared to the entire shoreline habitat available to the species.
- Federally endangered pallid sturgeon has been collected in the region of the site, and spawning habitat may exist within 10 mi. of the site.

In addition, the following state-listed species may be present:

- Endangered wood stork was observed in the summertime on Gin or Hamilton Lakes 18 years prior to the construction of GGNS Unit 1. It should be considered a non-breeding transient to the site and vicinity; impacts are, therefore, expected to be low.
- Endangered crystal darter is found in Bayou Pierre approximately 3 mi. to the south of the site.
- Critically imperiled hairy waterclover and jug orchid, and imperiled glade fern and American bittersweet are known to occur beyond 2 mi. but within 10 mi. of the site.
- Critically imperiled/imperiled Allegheny monkeyflower known to occur about 11 mi. from the GGNS site.

Given that the known locations of these species is in the vicinity of the site, they also have the potential to occur within the site boundary. While the evaluation of potential construction impacts of the first new unit at GGNS to protected species has indicated that the potential for impacts is SMALL, the potential cumulative impacts from overlapping construction activities for two new units are a concern, given the potential presence of several protected species in the site area. Final site-specific impacts relating to construction would be dependent on the timing of construction activities relative to the construction of the first new unit, and the extent to which a second new unit could use the intake and discharge systems proposed for the first new unit. However, a conservative conclusion of MODERATE impacts has been made to account for potential cumulative impacts.

B.1.4.3.4 W3

There are two federally listed terrestrial species and three federally listed aquatic species within St. Charles Parish, Louisiana. Terrestrial species include the bald eagle (now proposed for delisting) and the brown pelican. There have been reported sightings of the bald eagle in the parish; however, the presence of either species on-site is expected to be rare and infrequent. The three aquatic species are the gulf sturgeon (*Acipenser oxyrinchus desotol*), pallid sturgeon *(Scaphirhynchus albus*), and the West Indian manatee (*Trichechu manatus*). There have been reported sightings of the gulf sturgeon and pallid sturgeon in St. Charles Parish; however, thermal studies documented in the LPDES fact sheet found that no threatened or endangered species were present near W3. In a letter dated March 15, 2004, the LDWF commented on endangered species in the vicinity of the station. The pallid sturgeon was identified as an endangered fish found in both the Mississippi and Atchafalaya Rivers. The West Indian manatee was also listed as a federally protected species known to inhabit Lakes Pontchartrain and Maurepas and associated coastal waters and stream during the summer months. The LDWF did not identify any critical habitat in the vicinity of the site.

Construction of a new unit is not expected to result in a significant decline in suitable habitat for these species (assuming construction would occur in an agricultural land area). Therefore, construction impacts on T&E species at the W3 site are expected to be SMALL.

B.1.5 SOCIOECONOMIC

In general, the economic benefits of constructing and operating a new unit at each site would result in beneficial impacts to the area economy, particularly the local economy. An influx of workers and their families can also have adverse impacts to the existing infrastructure, housing, and community and educational services, depending on the number of people that in-migrate and where they choose to live. If their numbers are small compared to the regional population and/or they are distributed evenly across the site region (e.g., 50-mi. radius), the impacts would be expected to be SMALL. If their numbers are large (compared to the region) and/or the majority settle in the host county or smaller, nearby communities, the potential impacts could be MODERATE to LARGE. Site-specific evaluations are provided below and relate to physical impacts, demography, social and economic impacts, and infrastructure and community services. Potential cumulative impacts from the construction of two units at the GGNS are also considered in the evaluation.

Before the sites could be evaluated and compared, certain assumptions were made regarding the construction labor requirements and construction schedule, labor pool, and affected area. Many of these assumptions were made without the benefit of design-specific information and associated workforce projections, proposed construction schedule (particularly for GGNS Unit 3 in relation to proposed GGNS Unit 2), and site-specific information relating to areas/towns where the existing plant workforce currently resides. This portion of the evaluation may warrant future revision when additional data become available.

For the purposes of this report, assumptions were based on professional judgment, the Siting Guide, and information contained in NUREG-1437. NUREG-1437 included results of utility surveys, seven case studies (including ANO), and plant-specific studies that examined socioeconomic impacts of original nuclear power plant construction and operation (e.g., kinds of impacts that have occurred; causal factors behind those impacts; and impact thresholds, if any). The cases included a range of plants in terms of size and population characteristics of the study areas (low, medium, high) and were supposed to represent the range of potential impacts for a nuclear power plant.

According to the Siting Guide, plant workforce (construction) indicates a monthly maximum construction workforce requirement of 1000 persons per unit. Construction of a nuclear power plant is very labor-intensive and for the ESBWR, skilled and unskilled construction workers would likely be needed over a 4- to 5-year period. The following assumptions were used in this analysis:

- One unit would be constructed (for conservative bounding analysis), requiring a (peak) total of 1000 workers over a 5-year period.
- For RBS and ANO, the analysis assumed that no other major construction project would occur in the site vicinity concurrently with the plant construction and operation.
- For W3, it was assumed that the ongoing rebuilding of New Orleans would result in some competition for available construction workers.

- For GGNS, it was assumed that at least 1 year of peak construction of the second new unit would overlap with peak construction for the first new unit (to provide a conservative bounding analysis). Therefore, the peak construction workforce was assumed to be 2000 workers.
- In an effort to reduce or minimize the labor supply concerns associated with new nuclear plant construction projects, a new strategy was identified that would shift portions of the workforce to areas of the country where skills and craft are available in sufficient quantity (national workforce). This would most effectively be done through modularizing portions of the plants to be built and providing aggressive training of craftsmen before and during the construction phase of the project. (Source: U.S. Department of Energy study, 2004).
- Because of the large population projections and available workforce in the W3 region, it could be assumed that the majority of the construction and operation workforce would commute from within the area, and there would be minimal to no in-migrant workforce population. However, given the major (and projected long-term) rebuilding plans for the New Orleans area as a result of Hurricane Katrina, there could be significant competition for an available construction workforce during the construction of a new unit at W3. Based on this consideration and the potential use of a national workforce, the analysis assumed that 20 percent of the construction workforce would in-migrate into the W3 region.
- 30 percent of the construction workforce for a new unit at RBS would in-migrate into the region (based on assumptions used in the GGNS ESP).
- 50 percent of the construction workforce for a new unit at ANO would in-migrate into the region.
- 50 percent of the peak construction workforce for a third unit at GGNS would in-migrate into the region; the analysis was based on an overlapping peak construction workforce of 2000 workers (for the first and second new units).
- An influx of direct workers also would bring in an influx of indirect workers (0.4 ratio of direct to indirect workers – in absence of site-specific information – pertaining to the Regional Industrial Multiplier System direct/indirect ratios calculated for each plant, as found in NUREG/CR-2749).
- Operation of an additional unit would require up to 700 permanent operations employees.

Available population and economic data were obtained from the U.S. Census Bureau for each site. The data were collected by county to determine availability of an adequate labor force within commuting distance (based on an assumed location of the labor pool). Data relating to population and labor force (primarily construction industry) were compared with the construction labor requirements to determine availability of labor.

The study of economic structure examines employment, because of its pre-eminent role in determining the economic well-being of an area. Specifically, impacts were determined by comparing the number of direct and indirect jobs created by the plant's construction with the total employment of the local study area at the time of construction. Sites were rated according to economic impacts based on the following criteria: economic effects were considered SMALL if peak construction-related employment accounted for less than 5 percent of the total study area employment; MODERATE if it accounted for 5 to 10 percent of the total study area employment; and LARGE if it accounted for more than 10 percent of the total study area employment.

B.1.5.1 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. It is expected that all construction activities would occur within the existing site areas and would be located sufficiently far from critical receptors outside the plant boundaries (e.g., residential) that the noise would be attenuated to nearby ambient levels and would not be noticeable. In the event that some activities were loud enough, and some critical receptors were close enough to plant boundaries; to interfere with daily activities (e.g., outdoor speech communication), additional measures would be implemented (e.g., scheduling) to minimize any adverse effects. Off-site areas that would support construction activities are expected to be already permitted and operational. Impacts on those facilities from normal construction of the new unit(s) would be SMALL incremental impacts associated with their normal operation.

Aesthetic impacts would be temporary and limited, both in terms of land disturbance and the duration of activity; they would have characteristics similar to those encountered during industrial construction.

Construction activities would be temporary and occur mainly within the boundaries of each existing site. Off-site impacts would represent SMALL incremental changes to off-site services supporting the construction activities. Therefore, with respect to noise, impacts from construction activities are expected to be SMALL at all four sites, especially those in more rural settings where there would not be competing noises and where nearby wooded areas would provide natural noise abatement.

It should be noted that the potential cumulative impacts from overlapping construction periods of two new units at GGNS would generate greater physical impacts than at the other three sites. However, it was assumed that activities would be coordinated to minimize potential cumulative impact concerns, and mitigation measures would be implemented to ensure that total construction impacts relative to noise would be SMALL. Other physical impacts from construction (e.g., air quality, transportation) are addressed elsewhere in this report.

B.1.5.2 Demography

Local population growth associated with the construction of a new unit is driven by the number of workers who migrate into nearby communities to work at a nuclear plant. These individuals and their families (direct population), and other persons and their families who move into the area to work in the jobs generated by the plant's presence (indirect population), add to the communities' population totals as well. Such increases in population constitute the main driver of public service, housing, and other local economic impacts. In most cases, a sufficient workforce exists within the region to support construction of a new unit, although potential cumulative impacts from overlapping construction of two new units at GGNS could result in LARGE impacts on the labor market.

Assumptions relating to the in-migrating workforce were identified at the beginning of this section. Additional site-specific assumptions are provided below to allow a comparison of impacts.

B.1.5.2.1 RBS

- 30 percent of 1000 workers would in-migrate (300).
- 50 percent of these 300 would bring their families (150).
- Those with families would total 405, assuming 2.7 persons per household (150 x 2.7).
- 40 percent of 300 direct workers would in-migrate to the region as indirect workers (120).
- 50 percent of these [60] would bring their families, or 162 (60 x 2.7).

The result is a total population influx of 555 (direct population) and 222 (indirect population), or 777 persons. Given a total projected population in 2020 of more than 1.3 million for a 50-mi. radius of the site, this represents a small increase of only 0.06 percent. Demographic impacts within the 50-mi. radius would be SMALL. Even if the in-migrating population was not evenly distributed within a 50-mi. radius of the site, it is assumed that the majority would choose to live in the large metropolitan area of nearby Baton Rouge, where the impacts would still be considered SMALL.

B.1.5.2.2 ANO

- 50 percent of 1000 workers would in-migrate (500).
- 60 percent of these 500 would bring their families (300).
- Those with families would total 780, assuming 2.6 persons per household (300 x 2.6).
- 40 percent of 500 direct workers would in-migrate to the region as indirect workers (200).
- 60 percent of these 120 would bring their families, or 312 (120 x 2.6) [percentage bringing families based on percentage used for ANO in NUREG-1437, Appendix C].

The result is a total population influx of 980 (direct population) and 392 (indirect population), or 1372 persons. Given a total projected population in 2020 of more than 260,000 for a 50-mi. radius of the site, this represents an increase of less than 1 percent. Assuming that the incoming population moves mostly to the larger cities in the region (e.g., Little Rock or Fort Smith), impacts would be SMALL. However, if the majority of population migrated into rural and small towns in Johnson and Franklin counties, or small towns such as Russellville in host Pope County, the impacts would be MODERATE to LARGE.

B.1.5.2.3 GGNS

- 50 percent of 2000 workers would in-migrate (1000).
- 50 percent of these 1000 would bring their families (500).
- Those with families would total 1350, assuming 2.7 persons per household (500 x 2.7).
- 40 percent of 1000 direct workers would in-migrate to the region as indirect workers (400).
- 50 percent of these 200 would bring their families, or 540 (200 x 2.7).

The result is a total population influx of 1850 (direct population) and 740 (indirect population), or 2590 persons. Given a total projected population in 2020 of more than 382,000 for a 50-mi. radius of the site, this represents an increase of less than 1 percent. Assuming that the incoming population moves mostly to the larger cities in the region (e.g., Vicksburg or Jackson), impacts would be SMALL. However, if the majority of the population migrated into rural and small towns in Claiborne and Jefferson counties, impacts would be expected to be MODERATE to LARGE.

B.1.5.2.4 W3

- 20 percent of 1000 workers would in-migrate (200).
- 50 percent of these 200 would bring their families (100).
- Those with families would total 290, assuming 2.9 persons per household (100 x 2.9).
- 40 percent of 200 direct workers would in-migrate to the region as indirect workers (80).
- 50 percent of these 40 would bring their families, or 116 (40 x 2.9).

The result is a total population influx of 490 (direct population) and 156 (indirect population), or 646 persons. Given a total projected population in 2020 of more than 2.6 million for a 50-mi. radius of the site, this represents an increase of only 0.02 percent. Demographic impacts within the 50-mi. radius would be SMALL. Even if the in-migrating population was not evenly distributed within a 50-mi. radius of the site, it is assumed that the majority would choose to live in the large metropolitan areas of nearby Baton Rouge or New Orleans, where the impacts would still be considered SMALL.

B.1.5.3 Social and Economic

The study of economics examines employment, because of its role in determining the economic well-being of an area. In general, construction-related economic effects would all be BENEFICIAL and would range from SMALL to MODERATE beneficial impacts to the region, and LARGE beneficial impacts to the host county or parish and local economy for each of the four existing plant sites.

B.1.5.3.1 RBS

The RBS 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 a 50-mi. radius of the site. In recent years, the regional economy has become more diversified with major chemical, paper mill, and refining businesses; finance and health care components; and a growing high-tech business sector. The local economic development leaders consider an additional unit or units at the RBS site to be highly compatible with the current economy and their economic plans for the parish. Regionally, the service sector now offers the most employment opportunities. Construction and operation of one or more units at the RBS would be expected to add to the economic prosperity of the region, especially in West Feliciana Parish. Impacts would be expected to be minor in the region except for West Feliciana Parish, where the benefits would be LARGE and BENEFICIAL. Although the economic impacts would be diffused over several local jurisdictions, employment in West Feliciana Parish could increase by as much as 10 percent during the peak of construction (based on an influx of 420 new jobs and a year 2000 civilian workforce of 4369 for West Feliciana Parish). 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.

Construction of a new unit at the RBS is assumed to bring in 420 new jobs (direct and indirect), compared to 223,000 in total workforce and 20,000 construction workers in the region. Entergy 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 Baton Rouge. The availability of a construction workforce for regular construction projects of longer duration is expected to be good. The number of construction workers employed within the five parishes nearest the site was estimated to be approximately 27,000 in 2002 (Louisiana Department of Labor 2003, as cited in NUREG-1817).

Based on the evaluation, Entergy Nuclear concludes that construction labor at the RBS would be readily available from within the region, and there would be little problem recruiting the required labor skills to enable the construction of a new nuclear unit at the site.

B.1.5.3.2 ANO

Pope County is the 11th largest county in the state of Arkansas, with a population of 54,469. It is located in northwest Arkansas, midway between Little Rock and Fort Smith. The Arkansas River serves as its southern boundary, and the Ozark National Forest is included in its northern boundary. The incorporated cities and towns situated in the county include Atkins, Dover, Hector, London, Pottsville, and Russellville.

Construction of a third unit at ANO is assumed to bring in 700 new jobs (direct and indirect), compared to 73,356 in total workforce and nearly 8509 construction workers in the region; these base numbers expand to nearly 800,000 in total workforce and 32,070 if the towns of Little Rock and Fort Smith (and their host counties) are included. In comparison, Pope County has a total employed civilian workforce of 24,613 and 2481 construction workers. Entergy is expected to be able to attract the necessary workforce for construction activities at the site, based on its proximity and access to construction labor in Little Rock and Fort Smith. The availability of a construction workforce for regular construction projects of long duration is expected to be good.

Based on the evaluation, Entergy Nuclear concludes that construction labor at ANO would be readily available from within the region, and there would be little problem recruiting the required labor skills to enable the construction of a new nuclear unit at the site.

Overall positive effects would result for the regional economies. Impacts to the economy are generally BENEFICIAL and could reach a LARGE level in Pope County, where it is assumed that the majority of workers and families would choose to live. Construction of a new unit would result in direct construction jobs and increased spending in the region by the workers and through the purchase of non-labor goods and services to support construction.

B.1.5.3.3 GGNS

Three major economic categories dominate the labor market in Claiborne County: agriculture (particularly timber), education, and power generation. The power generation market is dominated by the GGNS, which has been positively influencing the Claiborne County economy for more than 25 years. GGNS currently employs more than 700 people (one of Claiborne County's largest employers) and has an annual payroll of approximately $49 million. Expansion of existing capacity through the construction of a second and third unit would further strengthen its presence and influence in the regional and local economy.

Construction of two new units at GGNS is assumed to bring in 1400 new jobs (direct and indirect), compared to 135,231 in total workforce and nearly 11,685 construction workers in the region. In comparison, host Claiborne County had a total civilian workforce of 3750 and only 285 construction workers in 2000. There is concern regarding the presence of an adequate construction workforce to support the overlapping construction of two units. Mississippi occupational employment statistics for 2002 to 2012 for the four-county area (Claiborne, Warren, Hinds, and Rankin counties) show more than 10,700 workers in the construction occupations. These numbers are projected to grow and while not all workers would be available for the construction of new nuclear units, this projected workforce represents a significant pool of workers in the necessary occupations. Several specialized occupations would have to be recruited from outside the area, although some might be trained locally if sufficient lead time is provided; this is assumed to be a viable option for a second new unit. It is expected that the majority of construction workers and their families would settle into larger cities in the area or their suburbs (Natchez, Clinton/Jackson, and Vicksburg). In 2000, the counties of Claiborne, Warren and Adams had a population of 300,000. However, if the majority of the workforce chose to live in Claiborne County, they would affect traffic, taxes, housing, and public services.

B.1.5.3.4 W3

Located in southeast Louisiana, St. Charles Parish, host county for the W3 site, is approximately 25 mi. west of the city of New Orleans. St. Charles Parish is one of the nine parishes that comprise the Metropolitan New Orleans Area. Bisected by the Mississippi River, St. Charles Parish is in proximity to both the cities of New Orleans and Baton Rouge.

Construction of a new unit at W3 is assumed to bring in 280 new jobs (direct and indirect), compared to 523,727 in total workforce and nearly 53,000 construction workers in the region. While there is some concern regarding the availability of a large construction workforce, particularly in light of the potential competition from the ongoing (long-term) and extensive rebuilding efforts in the region, Entergy is expected to be able to attract the necessary workforce for construction activities at the site because of its proximity to the major population centers of New Orleans and Baton Rouge.

The availability of a construction workforce for regular construction projects of longer duration is expected to be good. The economic base of St. Charles Parish is dominated by the energy and petrochemical industries. However, in recent years, St. Charles Parish made great strides in diversifying its economy by successfully recruiting transportation- and technology-related companies. The 2001 Labor Department preliminary figures show employment for St. Charles Parish at approximately 21,700. The areas accounting for the largest numbers of employees are manufacturing, service, and construction.

Noteworthy to the analysis are the impacts of Hurricane Katrina on economic and workforce development in the parish. Most of the 19 major employers in St. Charles Parish experienced power outages, but minimal damage. There has been a 318.8 percent increase in unemployment claims in the parish; 2200 applications have been filed from St. Charles Parish to the Small Business Administration for damage and/or economic loss. While St. Charles Parish ports and plants experienced minimal damage in this disaster, they are extremely vulnerable to future disasters. If affected, it would affect the nation, because roughly 60 percent of the nation's jet fuel and 30 percent of the nation's grain flow through this parish.

B.1.5.4 Taxes

Plant-induced increases to local tax receipts are considered beneficial. Typically, the benefits of plant construction to local tax structures are considered by evaluating the magnitude of potential new tax payments by the existing plant in relation to total revenues in the host community. The new payments could be made directly to local government jurisdictions or indirectly to local government jurisdictions through state tax and revenue-sharing programs. In the absence of plant-specific details regarding the local tax structure, the impacts on taxes from construction are assumed to be BENEFICIAL. In general, plant construction (and operation) workers would pay income, sales, and use taxes to the host state and to the local governments in the region where the sales occur and property taxes to the counties in which the workers 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 the construction workforce for goods and services. Corporate income taxes on profits would also be paid for those companies engaged in construction at the site.

Based on past experience, Entergy Nuclear has a significant impact on the well-being of the host parishes/counties where its existing plants now reside. The property tax base represented by a new nuclear facility at each of the four sites would represent a significant increase (LARGE and BENEFICIAL) in each host county/parish tax base. However, overall impacts on taxes in the entire region (and at state level) would be expected to be SMALL to MODERATE and BENEFICIAL for RBS and W3, given their proximity to existing and significant industry in Baton Rouge and New Orleans, respectively. The addition of one more unit at GGNS and ANO could have a MODERATE and BENEFICIAL impact, given the larger role power generation plays in the regional economies at these sites. However, the potential cumulative economic impacts from adding a third unit at these two sites could result in LARGE and BENEFICIAL impacts to the local economy at each site.

B.1.5.5 Infrastructure and Community Services

B.1.5.5.1 Transportation

Effects from construction would be noticeable on transportation and infrastructure, but would be temporary. Construction activities would result in increased traffic from the commuting workforce and the transport of construction materials, wastes, and excavated materials. However, the units are reported to be generally smaller and modular in nature and the workforce smaller than a conventional nuclear workforce such that the impacts would be less challenging.

Roadways could require minor repairs or upgrade to allow safe equipment access. Traffic on main plant access roads would increase substantially during the peak construction period and would be at its peak during morning and afternoon shift changes. Noise in the general area would increase from larger volumes of traffic; however, increases would be temporary and only occur twice during the day.

Site-specific conditions are noted below.

B.1.5.5.1.1 RBS

The general area around the site is served by several major highways, including Interstates 10 and 12, U.S. Highways 61 and 190, and SR 10. Baton Rouge is about a 20-minute drive from the 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 the existing ferry service at St. Francisville, Louisiana. The principal road access to the RBS site is via the River Bend Access Road and via Louisiana SR 965, which is a two-lane paved road. The plant site is located within 1.5 mi. of U.S. Highway 61 and within 2 mi. of State Highway 965 (to the north).

The level of service designation on the access road and SR 965 would likely be degraded during the peak construction period for a new unit. SR 965 intersects U.S. Highway 61 approximately 1.6 mi. from the plant, and the access road intersects U.S. Highway 61 approximately 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 require dredging) are available to the 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. They can support the relatively small shipments normally associated with the construction period.

An item of note from the West Feliciana Parish, 2007 Business and Parish Economic Development Plan (Community Development Foundation) (Reference 12) indicates that the impacts of a new unit could be significant on barge access to the site. Specifically, it states that construction of a second facility at the RBS will require development of a new transportation corridor to the Mississippi because the current corridor would be lost from construction of the new facility. Several options are being studied, and plans are being made to approach the legislature for the funds to construct the new road. It should be noted that the state dedicated $108 million of incentives to the construction of the new plant and part of these funds include the construction of port facilities and infrastructure.

Given the potential barge impacts, overall transportation impacts at the RBS are expected to be SMALL to MODERATE.

B.1.5.5.1.2 ANO

The plant site is located within 1 mi. of State Highway 333 and within 1.5 mi. of Interstate 40 and U.S. Highway 64 (to the north). Pope County is served by Interstate 40 (I-40), which runs through the southern part of the county, plus U.S. Highway 64 and Scenic Highways 7, 22, and 27, and State Highways 28, 124, and 333. ANO is located on a two-lane highway, with service to the site being convenient from four main directions. Highway access is adequate, but population growth in the county may create crowded conditions in the future, particularly at selected intersections.

Yell County is not served by the Interstate Highway system, but has ready access to the I-40 corridor via Scenic Highways 7, 154, and 309. State Highways 10, 60, and 247 complete the major road network. No roads in Yell County were identified as having serious congestion problems. Johnson County is served by the I-40 corridor, as well as U.S. Highway 64 and State Highways 21, 103, and 123. No roads in Johnson County were identified as having serious congestion problems.

The transportation infrastructure appears to adequately serve the residents living in communities near the plants. Two traffic issues, however, were identified as potentially problematic during plant relicensing by staff from the Arkansas Highway and Transportation Department and Pope County Sheriff's Office. These issues include congestion at the intersection of State Highway 333 and U.S. Highway 64, which serves as a major ingress/egress point for ANO traffic. Residents have also indicated that an additional east-bound on-ramp is needed onto I-40 at the west end of Russellville. The Arkansas Highway and Transportation Department has initiated a preliminary investigation regarding the addition of an on-ramp.

In general, the transportation network in Pope County is a well-developed system that includes rail (Union Pacific Railroad) and barge access (Port of Dardanelle), which adequately served the construction of ANO Units 1 and 2. Assuming that additional measures are taken to address the two congestion concerns noted above, prior to construction of a third unit, transportation impacts would be expected to be SMALL.

B.1.5.5.1.3 GGNS

The GGNS transportation system is well-developed and would not be significantly affected as a result of construction of a new unit. Several upgrades are planned or already under way that will lessen impacts. Most large pieces would arrive by barge. The proposed site is located about 1.5 mi. east of the Mississippi River (RM 406). The Port Claiborne river port facilities are located approximately 2 mi. southwest of the proposed site. A rail line located approximately 15.3 mi. northeast of the site is operated by Kansas City Southern Railway; it does not support passenger service. The rail line extends south from Vicksburg, Mississippi and terminates in LeTourneau, Mississippi. A rail line passing 2.9 mi. east of the site has been abandoned (previously operated by Illinois Central Gulf).

The large volume of construction workers from the combined workforce of two new units, along with regular traffic to the unit, could put stress on the existing road network and result in increased accidents. Mitigation would be necessary to reduce traffic congestion during the overlapping construction periods for the two new units, such as staggered shift changes. The plant site is located within 5 mi. of U.S. Highway 61 (to the east).

Improvements were made to existing roads and bridges during the construction of Units 1 and 2. U.S. Highway 61, which was a two-lane road during construction, is now a four-lane highway. Although traffic was heavy during shift changes, the highway was adequate with only two lanes. A highway project to extend State Highway 18 is in advanced planning stages. The proposed extension would provide additional access to the site. U.S. Highway 61 is expected to accommodate the increased traffic created by construction, and no new road construction should be necessary. Transportation impacts would be SMALL to MODERATE, taking potential cumulative impacts into account.

Claiborne County is partnering with GGNS to facilitate any future expansion. Recently, the county received a promise of federal funding for a new connector access road between the plant (along with the Claiborne County Port) and U.S. Highway 61. This new roadway would provide safer access to GGNS and other locations nearby.

B.1.5.5.1.4 W3

St. Charles Parish's location along the Mississippi River between New Orleans and Baton Rouge provides direct access to major markets throughout the state and the world. St. Charles Parish is served by rail, water, and commercial air transportation. Water transportation, in particular, is a major means for accessing St. Charles Parish. Cargo can be delivered from St. Charles Parish to all of mid-America via the 19,000 mi. Mississippi River system. For international access, the nearby deepwater Port of South Louisiana and Port of New Orleans operate foreign trade zones.

The plant site is located immediately adjacent to State Highway 18 (to the northeast) and State Highway 3127 (to the southwest). Major highways in the area include Interstates 10 and 310, U.S. Highways 61 and 90, and Louisiana Highways 18 and 3127. In terms of existing road conditions, Hurricane Katrina did considerable damage to the infrastructure; road damage incurred during debris removal totaled more than $400,000.

Overall, however, the existing transportation system is assumed to be sufficient to accommodate construction of another unit. Impacts would be SMALL.

B.1.5.5.2 Recreation

B.1.5.5.2.1 RBS

West Feliciana Parish boasts an 18-hole golf course, two wildlife management areas and a public preserve, three state parks, several recreational parks, and an abundance of historic homes and miles of winding country roads suitable for motorcycling or bicycling. Public recreation parks offer baseball, softball, soccer, tennis, off-road biking, walking trails, and both covered and uncovered basketball courts. Hunting, fishing, and bird watching are wildly popular on both private and public lands. However, the RBS site is an industrial site not used for recreation. No impacts on recreation would be expected from the construction of a new unit.

B.1.5.5.2.2 ANO

There is some tourism on Lake Dardanelle, one of the largest recreational resources in the area, and across the reservoir from the plant is the popular Lake Dardanelle State Park. Both the lake and the park are popular sites for fishing, boating, and other activities. Fishing near the plant is reported to be very good. Recreation was not affected by previous construction activities at ANO. Assuming that best construction practices are implemented to minimize construction impacts on water quality in Lake Dardanelle, impacts to existing recreation are expected to be SMALL.

B.1.5.5.2.3 GGNS

Grand Gulf Military Park is adjacent to the GGNS site. Increased traffic from construction would affect visitors to the park, although most park visitors are found on the weekends, when construction activities would not occur. Potential effects on the recreational experience at the military park, particularly during the weekdays, would be temporary during the period of construction. However, the combined construction period for two new units would extend several years so that overall cumulative impacts on recreation would be SMALL to MODERATE.

B.1.5.5.2.4 W3

St. Charles Parish, laced by swamps, bayous, and lakes, and bisected by the Mississippi River, is a natural area for water sports of all kinds, from fishing and swimming to water skiing, sailing, and boat riding. In addition, numerous parks and playgrounds located throughout the parish feature baseball, softball, and football programs. There are two organized park areas within the low-population zone: Kilona Park, 1.1 mi. to the northwest of the site, is a 12.5-ac. park that contains two basketball courts. An additional 12.5-ac. is proposed for this park; the park now contains baseball fields. Montz Park is approximately 1 mi. to north of the site; it is a 9-ac. park that contains a baseball field. No impacts on recreation are expected from the construction of a new unit.

B.1.5.5.3 Housing

B.1.5.5.3.1 RBS

An 18.7 percent vacancy rate, out of a total of 4485 housing units, currently exists in West Feliciana Parish. However, given the proximity of the site to the Baton Rouge metropolitan area, which has 12,000 vacant housing units in East Baton Rouge Parish alone, housing for the construction workers, most of which would be coming from within the region, would probably be throughout the region.

Based on this evaluation, the impacts of a construction and operation workforce on the demand for housing could be easily handled. This is based on the availability of approximately 840 vacant housing units in West Feliciana Parish, existing construction plans, and the existing proximity of the site to the larger Baton Rouge metropolitan area.

B.1.5.5.3.2 ANO

Operations at the ANO site have influenced population growth in Pope County. The construction of ANO was an important factor in the rapid growth of the Pope County housing stock. Substantial changes occurred in the housing market, housing characteristics, and property values. The conversion of large homes into apartments, the increase in multifamily housing, and the temporary increase in housing values and rental rates are some examples. The number of occupied housing units in Pope and Johnson counties has risen significantly since the construction of Unit 2. In 2000, there were 24,029 total housing units in Pope County, with a 9.4 percent vacancy rate and 2150 available units. Assuming that the distribution of construction workers is similar to that for operations workers, the majority (90 percent) of in-migrating construction workers would also be expected to live in Pope County. Despite a high number of vacant units, the impacts on housing during construction under this scenario would be MODERATE to LARGE.

B.1.5.5.3.3 GGNS

There would be a potential demand for many housing units in the region, primarily apartments though some single-family homes might be required if workers relocated with their families. In 2000, the housing inventory showed enough vacancies in the region to absorb the workforce. Claiborne County has limited new housing and has experienced nominal price increases. Only small numbers of units would be expected to be available in Claiborne County. Some relocated workers might bring mobile homes for the duration of their employment. If construction workers concentrate in the county, the impact on the local Claiborne County rental housing market could be MODERATE to LARGE when factoring in potential cumulative impacts from the overlapping construction of both units. A similar situation might prevail in Fayette and Jefferson counties, but the impact likely would be minimal in the surrounding counties that have larger housing markets and most likely would experience a smaller influx of workers. If, as expected, many of the in-migrating construction workers live in larger towns and cities in the region, the impacts on housing would be SMALL.

B.1.5.5.3.4 W3

A 5.8 percent percent vacancy rate, out of a total of 18,673 housing units, currently exists in St. Charles Parish. In addition, given the proximity of the site to both the Baton Rouge and New Orleans metropolitan areas, housing for construction workers, most of which would be coming from within the region, would probably be throughout the region.

Based on this evaluation, the impacts of a construction and operation workforce on the demand for housing could be easily handled. This is based on the availability of approximately 1083 vacant housing units in St. Charles Parish, existing construction plans, and the existing proximity of the site to the larger metropolitan areas of Baton Rouge and New Orleans. However, it is also important to take into account the effects of Hurricane Katrina on housing and community development impacts within the parish. A baseline needs assessment report (Reference 4) from the parish indicated the following:

- Approximately 6428 families reported damages to their homes because of Hurricanes Katrina and Rita.
- Population has increased in the parish by 1610 households, or 9.4 percent, compared to the pre-storm estimated population of 50,730.
- There is an estimated shortage of 1904 housing units within the parish.
- As a result of the post-storm influx of evacuees, new workers in disaster-related employment seeking housing, and local residents requiring temporary housing as they repair their primary residence, the parish is experiencing a severe shortage in rental units, especially those affordable to low-income residents. Currently, more than 60 Section 8 vouchers have gone unused because there are no units available.
- There have been approximately 1045 permit applications received for temporary housing in the parish.
- The parish enacted a moratorium on the development of the east bank due to population growth and potable water shortage.

Given that the number of workers and their families expected to in-migrate into the area is relatively small compared to the area population, and assuming that the majority of the above housing shortages are resolved at the start of construction for Unit 3, the housing impacts from construction are expected to be SMALL. Should the housing shortage in St. Charles Parish continue for the long-term, impacts from the construction of an additional unit could be MODERATE to the local communities and to St. Charles Parish, unless the construction workforce is evenly distributed throughout the region, and particularly Baton Rouge, which does not appear to have as severe a housing shortage.

B.1.5.5.4 Public Services

Public services would include water supply and waste treatment, as well as social services (counseling, child, and family services), medical services, and police and fire protection. It is not known whether each plant would include its own water supply and waste treatment facilities on-site (it is assumed that GGNS would), nor are the current capacities of existing water supply and waste treatment plants known for all sites. However, in general, assuming that the in-migrating population would depend on existing local and regional facilities, and assuming that the population influx is distributed throughout the region, impacts are expected to be SMALL. If a large percentage of the population elected to settle in the host county or nearby communities, however, the local impacts (particularly for low-population density areas such as GGNS and ANO) would be MODERATE to LARGE. However, the additional revenue generated by the plant could be used to add staff and facilities, where needed and appropriate, so that long-term impacts would be relatively SMALL.

With respect to social services, construction of a new unit may result in increased demand for some social services. Generally, however, a new facility would be considered beneficial economically to the disadvantaged population segments served by the state department of social services. A new unit may enable the disadvantaged population to improve their social and economic position by moving to higher paying jobs. At a minimum, the expenditures of the construction workforce in the area for food, services, etc., could, through the multiplier effect, increase the number of jobs available to the disadvantaged population.

B.1.5.5.4.1 RBS

West Feliciana Parish would have to upgrade some of the water distribution lines to accommodate growth, but plans for the upgrade are already 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. 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. 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 already live in the region and would commute to the site from their permanent residences. These workers are already served by existing police, fire, and medical services and facilities.

Thirty percent of the construction workforce of 1000 is anticipated to come from outside the region, resulting in an overall population increase of 777 persons. 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 estimated to in-migrate is significantly smaller.

Based on this review, the impacts of construction and operation workforce on police, fire, and medical services facilities would not be noticeable.

B.1.5.5.4.2 ANO

Potable water used within a 10-mi. (16-km) radius of ANO is from subsurface and surface sources and is used for domestic and industrial purposes. The area has seven public water systems and four wastewater systems that serve the incorporated towns and rural areas. Russellville, Dover, and London are all primarily served with surface water from the Illinois Bayou. Large areas of Pope County are not served by public water supplies. In 1997, the city of Russellville completed the construction of a new water supply source, the Huckleberry Creek Reservoir. The new reservoir significantly increases the water system storage capacity and provides residential and industrial customers in the area with a reliable supply of high-quality water. Plans are being made to double the current water treatment processing capacity of 0.4 m^3/s (10 million gpd).

The availability of wastewater collection is currently considered to be adequate. In 1990, public wastewater collection was provided for 51 percent of the Pope County residents, while 49 percent used septic tanks or other private means of disposal. Public wastewater collection was provided for only 35 percent of the residents of Johnson County and 39 percent of the residents of Yell County. Current conditions and availability are not known.

Public safety services in Pope County have benefited fiscally from current plant operations. Impacts to these services from construction of another unit are expected to be SMALL if spread throughout the region. However, if the majority of workers and their families choose to reside in Pope County and the town of Russellville, impacts could be MODERATE to LARGE.

B.1.5.5.4.3 GGNS

It is assumed that GGNS units would include an independent on-site water supply and water and sewer treatment facilities, so that there would be no impacts on Port Gibson water and sewer services from the plant itself. It is further assumed that the construction workforce would be distributed over a large region so that no local utilities would be overburdened. Municipal water and sewer services are at 70 percent capacity in Vicksburg and 85 percent capacity in Jackson. An increase in residential population could significantly affect the local water and sewer system of Port Gibson. Similarly, a population influx would increase demands on existing medical, police, and fire services in local Port Gibson and Claiborne County. These local governments would need to hire additional staff, buy additional vehicles, and improve/build new facilities. However, additional tax revenues from the population influx would help offset the cost to expand the local police and fire departments. There are numerous hospitals in the region, and a new medical facility was recently constructed in Vicksburg. Based on the size and availability of medical services in Claiborne and surrounding counties, temporary construction workers would not overburden the existing medical services. Overall impacts are expected to be SMALL. Residents of Claiborne County have access to the very best in health care services. In addition to primary and acute care resources in Port Gibson, the very latest in advanced medical treatment is less than an hour away in Jackson, Mississippi.

The majority of health care needs can be met in Claiborne County. There are an adequate number of family practice and primary care physicians in Port Gibson, as well as the Claiborne County Hospital. This 32-bed acute care facility is a member of the Rural Hospital Performance Improvement Project.

Given the large influx of construction workers and their families, particularly associated with the potential for overlapping construction of the two units, impacts to existing public services could be considerable. If the impacts are evenly distributed across the region, they are expected to be SMALL to MODERATE. If, however, they are targeted primarily in the host county and town of Port Gibson, impacts could be MODERATE to LARGE.

B.1.5.5.4.4 W3

Portions of the parish wastewater facilities are operating at or above capacity. The parish is under an EPA Administrative Order because of non-compliant effluent discharge from one of its facilities. Infrastructure improvements are needed to accommodate the increased demand due to the influx of evacuees and anticipated post-Katrina growth. St. Charles Parish is faced with a myriad of water supply problems that are exacerbated by the post-storm population increase. Current east bank water production capacity is 6.3 million gpd. Consumption in November 2005 averaged 5.1 million gpd, leaving little reserve capacity. Infrastructure improvements are needed to accommodate the increased demand and to provide for the health and fire safety needs of the parish.

Other noteworthy Hurricane Katrina effects include the following:

- The disaster and the recovery have greatly affected the mental health issues of the region. The parish needs a mental health program to address increases in substance abuse, domestic abuse, threats of suicide, and other mental health concerns. The parish collaborative of mental health providers, including the St. Charles Parish Community Health Center, does not have an adequate number of mental health clinic (in-patient facility) beds to meet the demand.
- Nonprofit human service organizations cannot keep pace with the salary needs to maintain administrative and service-related positions, as well as professional staff, at adequate capacity. The staffing shortfall, not experienced prior to the disaster, is directly related to competition with higher paying disaster-related jobs and the increased costs of living, particularly housing.
- At present, the St. Charles Community Health Center has increased service by 30 percent. One-third of the parish population is at or below 200 percent of the federal poverty level, which is the target population for the St. Charles Community Health Center.

St. Charles Parish Hospital, located in Luling with 104 beds, and the St. Charles Parish Health Unit, a state-operated clinic, provide skilled medical care for the residents of the parish. A large number of regional facilities, including Thibodaux Hospital and Health Centers, Kenner Regional Medical Center, and River Parishes Hospital, offer excellent medical care alternatives. In addition, residents have access to the vast supply of medical services in the New Orleans area.

While much of the public service infrastructure in the parish is in need of upgrades and repair, impacts are still expected to be SMALL to MODERATE, given the small workforce assumed to in-migrate into the area (the majority of the workforce is assumed to already live in the area) and the fact that construction and operation of a new unit would bring in much needed revenue to help implement the necessary repairs and upgrades (if they have not already been implemented), as part of the ongoing rebuilding efforts, by the start of construction.

B.1.5.5.5 Education

B.1.5.5.5.1 RBS

The West Feliciana Parish school system has just over 2000 students. There is currently no overcrowding in the system; it has one of the lower student-teacher ratios in Louisiana, high standardized test performances, and excellent facilities. The extensive regional parochial school system is expected to be minimally affected by the construction workforce of a new unit. Is it expected that most of the workforce would come from within the region and would not relocate their families. Those that would relocate would not be in sufficient concentrated pockets to place an undue burden on the existing school system.

B.1.5.5.5.2 ANO

The primary school district serving the area around ANO is the Russellville School District (5350 enrolled in October 1999), providing schooling with seven elementary schools, two middle schools, and one high school. Other school districts around the ANO site include the Clarksville School District in Johnson County (with an enrollment of approximately 1700 during the 1999 - 2000 school year) and the Dardanelle School District in Yell County with an average enrollment of 1743 in 1999 - 2000. The Clarksville School District consists of two elementary schools, one middle school, and one high school; the Dardanelle School District has two elementary schools, one middle school, and one high school.

Assuming that most families/students would choose to live in Pope County, the local impacts could be considerable (MODERATE). If, however, most choose to live in larger communities, the other school districts in the region are likely to have sufficient capacity to absorb potential increases in enrollment related to construction. The impacts on these other districts would be SMALL.

B.1.5.5.5.3 GGNS

With just over 2000 students, the Claiborne County School District is a small, but effective educational resource. The Mississippi Department of Education considers Claiborne County's Level 3 accreditation the mark of a successful school system. More than 70 percent of high school students are involved with some sort of vocational training, preparing skilled workers for future economic growth.

Assuming an overlapping population influx from the construction of two new units, to be distributed in a similar fashion as the current workforce today, the impacts could be considerable in Port Gibson. Under this assumption, impacts would be MODERATE, assuming some kind of state assistance. If most of the families/students live outside of Claiborne County, the other school districts in the region likely to receive students are larger than Port Gibson or have sufficient capacity to absorb potential increases in enrollment related to construction. The impacts on these other districts would be SMALL. In 2000, school enrollment was 4792 for ages 3 and higher.

B.1.5.5.5.4 W3

The St. Charles Parish Public School System is an innovative, progressive system, with 7000 students in 2002 (Reference 13). In addition, there are two vocational/technical colleges within commuting distance, as well as 10 colleges and universities within the metropolitan New Orleans area. Factoring in Hurricane Katrina effects, it is noted that there has been an increase of 700 new students to the St. Charles Parish Public School System post-Katrina. The federal government is only providing funding for 1 year to the local school system to supplement the costs of accommodating displaced students. In addition, the St. Charles Parish Public School System hired 15 new teachers to accommodate the increase in student enrollment, which occurred mostly on the east bank side of the parish. Potential cumulative impacts of new plant construction and operation (with Hurricane Katrina) could result in MODERATE impacts to the existing school system. However, given the small number of students expected to in-migrate for construction and operations, the lengthy delay before construction of a new unit would begin, and the additional funds it would bring to help improve the existing school system, impacts are expected to be SMALL.

B.1.6 HISTORIC AND CULTURAL RESOURCES

The construction-related impacts to historic and cultural resources are discussed below for each candidate site.

B.1.6.1 RBS

The footprint for a new generating facility at the RBS site does not appear to have any historic properties located within areas likely to be affected by new construction and operations. In 1972, Gulf States Utilities Company commissioned an archaeological survey of portions of the planned RBS. No archaeological deposits were encountered during the survey. In 1978, Gulf States Utilities Company commissioned two transmission line surveys. Prehistoric sites were identified within the ROW, but not within the plant boundaries. In 1982, personnel from Gulf States Utilities Company informed the Louisiana State Historic Preservation Office (SHPO) of the remains of a 19th century sugar mill within the plant boundaries. Testing and evaluation of the mill remains determined that the site was not eligible for listing on the National Register of Historic Places (NRHP). Miscellaneous archaeological surveys conducted over the years in the area indicate that, while sites may exist on the premises, they are either not eligible for listing on the NRHP 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 SHPO and would consult with him or her in assessing the discovery to determine if additional evaluation of the discovery is needed.

Based on the information provided, the impacts on historic and cultural resources at the RBS site from construction activities would be SMALL.

B.1.6.2 ANO

As described in NUREG-1437, Supplements 3 and 19, the area around the existing ANO site is rich in prehistoric and historic Native American and historic Euro-American resources. In particular, the Cherokee occupation of the area, including the ANO site, was fairly intense and left a lasting mark in the archaeological and historic records. The primary historic site associated with this period is the Dwight Mission, a Presbyterian mission to the Cherokees, established in 1820 on the west bank of Illinois Bayou, about 15 mi. (2.4 km) east of the ANO property line. When the Cherokees were forced out of the area a few years later, the mission relocated to Oklahoma as well. Lake Dardanelle inundated some of the original mission compound in the 1960s. The archaeological record from the Cherokee villages and home sites in the area outside the ANO property line is relatively unknown, but recent investigations indicate that local archaeological remains hold great promise for significant research potential.

There were two routes of the 1838 Trail of Tears that passed by the present-day ANO site. The first was the water route that, in part, followed the Arkansas River into Indian Territory. In the summer of that year, three detachments of Cherokees followed the water route to Fort Smith, west of Russellville, then on into their new homelands. The second route, designated Bell's Route, involved a detachment of 600 to 700 Cherokees, led by John A. Bell, that followed the land route along the north side of the Arkansas River. For the ANO site, the water route passed along the southern boundary, using the now submerged Arkansas River waterway, and the land route passed just to the north, along the military road.

The Trail of Tears was designated a National Historic Trail by Congress in 1987, and granted additional protection under the National Trails System Act of 1990. The legislatively designated historic trail includes only the water route in the vicinity of the ANO site; Bell's Route was not formally included, although its designation as part of the national trail system is still under study.

B.1.6.2.1 Prehistoric

Construction of the ANO plant within the 1164-ac.site began in 1968. In 1969, the Arkansas Archaeological Society conducted a reconnaissance field survey of the lands within the site that were not within the construction zone and that were not heavily vegetated. The goal of the fieldwork was only to identify and record Native American archaeological properties.

Five prehistoric sites were recorded by the survey. Because each of the archaeological sites was located away from the construction area, the survey report concluded that no further analysis was necessary at the time, although it cautioned that if any of the sites were to be affected by project activities, further evaluation would be necessary. To date, none of these sites has been fully evaluated for potential significance for nomination to the NRHP. Until these evaluations are completed, the Arkansas Historic Preservation Program considers these sites to be potentially eligible for inclusion in the NRHP and, therefore, subject to consideration under the provisions of the National Historic Preservation Act of 1966 and its implementing regulations.

A site-file search of the archaeological records maintained at the Arkansas Archaeological Society Research Station of Arkansas Tech University in Russellville, Arkansas, revealed another 13 prehistoric archaeological sites that have been recorded within less than 1 mi. (1.6 km) of the ANO site boundary. These results, along with the reconnaissance-level survey methodology employed in the 1969 survey, indicate a potential for additional prehistoric Native American sites to exist on ANO property.

B.1.6.2.2 Historic

As noted above, the 1969 archaeological survey of the ANO site only focused on potential Native American properties, though historic-era Euro-American sites were present. Consequently, none of the historic-era properties has been recorded or evaluated for NRHP eligibility. A review of historic-era records and maps during the site visit revealed that more than 35 historic-era properties existed within the ANO property boundaries, dating from approximately 1830 to 1967, when the property was acquired by the Arkansas Power and Light Company. Specific information was not found on either the number of or precise locations of historic-era sites. Examination of three sequential historic-era maps from the 1900s indicates intensive occupation of the project area, along with some interesting trends in the density of the occupation. The maps that were examined, along with the results, include the following:

- 1913 Soils Map, U.S. Department of Agriculture, Bureau of Soils – This map indicates the presence of between 13 and 16 farms that were located on the ANO property at the time of the soil survey.
- 1940 Arkansas Tributary and Tributaries Map, USACE, Little Rock District, Arkansas Survey River Survey Board – Data reflected on this map show that by 1940, some 35 to 37 farms were located on the ANO property.
- 1963, USGS, Russellville West Topographic Map – By the time this map was published (1963), the number of farms located on the soon-to-be ANO site had been reduced to 11 to 13 properties. According to an article in the Russellville, Arkansas, *Daily Courier Democrat* (August 22, 1967), one-half dozen landowners were affected by the Arkansas Power and Light land-acquisition activity.

No standing structures remain at any of these former historic sites, except for a few storm shelter/storage cellars. They exist as unrecorded and unevaluated historic-era archaeological sites that exhibit house and outbuilding foundations, artifact scatters, trash dumps, and buried features, along with the historic roads and trails that linked the farming community.

In addition to the farms, one historic-era cemetery, the May Cemetery, is located on ANO property, about 1/2 mi. south of the plant. The cemetery is protected by a chainlink fence and is well maintained. The cemetery was established in 1885. Two other historic cemeteries exist in proximity to the site: the Swan (Finchum) Cemetery, located about 0.5 mi. (0.8 km) west of the northwest corner of the site boundary, and the Crain Cemetery, situated immediately north of State Highway 333, between the plant entrance and London. The Crain Cemetery does not appear on site or USGS base maps, but includes some 32 marked graves dating back to 1865.

During the site visit as part of plant relicensing in 2000, the NRC staff became aware of the following information and activities at the ANO site, unrelated to license renewal, that may have jeopardized potentially significant cultural resources:

- Entergy reported that archaeological Site 3PP66 was potentially damaged during the construction, in the early 1990s, of the Entergy Office Building. However, the location of Site 3PP66, as plotted by the 1969 archaeological survey, appears to be somewhat south of the building location, closer to the edge of Lake Dardanelle. The original plotting of the archaeological site's location was just outside of the ANO property line boundary.
- The 1969 archaeological survey of the ANO site identified at least 35 historic-era Euro-American properties. To date, these properties have not been recorded or evaluated for their inclusion on the NRHP.
- It appears that archaeological Sites 3PP63 and 3PP65, as well as at least 15 undocumented potential historic-era sites, have recently been affected by ground disturbances unrelated to NRC-licensed activities at the ANO site. These activities include tree-thinning, clear-cutting, plowing, and replanting of trees across portions of the plant property.

The NRC staff initiated discussions with the Arkansas SHPO, and notified it of the results of the site visit. In addition, the Tribal Historic Preservation Officer for the Caddo Tribe of Oklahoma expressed concern that the area in which ANO is located has the potential to produce important historic properties that could be associated with the Tribe. His concerns were forwarded to the Arkansas SHPO. In a letter dated September 21, 2000, Entergy committed to continue to work with the SHPO in order to identify additional sites that should be included with those that currently require an evaluation for land disturbances. In a letter dated February 2, 2001, Entergy stated that it has implemented an administrative-level environmental procedure to provide additional control over future land disturbances at the ANO site.

With respect to the two routes of the 1838 Trail of Tears that pass by the present-day ANO site, the water route of the 1838 Trail of Tears National Historic Trail near the plant has been inundated by earlier development of the McClellan-Kerr Navigation System, specifically Lake Dardanelle. Bell's Route of the Trail of Tears passes in the vicinity (within 0.5 mi. [0.9 km]) of the ANO northern property boundary, close to the paths occupied today by U.S. Highway 64 and the Union Pacific Railroad.

While it is assumed that a new unit could be constructed on a portion of the ANO site that is away from known and potential historic and cultural resource sites – thereby avoiding or minimizing adverse effects from construction – past study results indicate that the potential for finding significant new historic and cultural resource sites on ANO property is high. Given the large number of potentially significant sites that have already been identified, and the high potential for discovering significant new sites prior to construction, the potential for affecting historic or cultural sites from construction is MODERATE to LARGE without implementing appropriate mitigation measures. This would include, but not necessarily be limited to, those protective measures that would be implemented if historic and/or cultural resources were discovered during construction or operations. If an unanticipated discovery is made, site personnel would be instructed to notify the SHPO and would consult with him or her in assessing the discovery to determine if additional evaluation of the discovery is needed.

B.1.6.2.2.1 GGNS

While the location of a second new unit at GGNS has not been identified, previous cultural resource efforts that were conducted in support of the construction and operation of the first new unit now being proposed have identified the presence of several archaeological sites and the potential for additional sites. None of the known sites are considered significant, however, and most are generally located away from the areas targeted for construction of the first new unit currently proposed at GGNS. The Callendar House and the segment of the GGNS and Port Gibson railroad bed are not considered significant. In addition, literature reviews and consultations with regional Native American tribes did not identify any traditional cultural properties in the vicinity of currently proposed (first) new unit. Finally, potential visual impacts from the cooling tower on nearby Grand Gulf Military Park were dismissed, since the tower would not be visible from main portions of the park.

Given the location of existing historic and cultural resources on-site and assuming that sufficient land exists to locate a second new unit that should avoid these resources, as well as potential visual impacts to Grand Gulf Military Park, the potential impacts to historic and cultural resources from a second new unit at GGNS would be SMALL. This is based on the development of procedures to provide immediate reaction and notification in the event of inadvertent discovery of cultural resources and to conduct surveys prior to construction of a third unit so that any identified resources could be avoided or adequately mitigated.

Based on the information provided, the impacts on historic and cultural resources at the GGNS site from construction activities would be SMALL.

B.1.6.2.2.2 W3

Past cultural resource surveys have identified no sites at the W3 plant site location that are currently on, nominated to, or declared eligible for the NRHP or the National Registry for National Landmarks. At the time of original construction of W3, it was concluded that no significant historic or prehistoric cultural remains would be disturbed by construction intake and discharge structures, or transmission lines. A second survey was later performed at the request of the NRC for the purpose of investigating potential historic resources associated with the Waterford Plantation. Archival research indicated that six buildings or structure-clusters had been located on the Waterford Plantation in 1894. Five of these areas are located in the vicinity of the Plant Island, and the sixth is located away from the Plant Island in the area of the 40 Arpent Canal. Phase II of the survey found no standing structures formerly associated with the Waterford Plantation, although relatively undisturbed archaeological remains were found in two of these areas. The cultural resources remaining from the Waterford Plantation are located far from the plant, however, and it was determined that none of the archaeological remains located by the second survey would be disturbed by construction of the original W3 unit.

The location of an additional nuclear unit at W3 has not been identified. However, considering that no significant resources were found prior to construction of W3, the plant is located in a heavily industrialized setting, and assuming that sufficient land exists to locate a second unit away from the cultural resources remaining from the Waterford Plantation, the potential impacts to historic and cultural resources from a new unit at W3 would be SMALL. This conclusion is based on the development of procedures to provide immediate reaction and notification in the event of inadvertent discovery of cultural resources, and to conduct surveys prior to construction of a new unit so that any significant resources identified could be avoided or adequately mitigated (e.g., if additional construction activities were found to disturb archaeological remains at Waterford Plantation).

B.1.8 ENVIRONMENTAL JUSTICE

Environmental justice refers to a federal policy in which federal actions should not result in disproportionately high and adverse impacts on minority or low-income populations. A minority population is defined to exist if the percentage of minorities individually or in combination within the census blocks near the site exceeds the corresponding percentage of minorities in the entire host state by 20 percentage points, or if the corresponding percentage of minorities within the census block is at least 50 percent. Executive Order 12898 (59 *FR* 7629) directs federal executive agencies to consider environmental justice under the National Environmental Policy Act of 1969 (NEPA), and the CEQ has provided guidance for addressing environmental justice under NEPA. Although it is not subject to the Executive Order, the NRC has voluntarily committed to undertake environmental justice reviews. As part of that commitment, the NRC issued a policy statement in 2004 setting out its position on the treatment of environmental justice issues in the agency's licensing and regulatory activities. The policy statement (and related NRC guidance) charged the NRC staff with diligently investigating potential adverse environmental impacts on minorities and low-income populations, as well as conducting even more detailed examination in situations where the percentage in the affected area exceeds [by more than 20 percent] that of the state or the county percentage for either the minority or low-income population, or if the staff finds that the minority or low-income population percentage in the affected area exceeds 50 percent.

Furthermore, when minority or low-income populations are identified in a potentially significant environmental impact area, NRC guidance directs that six questions be considered in determining the potential for "disproportionately high and adverse effects":

- Are the radiological or other health effects significant or above generally accepted norms?
- Is the risk of rate of hazard significant and appreciably in excess of the general population?
- Do the radiological or other health effects occur in groups affected by cumulative or multiple adverse exposures from environmental hazards?
- Is there an impact on the natural or physical environment that significantly and adversely affects a particular group?

- Are there any significant adverse impacts on a group that appreciably exceed or [are] likely to appreciably exceed those in the general population?
- Do the environmental effects occur or would they occur in groups affected by cumulative or multiple adverse exposure from an environmental hazard?

B.1.8.1 RBS

Just under half the population of West Feliciana Parish is African-American (2005 data). About 20 percent of the population live below the poverty level, according to the U.S. Census Bureau (2004 data). Minority and low-income percentages for West Feliciana and other surrounding parishes (East Feliciana, East Baton Rouge, West Baton Rouge, and Point Coupee) combined are estimated at just over 45 percent minorities and just below 18 percent for persons living below the poverty level. When compared to the state averages for Louisiana – 36 percent minority and 19.2 percent low-income – the levels for RBS exceed the state average for minorities and are just under the state average for the low-income population; the exceedance for the minority population is less than 20 percentage points, however. [It should be noted that, in terms of potential effects from Hurricane Katrina, an examination of U.S. Census Bureau race estimates for 2005 indicate that, with the exception of East Baton Rouge, there is a slight increase in the percentage of white population since 2000, and a slight decrease in the percentage of population living below the poverty level since 2000.]

The pathways through which the environmental impacts associated with the construction of a new unit at the RBS site could affect human populations were evaluated to determine whether minority and low-income populations could be disproportionately affected by these impacts. No unusual resource dependencies or practices, such as subsistence agriculture, hunting, or fishing, were identified through which the populations could be disproportionately affected. Therefore, off-site adverse impacts from the construction of a new unit at the RBS site to minority and low-income populations would be SMALL. No adverse and disproportionately high impacts were identified. On the contrary, the minority and low-income populations at the RBS have presumably directly benefited from the economic impacts of the existing plant. Similar beneficial economic impacts are expected to occur for an additional unit at the RBS site. From this perspective, it could be argued that the economic impacts to minority and low-income populations are superior at RBS. Therefore, impacts are expected to be MODERATE to LARGE and BENEFICIAL.

B.1.8.2 ANO

In 2005, the minority population in Pope County was approximately 5.6 percent, and the low-income population was at nearly 16 percent, based on 2004 data from the U.S. Census Bureau. Minority and low-income population percentages for Pope County and other surrounding counties (Johnson, Franklin, Logan, Yell, Perry, and Conway) combined are at similar percentages (5.8 percent minority and 15.8 percent low-income). This compares to a state average for Arkansas of 18.7 percent minority and 15.6 percent low-income populations). Thus, the minority population for the site area is significantly below the state average, and the low-income population is approximately equal to the state average.

In addition, the pathways through which the environmental impacts associated with the construction of a new unit at the ANO site could affect human populations were evaluated to determine whether minority and low-income populations could be disproportionately affected by these impacts. No unusual resource dependencies or practices, such as subsistence agriculture, hunting, or fishing, were identified through which the populations could be disproportionately affected. Therefore, off-site impacts from the construction of a new unit at the ANO site to minority and low-income populations would be SMALL. No adverse and disproportionately high impacts were identified.

B.1.8.3 GGNS

Slightly more than 84 percent of Claiborne County is African-American (2005 data). Nearly 29 percent of the population lives below the poverty level, according to the U.S. Census Bureau (2004 data). Minority and low-income populations for Claiborne County and other surrounding counties (Hinds and Warren) combined are estimated at approximately 60 percent minorities and just over 18 percent for low income. When compared to the state averages for Mississippi – 38.8 percent minority and 19.3 percent low income – the levels for GGNS are significantly higher, above 50 percent for minorities (which also exceed the state average by more than 20 percentage points). In terms of potential effects from Hurricane Katrina, it should be noted that the percentages of minority and low-income populations increased slightly between 2000 and 2005.

In general, the pathways through which the environmental impacts associated with the construction of a second new unit at the GGNS site could affect human populations were evaluated to determine whether minority and low-income populations could be disproportionately affected by these impacts. No unusual resource dependencies or practices, such as subsistence agriculture, hunting, or fishing, were identified through which the populations could be disproportionately affected. However, given the high percentages of minority and low-income populations in the GGNS area, in conjunction with the potential for cumulative impacts from the overlapping construction of two new units and the combined operation of three units, it would indicate that there is a potential for minority and low-income populations to be disproportionately affected by adverse physical impacts from construction. As such, off-site impacts from construction of a new unit at the GGNS site to minority and low-income populations would be SMALL to MODERATE.

A final consideration, however, as supported through existing operations at GGNS Unit 1, is that construction of two new units would present significant employment opportunities to minority and low-income populations. These population groups have directly benefited from the economic impacts of the existing plant. Similar beneficial economic impacts are expected to occur for additional units at the GGNS site. From this perspective, it could be argued that the economic impacts to minority and low-income populations are superior at GGNS. Therefore, impacts are expected to be LARGE and BENEFICIAL.

B.1.8.4 W3

In 2005, the minority population in St. Charles Parish was slightly more than 25 percent, and the low-income population was slightly more than 13 percent, based on 2004 data from the U.S. Census Bureau. Minority and low-income populations for St. Charles and other surrounding parishes (St. James, St. John the Baptist, Ascenscion, Lafourche, Jefferson, and Orleans) combined are nearly 46 percent minority and 25 percent low income. When compared to the state averages for Louisiana – 36 percent minority and 19.2 percent low income – the levels for St. Charles Parish are lower than the state averages. However, when comparing the entire W3 region to the state averages, the minority and low-income populations in the W3 region are considerably higher, although the exceedances are less than 20 percentage points. It should be noted that the combined percentages are significantly influenced by data for the Orleans Parish. It should be noted also that updated population estimates for Orleans Parish for 2005 indicate a 53.9 percent reduction from 2000 levels (down to 223,388), presumably as a result of displacement from Hurricane Katrina. The breakout of minority and low-income populations in 2005 compared to 2000 is approximately the same.

The pathways through which the environmental impacts associated with the construction of a new unit at the W3 site could affect human populations were evaluated to determine whether minority and low-income populations could be disproportionately affected by these impacts. No unusual resource dependencies or practices, such as subsistence agriculture, hunting, or fishing, were identified through which the populations could be disproportionately affected. Therefore, off-site impacts from the construction of a new unit at the W3 site to minority and low-income populations would be SMALL. No adverse and disproportionately high impacts were identified.

Another comment of note for the W3 minority and low-income populations is that significant minority and low-income populations have presumably directly benefited from the economic impacts of the existing plant. Similar beneficial economic impacts are expected to occur for an additional unit at the W3 site. From this perspective, it could be argued that the economic impacts to minority and low-income populations are superior at W3. Therefore, impacts are expected to be MODERATE and BENEFICIAL to minority and low-income population groups.

B.1.9 <u>NONRADIOLOGICAL HEALTH</u>

Typical nonradiological health hazards associated with large construction projects (such as the construction of a new nuclear power plant) include the following:

- Air emissions, such as fugitive dust, smoke, and engine exhaust.
- Physical hazards, such as falls, impact injuries, and vehicular accidents.
- Noise hazards.

In all cases, construction activities would be performed in compliance with the Occupational Safety and Health Act (29 CFR 1910).

B.1.9.1 Air Emissions

Construction-related air emissions are anticipated to consist of fugitive dust, smoke, and engine exhaust. Impacts to construction workers would be the same for both the proposed and alternative sites. Construction workers would be protected from such hazards via personal protective equipment (dust masks, etc.) and other controls (water sprays, equipment emission controls, equipment inspections, etc.).

Impacts to neighboring populations would be dependent on distance to these receptors. Each of the sites is located adjacent to operating nuclear power plants, and the W3 site is located adjacent to neighboring industrial activities. However, the majority of workers at these plants work indoors and would not be affected. Training, awareness, and personal protective equipment would minimize the impacts to personnel working outdoors. The RBS, GGNS, and W3 sites are not located in the immediate vicinity of residential areas, and fugitive emissions are not anticipated to affect off-site receptors. The ANO site is located approximately 1.0 to1.5 mi. south and approximately 2.0 to 2.5 mi. northwest of neighboring residential areas; however, air emissions are not expected to affect these areas because of the distance from the site.

B.1.9.2 Physical Hazards

Physical hazards at the construction site would be consistent with any large-scale construction project and could include falls, impact injuries, vehicular accidents, and electric hazards. Access to the construction site would be controlled, and physical hazards to neighboring populations are not anticipated. Impacts to construction workers would be minimized through training, awareness, and personal protective equipment, and are expected to be minor.

B.1.9.3 Noise Hazards

Activities at the site would create noise consistent with large-scale construction activities. Noise levels for common construction activities are typically about 90 dBA at a distance of 10 ft. (NUREG-1817), and decrease with distance from the source. Because of the distance to local residential areas at each of the sites, these populations are not expected to be affected by construction noise hazards. Impacts to construction workers and personnel at neighboring industrial sites would be minimized through training, awareness, personnel protective equipment, and the scheduling of activities with particularly high levels of noise generation.

In summary, nonradiological health impacts (air emissions, physical hazards, and noise hazards) to construction workers, workers at neighboring facilities, and neighboring residential areas are expected to be SMALL for all sites, and impacts can be minimized through training, awareness, personal protective equipment, and activity scheduling.

B.1.10 RADIOLOGICAL HEALTH

The source of radiation exposure to site preparation and construction workers is primarily due to the operation of the existing nuclear power plants at each of the sites. Site-specific dose estimates would depend largely on the proposed location of the new plant in relation to the existing plant; such locations have not been finalized at the time of this assessment. Should the new plant location be located downstream from the existing plant, contact with radioactive liquid effluents could occur during construction of the intake/discharge structures. The dose to construction workers is assumed to be less than that for operational personnel at the existing plants, and potential impacts, although assumed to be SMALL, could be mitigated through training, awareness, and monitoring of conditions.

Plant locations at each site were assumed to be capable of maintaining the required exclusion zone and meeting low-population zone requirements. Therefore, it was assumed that impacts to off-site receptors would be minimal.

Radiological health impacts to construction workers, workers at neighboring facilities, and neighboring residential areas are expected to be SMALL for all sites, and impacts can be minimized through training, awareness, and monitoring of conditions.

B.1.11 REFERENCES

1. Entergy Operations, Inc., "Arkansas Nuclear One, Unit 2, Final Safety Analysis Report," Amendment No. 18.
2. Environmental Protection Agency, "Currently Designated Nonattainment Areas for All Criteria Pollutants," October 10, 2007, Website, http://www.epa.gov/oar/oaqps/greenbk/ancl.html.
3. System Energy Resources, Inc., "Grand Gulf Site Early Site Permit Application," October 2005.
4. "Louisiana Speaks, Long-Term Community Recovery Planning, St. Charles Parish Information," 2006. Website, http://www.louisianaspeaks-parishplans.org/IndParishHomepage_BaselineNeedsAssessment.cfm?EntID=14.
5. U.S. Nuclear Regulatory Commission, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants.* NUREG-1437, Supplements 3 and 19, Washington, D.C., May 1996.
6. Entergy Operations, Inc., "River Bend Station Updated Safety Analysis Report" through Revision 19, July 2006.
7. U.S. Census Bureau, Website, http://quickfacts.census.gov/qfd/.
8. U.S. Geographical Survey, Topographic Maps.
9. Entergy Operations, Inc., "Waterford Steam Electric Station Unit No. 3, Final Environmental Assessment and Finding of No Significant Impact Related to the Proposed License Amendment to Increase the Maximum Reactor Power Level," Docket No. 50-382, 7590-01-P, 2005.
10. Entergy Operations, Inc., "Waterford Steam Electric Station Unit No. 3, Final Safety Analysis Report," Revision 11, May 2001.

11. Entergy Operations, Inc., "Waterford Steam Electric Station Unit No. 3, Environmental Report, Operating License Stage," Amendment 1, September 1979.

12. West Feliciana Parish, 2007 Business and Parish Economic Development Plan (Community Development Foundation), Website, http://www.stfrancisville.org/downloads/2007businessplanwebquality.pdf.

13. National School Boards Association, 2002, Website, http://www.nsba.org/site/page_REN4.asp?TRACKID=&CID=428&DID=509.

B.2 OPERATIONAL IMPACTS AT THE PROPOSED AND ALTERNATIVE SITES

This section evaluates the potential environmental impacts associated with the operation of a new nuclear power plant at the RBS site (proposed site) and at the ANO site, the GGNS site, and the W3 site (alternative sites). Table 9B-3 summarizes the operational impacts of the proposed action.

B.2.1 LAND USE

Land use impacts associated with plant operation include both impacts to the site and immediate vicinity and impacts to off-site areas such as transmission and transportation ROWs.

B.2.1.1 Site and Vicinity

Operational impacts to the site and immediate vicinity would largely be limited to maintenance operations on existing structures and would be SMALL and temporary in nature. Cooling tower operation would result in an increase in the transport of residual salts and chemicals through water droplets carried out of the cooling towers. Based on a review of the deposition of draft from nuclear power plants (NUREG-1437), measurements indicate that, beyond about 1.0 mi. (1.5 km) from nuclear plant cooling towers, salt deposition is not significantly above natural background levels. Additionally, no instances of nuclear power plant cooling tower operation resulting in measurable productivity losses in agricultural crops or measurable damage to ornamental vegetation have been identified (NUREG-1437).

Other area land use impacts would result from construction of housing and other infrastructure in support of an operating workforce. It is predicted that the majority of this expansion would occur near existing communities, and a significant land use impact is not expected to occur. Land use impacts at the site and immediate vicinity are predicted to be SMALL for each site under consideration.

Table 9B-3
Comparison of the Operational Impacts at the Proposed and Alternative Sites

Impact Area Category	Proposed Site	Alternative Sites		
	RBS	ANO	GGNS	W3
Land Use				
Site and vicinity	SMALL	SMALL	SMALL	SMALL
Power transmission line ROW and off-site areas	SMALL	SMALL	SMALL	SMALL
Air Quality	SMALL	SMALL	SMALL	SMALL
Water-Related				
Water use	SMALL	SMALL to MODERATE	SMALL	SMALL
Water quality	SMALL	SMALL	SMALL	SMALL
Ecological				
Terrestrial ecosystems	SMALL	SMALL	SMALL	SMALL
Aquatic ecosystems	SMALL	SMALL	SMALL	SMALL
Threatened and endangered species – terrestrial and aquatic	SMALL	SMALL	SMALL	SMALL
Socioeconomic				
Physical impacts	SMALL	SMALL	SMALL	SMALL
Demography	SMALL	SMALL to MODERATE	MODERATE to LARGE	SMALL
Social and economic	BENEFICIAL	BENEFICIAL	BENEFICIAL	BENEFICIAL
Infrastructure and community services	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL
Historic and Cultural Resources	SMALL	SMALL	SMALL	SMALL
Environmental Justice	SMALL	SMALL	SMALL to MODERATE	SMALL
Nonradiological Health	SMALL	SMALL	SMALL	SMALL
Radiological Health	SMALL	SMALL	SMALL	SMALL
Impact of Postulated Accidents	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE

B.2.1.2 Power Transmission Line ROW and Off-Site Areas

Operational impacts of transmission lines result primarily from line maintenance; these include ROW vegetation clearing, transmission line maintenance, and other normal access activities. To ensure power system reliability, the growth of tall vegetation under the lines must be prevented to avoid physical interference with lines or the potential for short-circuiting from the line to the vegetation. Additional ROW acquisition and development would not normally be required as part of plant operation activities. Maintenance activities would be limited to the immediate ROW and would be minimal.

Other off-site land use impacts as a result of plant operation activities would be minimal, temporary, and limited in aerial extent. Such activities could include road and rail maintenance and Auxiliary Building maintenance.

In summary, impacts from transmission line maintenance and transportation infrastructure maintenance are predicted to be SMALL and relatively similar between the sites. While a plant sited at the ANO site would require maintenance of a greater distance of transmission lines, impacts from maintenance activities are still estimated to be SMALL.

B.2.2 AIR QUALITY

Air quality impacts associated with plant operation include both impacts from the plant operation activities themselves and transportation impacts from workers commuting to the plant. Operating activities would require obtaining federal, state, and/or local permits and approvals prior to beginning activities.

B.2.2.1 Operation Activities

Air quality impacts from operation activities result from the releases of heat and moisture to the environment from cooling tower operation and emissions from the operation of auxiliary equipment. Cooling tower operation often results in drift, or the transport of residual salts and chemicals through water droplets carried out of the cooling towers. Based on a review of the deposition of draft from nuclear power plants (NUREG-1437), measurements indicate that, beyond approximately 1.0 mi. (1.5 km) from nuclear plant cooling towers, salt deposition is not significantly above natural background levels. Additionally, no instances of nuclear power plant cooling tower operation resulting in measurable productivity losses in agricultural crops or measurable damage to ornamental vegetation have been identified (NUREG-1437).

Auxiliary equipment may also be operated on an intermittent basis. Auxiliary equipment emissions can be controlled through equipment inspections and regular maintenance. Small amounts of ozone and smaller amounts of oxides of nitrogen (NO_x) are produced by transmission lines (NUREG-1817). The production of ozone and NO_x is insignificant and does not measurably contribute to the ambient levels of those gases (NUREG-1437). In total, air quality emissions from operation activities would be SMALL and could be mitigated to minimize any resulting impacts. Each site would experience similar air quality impacts.

B.2.2.2 Transportation

Air quality impacts would also result from the workforce commuting to the plant. Vehicular emissions would increase as a result of the action. It is unlikely that the air quality would be degraded to be noticeable beyond the immediate site vicinity. Air quality impacts would be more detrimental in areas already exceeding the NAAQS for criteria pollutants. None of the sites are in the immediate vicinity of areas exceeding the NAAQS for criteria pollutants. Impacts associated with increases in vehicular transportation associated with construction activity are expected to be SMALL.

In summary, air quality impacts from both operation activities and transportation increases are predicted to be SMALL, and there is no clear distinction between the sites in assessing air quality impacts.

B.2.3 WATER-RELATED

Water-related impacts associated with plant operation include both water use impacts and water quality impacts. Plant operation would require obtaining federal, state, and/or local permits and approvals prior to beginning activities.

B.2.3.1 Water Use

Plant operation activities consume water through plant cooling and personal (sanitary) uses. The overall use of water is dominated by plant cooling uses for wet-cooled plants. This analysis assumes complete wet-cooling of a one-unit plant using cooling towers at each site. The assumed maximum plant cooling design consumption for a one-unit plant is 48,390 ac.-ft/yr (30,000 gpm; 66.9 cfs).

Each site is located near a major river. The RBS, GGNS, and W3 sites are located near the Mississippi River, with low flow rates between 100,000 cfs and 140,000 cfs, and average flow rates between 450,000 cfs and 500,000 cfs. Plant cooling would necessitate the use of 0.05 to 0.07 percent of the low flow and 0.01-0.02 percent of the average flow. Surface water use from the Mississippi River for plant operation activities would have a SMALL impact.

The ANO site is located near the Arkansas River and Lake Dardanelle. The average flow rate is 42,000 cfs, and the average low flow is 416 cfs, although the potential for a low flow of 0 cfs exists. Plant cooling would necessitate the use of 16 percent of the low flow and 0.16 percent of the average flow. Surface water use from the Arkansas River for plant operation activities would normally have a SMALL impact, although impacts could be MODERATE during times of low flow.

Groundwater sources could be used for personnel/sanitary and other plant operation needs. Each site is located near groundwater sources that are used for public consumption, and quantities are not assumed to result in a significant impact to groundwater sources. However, specific aquifer analyses would be required to accurately predict the impacts of groundwater use.

In summary, because of the significant surface water volumes at the RBS, GGNS, and W3 locations, these sites would have a SMALL impact on water use. The lower surface water volumes at the ANO site would result in a SMALL to MODERATE impact on water use at this location.

B.2.3.2 Water Quality

Cooling tower operations result in the concentration of dissolved solids in the water stream, resulting from evaporation loss, which must be discharged and replenished with freshwater. The discharged water (blowdown) would be of lower quality than the source water. However, because of the large capacity of the neighboring surface waters, water quality impacts from regulated discharges would easily be distributed in the receiving water bodies. The concentration of total dissolved solids in the cooling tower blowdown averages 500 percent of that in the makeup water, a concentration factor that can be tolerated by most freshwater biota (NUREG-1437). Additionally, an LPDES permit would be required to discharge effluents, and any unforeseen water quality impacts could be addressed during periodic permit renewals.

Water quality impacts could also result from erosion and stormwater effects, and activity mitigation requirements would be stipulated through LPDES permits obtained for the action. The RBS and GGNS sites have local drainages that could carry sediments to the Mississippi River, and the ANO site has local drainages that could carry sediments to the Arkansas River. The W3 site is largely isolated from surface water runoff to the Mississippi River because of levees constructed along the river. Standard BMPs could be implemented to minimize the impacts of erosion and stormwater runoff.

Therefore, because of the location of each site near a major surface water body, and because of the regulatory conditions associated with the plant operation activities, impacts to water quality would be SMALL for each site.

B.2.4 ECOLOGICAL

B.2.4.1 Terrestrial Ecosystems

As noted previously, it was assumed that the new unit at each of the four sites would employ a closed cycle cooling system with cooling towers. Impacts to terrestrial resources that may result from the operation of a new nuclear unit include those associated with cooling tower drift and bird collisions. The impacts of cooling tower drift on crops, ornamental vegetation, native plants, birds, shoreline habitat, and protected species were evaluated previously in NUREG-1437 and were found to be SMALL for all plants, including those with multiple cooling towers of various types. No new information has been identified at the sties to change earlier conclusions. Therefore, the impacts of cooling tower drift and bird collisions as a result of one or more nuclear units at any of the four sites would be SMALL.

The W3 plant warrants additional discussion. There is heavy industry in the area, with presumably significant air and water emissions. The water quality of the Mississippi River at the site is assumed to be poor (with contaminants), and the saline concentrations at W3 are assumed to be higher than at the other three sites, given its proximity to the Gulf of Mexico. Drift effects to nearby ecosystems could potentially be greater at this site. However, given the absence of important or unique habitats and species in the area – likely due to the heavy industry and potential contamination in the area – the impacts from operation of a new nuclear unit at this site are still considered to be SMALL.

B.2.4.2 Aquatic Ecosystems

Impacts to aquatic resources from plant operation primarily include those from water intake (i.e., impingement and entrainment) and the discharge of heated effluents (heat shock). Additional concerns could include physical changes to aquatic systems from stormwater collection and the accumulation of contaminants in sediments or biota and thermal plume barrier to migrating fish.

Entrainment occurs when planktonic larval fish and shellfish drifting in waters in the plant vicinity are carried with cooling water through the intake screens, pumps, and steam condensers. High mortality to larval fish can result from mechanical and hydraulic forces experienced within the cooling system. The impacts of fish and shellfish entrainment are typically SMALL and are not expected to be a concern for new units with a closed cycle cooling system. However, they remain a concern at certain plants with once-through cooling systems (ANO Unit 1 and W3 were not identified as plants with a problem, however).

Aquatic organisms that are drawn into the intake with the cooling water and are too large to pass through the debris screens may be impinged against the screens. Fish mortality from impingement is high at many plants because impinged organisms are eventually suffocated by being held against the screen mesh or are abraded, which can result in fatal infection. As with entrainment, operational monitoring and mitigative measures, and modified intake designs for new units with closed cycle systems, have eased concerns about population-level effects at most plants, but impingement mortality continues to be an issue at plants with once-through cooling systems.

The heated effluent of steam-electric power plants can cause mortality among fish and other aquatic organisms from either thermal discharge effects or cold shock. Plants today have the benefit of extensive studies on thermal effects so that discharge effects are now relatively predictable. Mitigative measures (and those incorporated into plant design) can now be employed to reduce the potential for thermal discharge effects.

In conclusion, the final design of intake and discharge systems will consider potential impacts on aquatic organisms under EPA regulations implementing Section 316(b) of the CWA. Using cooling towers is a mitigation measure for reducing impacts from impingement and entrainment (they use relatively smaller volumes of makeup water in comparison to once-through cooling systems). The thermal discharge characteristics into the river would also be reduced through the use of a cooling tower system. It is assumed that system designs at each site would use intake and cooling tower designs that would minimize operational impacts to aquatic resources. Therefore, impacts are expected to be SMALL. This is consistent with NUREG-1437, which concluded that the impacts would be SMALL, and plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

B.2.4.3 Threatened and Endangered Species

Terrestrial and aquatic T&E species that could occur at each site or in its vicinity were identified previously in the discussion of construction impacts. Given the findings relative to plant operations on terrestrial and aquatic ecosystems previously stated, impacts to any protected species found at the site are also expected to be SMALL. Supporting site-specific analyses that are related to protected aquatic species, which typically have greater potential for impact from plant operations, are summarized below. These analyses also consider the potential for cumulative impacts from the operation of a new unit, in addition to ongoing operations of existing units at a given site, including those with existing once-through cooling systems (e.g., ANO and W3).

B.2.4.3.1 RBS

Operation of a new unit 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 the closed cycle cooling system, 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. No federal- or state-listed aquatic species have been observed in the immediate vicinity of the site.

The other water resources at the RBS site are not anticipated to be affected by operation of a new unit or units. West Creek was rerouted when the current facility was built and is used for the 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 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 presumably would not be changed.

B.2.4.3.2 ANO

As noted previously, ANO Unit 1 has a once-through cooling water system; ANO Unit 2 has a closed cycle cooling system with a natural draft cooling tower. A third new unit is assumed to also be a closed cycle system. Entergy has performed environmental monitoring, as described in NUREG-1437 Supplements 3 and 19, including an ecological assessment of the effects of the ANO Unit 1 once-through cooling water system.

Entrainment of larval fish at ANO was monitored between 1977 and 1987. The results indicate that the entrainment of fish from Lake Dardanelle does not adversely affect population levels or the quality recreational fishery in Lake Dardanelle. Similar findings were made relative to impingement. A comparison of the number and weight of the forage fish in Lake Dardanelle indicates that gizzard and threadfin shad make up the greatest number of impinged fish. The high impingement rate for these fish can be attributed to their inability to withstand thermal stress during winter months. The results of the impingement studies at ANO and field surveys in Lake Dardanelle indicate that fluctuation in shad populations occur naturally in the lake and the declines are related to low winter temperatures. The study concluded that the shad impinged at the ANO intake during periods with cold water temperatures were dead or cold-stressed and would likely have died in any case. The study also concluded that threadfin shad and gizzard shad populations are able to reestablish themselves in the lake. In 1995, the Arkansas Game and Fish Commission (AGFC) concluded that impingement losses have not affected the maintenance of a quality recreational fishery in Lake Dardanelle.

B.2.4.3.2.1 Heat Shock

Lake Dardanelle is a part of the Arkansas River and serves as the cooling water source for Units 1 and 2. The discharge limits for ANO are currently established in National Pollutant Discharge Elimination System (NPDES) Permit Number AR0001392, dated September 30, 1997. Since 1973, when ANO was originally permitted to discharge cooling water to Lake Dardanelle, no violations of established thermal permit limits have occurred.

A specific condition of NPDES Permit Number AR0001392 requires the applicant to monitor water temperatures after the discharged cooling water passes through the discharge embayment and enters the main channel of Lake Dardanelle. The Arkansas water quality standard for Lake Dardanelle is 35°C (95°F). Because water quality standards for temperature are being met in Lake Dardanelle, no Section 316(a) variance is required or needed. In support of previous conclusions by state and federal regulatory agencies, the AGFC concluded in 1995 that thermal discharges from ANO have not affected the maintenance of a quality recreational fishery in the lake.

A biological assessment was prepared to assess the potential impacts of license renewal for both Units 1 and 2 on federally protected species in the area. The USFWS concurred with the findings that continued operation of ANO Units 1 and 2 is likely to have no effect on federally listed threatened or endangered species.

While it is clear that current operations at ANO result in minimal impacts to the existing aquatic resources, including T&E aquatic species, it is not clear whether Lake Dardanelle is sufficiently large to accommodate a third unit without adversely affecting existing aquatic protected resources; the potential cumulative impacts of all three units remain a concern. However, given the assumption that a new unit would utilize a closed cycle cooling system and that there are no protected species in the immediate plant vicinity, the impacts from a third unit are expected to be SMALL.

B.2.4.3.3 GGNS

The federally endangered mussel species has the potential to occur in the site area, and sperm and juvenile stages of the mussel could become entrained on the water intake screens. However, the potential impact area is very small compared to the entire reach of the Mississippi River where this species can occur. As the mussels mature, they settle into the sand or mud or stable substrate to grow into adults. Thermal effects on the mussel are not known; however, the impacts of the thermal discharge are likely to be minimal. The area that would be affected by the increased temperature from the discharge plume would be small; the warmer water is buoyant and would not normally impinge on the river bottom.

The gulf sturgeon has not been collected in reach of the site; however, it could pass by the site as it migrates up and down the river. No known spawning areas have been found the near the site, and the site area is unlikely to be used by larval stages of sturgeon. It is assumed that the intake design of a third unit would incorporate features to address any impingement concerns. Thermal temperature effects on the sturgeon are unknown; however, the thermal plume is not likely to affect migration. Fish should be able to avoid the plume if temperatures are too high.

The pallid sturgeon has been collected in the region of the site, and spawning habitat may exist within 10 mi. of the site. While this species should be able to avoid impingement, potential impacts from elevated temperatures of the thermal plume are not known. 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. 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 the number of larval pallid sturgeon in this area are likely to be low. If the higher temperatures are detrimental, the larval stages drifting with the river current could become disoriented, but the temperature increase would not likely be lethal. Also, the thermal plume is buoyant and does not extend more than 3 ft. below the water surface. If present, drifting pallid sturgeon larvae would be found near the bottom of the river and would not be affected by the thermal plume. Therefore, the impacts on pallid sturgeon from the discharges at the GGNS plant would likely be minimal.

While there are several protected aquatic species in the area, none have been identified at the plant site, nor has critical habitat been identified in the immediate plant area. Given this information and the mitigative design features of a closed cooling system, it is assumed that impacts from a third unit would likely be SMALL. It should be noted that operation of a second new unit at GGNS would bring the total number of units to three. The potential cumulative impacts from all three units (in a single location) on existing aquatic resources are a concern. Given that protected species could occur in the area, and the uncertainties surrounding impacts to protected resources from plant thermal discharges of up to three units, potential cumulative impacts could be SMALL to MODERATE.

B.2.4.3.4 W3

Impacts from impingement and entrainment are not expected to be a concern for W3. Fish and other organisms removed from the cooling water by the traveling water screens are washed to a trough to a point downstream of the intake. With respect to thermal discharge effects (heat shock), Entergy has conducted thermal studies in the Mississippi River in the vicinity of the W3 discharge for more than 26 years, and no adverse impacts on fish have been observed. The temperature of the water discharged to the river by a new unit would be controlled by an LPDES permit, which would include a bounding thermal limit and would regulate the amount of heat discharged to the Mississippi River from this facility such that it protects the balanced indigenous population. Therefore, impacts are expected to be SMALL.

Given that (1) operation of the existing W3 unit, with a once-through cooling system, does not appear to adversely affect protected species in the plant vicinity, and (2) no protected species have been found in the immediate plant vicinity and no critical habitat has been identified, operation of a second closed cycle nuclear unit would not appear to have adverse effects. It should be noted that operation of a second nuclear unit at W3 in combination with the existing nuclear Unit 3 (with a once-through cooling system), as well as adjacent W3 Units 1 and 2 SES and the nearby Little Gypsy (Units 1, 2, and 3) SES across the river, raises potential cumulative impact concerns to existing aquatic resources. The potential impacts to aquatic resources from stirring up potential contaminated sediments along the river bottom – as a result of regular maintenance dredging of the intake area – is also a concern, given the generally poor water quality in the site area. However, given the large volume of flow in the Mississippi River, the long-time presence of heavy industry along this portion of the river (as noted in the discussion of construction impacts), and the absence of any protected species in the immediate plant vicinity, the impacts are still considered to be SMALL.

B.2.5 SOCIOECONOMIC

A general introduction and list of assumptions associated with the socioeconomic analysis is included in the impacts analysis evaluation associated with construction activities. This information is also applicable to plant operation activities.

B.2.5.1 Physical Impacts

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; traffic at the site would also be a source for noise. Any noise coming from the proposed site would be controlled in accordance with standard noise protection and abatement procedures. Noise levels would be managed to local ordinances. 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 site.

New units would have standby diesel generators and auxiliary power systems. Permits obtained for these generators would ensure that the air emissions comply with regulations. In addition, generators would be operated on a short-term, limited 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.

With respect to aesthetics, any new units would be closed systems that would require cooling towers. Visible plumes resulting from cooling tower operation could cause negative aesthetic effects. However, since the current sites already have cooling towers, additional cooling towers for a new reactor would not be expected to significantly change the existing appearance of the site. During plant layout, it is also assumed that every effort would be made to locate the towers in an area isolated from area viewpoints to the maximum extent possible.

Based on this information, the physical impacts of construction and operation would be SMALL.

B.2.5.2 Demography

As noted previously, the addition of one new unit is assumed to require an increase in the operations workforce of 700 employees; in the case of GGNS, the cumulative workforce for two new units would be 1400. While part of the station operation workforce at each site is expected to relocate into the region, their numbers are small when compared to those in-migrating for construction and when compared to the total base population within a 50-mi. radius of each site. Therefore, the demographic impacts within a 50-mi. radius of each site from operations are expected to be SMALL. Should the majority of the in-migrating population choose to live in the local communities surrounding GGNS and ANO, however, the impacts would be MODERATE at ANO and MODERATE to LARGE at GGNS.

B.2.5.3 Social and Economic

Socioeconomic impacts of operation relate primarily to the benefits afforded to local communities as a result of the plant's presence (e.g., tax plans, local emergency planning support, educational program support). The continued availability (and proposed expansion at each nuclear site) and the associated tax base are important features in each host county's ability to continue to invest in infrastructure and to draw industry and new residents.

Potential social and economic impacts due to expanded operation at each plant site would include significant increases in tax revenues for the host counties and in the size of the operations workforce. Each Entergy facility is a major employer in the local community, and Entergy is a major contributor to the local tax base. Entergy personnel also contribute to the tax base by paying sales taxes.

During the life of the new unit, operations workers would pay income, sales, and use taxes to state and local governments in the region where the sales occur and property taxes to the counties in which they own a residence. Sales and use taxes would be paid on expenditures of the operations workforce for goods and services. Corporate income taxes on profits would also be paid for those companies supporting plant operation.

In summary, the economic impacts from operation of a new unit at each plant site would result in LARGE and BENEFICIAL impacts, particularly to the local economies. The impacts to the regional economies would be expected to be smaller (SMALL) at the RBS and W3 and SMALL to MODERATE at GGNS and ANO, where the plants play a more significant role in the regional economy.

B.2.5.4 Infrastructure and Community Services

B.2.5.4.1 Transportation

Transportation impacts from operation at all four sites would be significantly less than construction because the operations workforce and daily plant deliveries would be significantly less. Some congestion could still occur during shift changes, particularly for those facilities that have three units (ANO and GGNS); however, the magnitude of impact is expected to be SMALL. Moderate population growth is expected in the study areas of all four plant sites, some of which would be due to the construction of new units – both directly and indirectly – particularly at GGNS and ANO. However, even this indirect impact is likely to be fairly SMALL and difficult to predict. Future general population increases likely would increase highway congestion at specific locations, but the magnitude of impact of the new unit at each site on this service degradation is likely to be SMALL and would not require mitigation.

B.2.5.4.2 Recreation

All four sites have existing plants currently in operation. Operation of a new unit at each site would occur on lands currently owned by Entergy. Impacts from operation are expected to be less than the impacts from construction, which are expected to have minimal impact on nearby recreational facilities or recreational users. Impacts to recreation from the operation of a new unit are expected to be SMALL at all sites.

B.2.5.4.3 Housing

The impacts on housing from the operations workforce are expected to be SMALL at all sites, given that the number of in-migrating operations workers (and their families) would be significantly less than the construction workforce and their numbers are considered to be small in relation to the available housing markets, particularly a market that presumably would have been recently expanded to accommodate the construction workforce.

B.2.5.4.4 Public Services

It is assumed that revenue generated by plant construction and operation would be used to expand and update public services, as needed and appropriate, to accommodate in-migrating workers and their families associated with construction activities. Such improvements are assumed to be completed, or well under way, to sufficiently accommodate the influx of a smaller population associated with plant operation. Therefore, impacts are expected to be SMALL at all sites. A possible exception is the GGNS site, which would be adding a workforce for two new units. If the majority of these workers choose to reside in close proximity to the plant, the potential cumulative impacts on public services could be SMALL to MODERATE.

B.2.5.4.5 Education

Similar to housing and public services, the impacts on the educational systems from the operations workforce are expected to be SMALL at all sites, given the following:

- The number of in-migrating operations workers (and their families) would be significantly less than the construction workforce.
- The local and regional school systems would have already taken the necessary steps to add teachers and expand facilities to accommodate the construction workforce.

It is assumed that the in-migrating operations workforce and their families would benefit from educational improvements implemented during the construction phase and that additional improvements would be implemented, as needed and appropriate, using revenues generated by plant operation of a new unit.

A possible exception is the GGNS site, which would be adding a workforce for two new units. If the majority of these workers choose to reside in close proximity to the plant, the potential cumulative impacts on the educational system could be SMALL to MODERATE.

B.2.6 HISTORICAL AND CULTURAL RESOURCES

In general, plant operation is not expected to involve the physical conversion of additional lands for the station's use. It is further assumed that any plans to disturb additional lands would avoid existing known (and significant) historic and cultural resources and would require consultation with the SHPO prior to disturbance to address potential impacts on unidentified and potentially significant resources. Such mitigative actions would ensure that impacts to historic and cultural resources from plant operation are SMALL at all sites.

The other area of impact to historic and cultural resources relates to plant impacts on aesthetic resources of the site area. The most noticeable aesthetic impact of plant operation would result from the presence of the cooling towers and the steam plume that they emit. The towers and plume, if visible from many miles away, could have adverse effects on the natural beauty of the area. However, each of the sites already has cooling towers on-site. The presence of an additional cooling tower is not expected to significantly degrade the existing aesthetics of the area. Refer to the discussion of aesthetic impacts under the discussion of physical impacts.

B.2.7 ENVIRONMENTAL JUSTICE

Impacts to minority and low-income populations from construction activities were all shown to be either SMALL (at ANO) or MODERATE to LARGE and BENEFICIAL impacts at the other three sites, particularly the GGNS site where the minority and low-income population percentages are the highest. Impacts to minority and low-income populations from plant operation are expected to be identical to those identified for construction activities.

No significant minority or low-income populations were identified at any of the sites except GGNS. In such cases, as indicated previously in the discussion of construction impacts, NRC guidance directs that six questions be considered in determining the potential for "disproportionately high and adverse effects":

- Are the radiological or other health effects significant or above generally accepted norms?
- Is the risk of rate of hazard significant and appreciably in excess of the general population?
- Do the radiological or other health effects occur in groups affected by cumulative or multiple adverse exposures from environmental hazards?
- Is there an impact on the natural or physical environment that significantly and adversely affects a particular group?
- Are there any significant adverse impacts on a group that appreciably exceed or [are] likely to appreciably exceed those in the general population?
- Do the environmental effects occur or would they occur in groups affected by cumulative or multiple adverse exposure from the environmental hazard?

In conclusion, while GGNS has a disproportionate percentage of minority and low-income populations, no significant health or physical impacts to any human populations are expected to occur at the GGNS site (or any of the sites under consideration); thus, there cannot be significant disproportionate impacts to minority or low-income populations. Also, as noted previously, minority and low-income populations have benefited economically from the existing plant (construction and operation) and are expected to receive positive economic benefits from construction of a second and third unit as well. From this perspective alone, it could be argued that GGNS is superior for these two population groups, given their higher percentages and greater potential for benefit.

B.2.8 NONRADIOLOGICAL HEALTH

In general, nonradiological health hazards would be dominated by occupational injuries. Historically, actual injury and fatality rates at nuclear reactor facilities have been lower than the average U.S. industrial rates (NUREG-1817). In all cases, plant operation activities would be performed with adherence to applicable laws and regulations, practices, and procedures.

Other typical nonradiological health hazards associated with plant operation activities include the following:

- Health impacts from cooling tower operation.
- Noise hazards.
- Health impacts from transmission line operation.

B.2.8.1 Cooling Tower Operation

Cooling tower blowdown would be discharged to a surface water body at each site. For the RBS, GGNS, and W3 locations, the receiving water body is the Mississippi River. For the ANO location, the receiving water body is the Arkansas River and Lake Dardanelle. Blowdown discharges have the potential to increase the growth of microorganisms in the receiving waters. Serious illness and death can occur when there is high exposure to these microorganisms (NUREG-1817).

NUREG-1437 notes that a discharge to a small river (defined as having an average flow of less than 100,000 cfs) would have the greatest chance of affecting the public. The Mississippi River, in the vicinity of the site locations, has an average flow rate between 450,000 cfs and 500,000 cfs, and blowdown discharge would have a SMALL impact. The Arkansas River, in the vicinity of the site location, has an average flow rate of 42,000 cfs, and blowdown discharge would have a MODERATE impact.

B.2.8.2 Noise Hazards

The principal sources of noise from plant operation are cooling towers, transformers, and loudspeakers. Generally, power plant sites do not result in off-site levels more than 10 decibels above background (NUREG-1437), and impacts to neighboring populations would be SMALL. Impacts to plant operators and personnel at neighboring industrial sites would be minimized through training, awareness, personnel protective equipment, and the scheduling of activities with particularly high levels of noise generation.

B.2.8.3 Transmission Line Operation

The two human health issues related to transmission lines are the acute effect, shock hazard, and the potential for chronic effects from exposure to electric and magnetic fields. Acute effects can be minimized through a tower design that precludes direct public access to components that may pose a shock hazard and are considered to be SMALL at each location. Chronic effects from the operation of energized transmission lines on public receptors is not conclusive, but does indicate that some impacts are possible. However, these impacts are assumed to be SMALL because transmission ROWs would be located in a manner to avoid residential populations to the greatest extent.

In summary, noise hazards and hazards associated with transmission line operation are SMALL for each site considered. Health impacts associated with the discharge of blowdown from cooling towers are SMALL for sites discharging to the Mississippi River and MODERATE for the site discharging to the Arkansas River. However, since impacts would generally be dominated by occupation injuries, and since injury/fatality rates at nuclear plants are generally lower than the average rates at industrial sites, nonradiological impacts at each site are considered SMALL.

B.2.9 RADIOLOGICAL HEALTH

Radiological impacts of plant operation occur through exposure pathways from releases and direct radiation from the plant and can be viewed as dose to public receptors and dose to occupational receptors.

B.2.9.1 Water

Each plant site is located adjacent to and would discharge cooling tower blowdown to surface waters. However, these waters are sufficiently large enough to dilute any effects of radiological impacts. The W3 site is in the vicinity of downstream users of the Mississippi River for potable uses, but normal plant operation would not affect these users.

Each plant site is also located in an area of groundwater used for potable uses and agricultural irrigation. The valuable groundwater aquifers are generally deep and would not be affected by plant operation. Additionally, area agricultural operations do not commonly require manual irrigation of crops.

B.2.9.2 Air

Each plant site is located near existing agricultural operations, and potential radiological releases could affect these foodstuffs. Agricultural operations near the W3 site are less than the other sites considered, and impacts would be the smallest at this location. Environmental monitoring programs are in place to provide a backup to the calculated doses, based on effluent release measurements. Because the primary coolant is contained in a heavily shielded area, dose rates are generally undetectable and are less than 1 mrem/yr at the site boundary (NUREG-1437).

Plant locations at each site were assumed to be capable of maintaining the required exclusion zone and meeting low-population zone requirements. Radiation doses to members of the public from current operation of the nuclear power plant have been examined from a variety of perspectives, and the impacts were found to be well within design objectives and regulations in each instance (NUREG-1437). Therefore, radiological impacts to public receptors are SMALL for each site. Additionally, NUREG-1437 examines radiological impacts to occupational receptors and concludes that occupational radiation exposure is of SMALL significance.

B.2.10 IMPACT OF POSTULATED ACCIDENTS

NUREG-1437 contains a thorough analysis of the environmental impacts of accidents during operation. The analysis assumes accident frequency based on regulatory controls that ensure the plant's licensing basis is maintained. The analysis concludes that the environmental impacts from design basis accidents are of SMALL significance for all plants (NUREG-1437). Similarly, the analysis evaluated severe accidents and concluded that calculated impacts from atmospheric releases, fallout onto open bodies of water, groundwater releases, and societal and economic impacts to be of SMALL significance. Effective emergency planning can aid in mitigating the impacts of accidents.

The RBS, GGNS, and W3 sites are not located in the immediate vicinity of residential areas. The ANO site is located approximately 1.0 to 1.5 mi. south and approximately 2.0 to 2.5 mi. northwest of neighboring residential areas, and is in the general vicinity of Russellville, Arkansas. As such, the accident impacts at the ANO location are SMALL to MODERATE. Additionally, the W3 location is in the area of numerous neighboring industrial locations, and the accident impacts are SMALL to MODERATE. The accident impacts at the RBS and GGNS locations are SMALL.

B.2.11 REFERENCES

1. Entergy Operations, Inc., "Arkansas Nuclear One, Unit 2, Final Safety Analysis Report," Amendment No. 18.
2. Environmental Protection Agency, "Currently Designated Nonattainment Areas for All Criteria Pollutants," October 10, 2007, Website, http://www.epa.gov/oar/oaqps/greenbk/ancl.html.
3. System Energy Resources, Inc., "Grand Gulf Site Early Site Permit Application," October 2005.
4. U.S. Nuclear Regulatory Commission, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants.* NUREG-1437, Supplements 3 and 19, Washington, D.C., May 1996.
5. "Louisiana Speaks, Long-Term Community Recovery Planning, St. Charles Parish Information," 2006. Website, http://www.louisianaspeaks-parishplans.org/IndParishHomepage_BaselineNeedsAssessment.cfm?EntID=14.
6. Entergy Operations, Inc., "River Bend Station Updated Safety Analysis Report" through Revision 19, July 2006.
7. U.S. Department of Energy, *Study of Construction Technologies and Schedules, O&M Staffing and Cost, Decommissioning Costs and Funding Requirements for Advanced Reactor Designs,* 2004.
8. U.S. Census Bureau, Website, http://quickfacts.census.gov/qfd/.
9. U.S. Geographical Survey, Topographic Maps.
10. Entergy Operations, Inc., "Waterford Steam Electric Station Unit No. 3, Final Environmental Assessment and Finding of No Significant Impact Related to the Proposed License Amendment to Increase the Maximum Reactor Power Level," Docket No. 50-382, 7590-01-P, 2005.
11. Entergy Operations, Inc., "Waterford Steam Electric Station Unit No. 3, Final Safety Analysis Report," Revision 11, May 2001.
12. Entergy Operations, Inc., "Waterford Steam Electric Station Unit No. 3, Environmental Report, Operating License Stage," Amendment 1, September 1979.
13. West Feliciana Parish, 2007 Business and Parish Economic Development Plan (Community Development Foundation), Website, http://www.stfrancisville.org/downloads/2007businessplanwebquality.pdf.

CHAPTER 10 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

Section 102(c) of the National Environmental Policy Act (NEPA) specifies three special NEPA requirements that an environmental impact statement (EIS) must evaluate. Chapter 10 evaluates these three requirements, as well as a benefit-cost analysis (BCA) associated with constructing and operating RBS Unit 3. The three requirements, as well as the BCA, are evaluated in the following four sections:

- Unavoidable Adverse Environmental Impacts (Section 10.1).
- Irreversible and Irretrievable Commitments of Resources (Section 10.2).
- Relationship between Short-Term Uses and Long-Term Productivity of the Human Environment (Section 10.3).
- Benefit-Cost Balance (Section 10.4).

10.1 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

This section presents the potential environmental consequences of constructing and operating Unit 3 at the RBS. Unavoidable adverse impacts are predicted adverse environmental impacts that remain after all practical mitigation measures have been taken. This section considers the unavoidable adverse impacts from the construction and operation of Unit 3 and its new transmission system.

10.1.1 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS OF CONSTRUCTION

Construction impacts are described in Chapter 4. Table 4.6-1 summarizes those impacts (temporary and permanent) and briefly describes the measures and controls that would be implemented to reduce or eliminate the adverse impact. Mitigation measures are frequently implemented through permitting requirements and plans and procedures developed for the construction activities. For some of the impacts related to construction activities, mitigation measures that would be applied are generally grouped as Best Management Practices (BMPs). BMPs are designed to address the specific types of activities that are to be performed.

Some of the impacts anticipated during construction (temporary or permanent) cannot be avoided, and there are no practical means for mitigation. Unavoidable adverse impacts from construction of the new unit and on-site and off-site transmission corridors for Unit 3 include those impacts associated with land use, historic properties, hydrologic alterations, water use, terrestrial ecosystems, aquatic ecosystems, socioeconomics, and radiation exposure. These expected impacts and the mitigation measures that are available to reduce them are summarized in Table 10.1-1.

10.1.2 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS OF OPERATIONS

The operational impacts of Unit 3 are discussed in Chapter 5. Table 5.10-1 summarizes those impacts and briefly describes measures and controls that would be implemented to reduce or eliminate them. Some of these impacts cannot be avoided, and there are no practical means for mitigation. These expected impacts and the mitigation measures that are available to reduce them are summarized in Table 10.1-2.

Unavoidable adverse impacts from the operation of the new unit at the RBS are generally limited to those related to land use (on-site and transmission corridor), terrestrial and aquatic ecosystems, socioeconomics, and worker exposure to radiation. These categories of unavoidable adverse impacts and corresponding mitigation measures are described in Table 10.1-2.

10.1.3 REFERENCES

None.

Table 10.1-1 (Sheet 1 of 12)
Construction-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impacts Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Site and Vicinity			
Land Use	During construction, 364 ac. of land would be altered and converted, with the potential for erosion (Subsection 4.1.1); 43 ac. would be permanently occupied by structures and impervious surfaces (Subsection 4.1.1).	Adjust grade elevations in the parking, construction laydown, and batch plant areas to minimize net gain/loss of spoils materials.	SMALL adverse impact from the construction of Unit 3 would temporarily alter 364 ac. of habitat; 43 ac. (Subsection 4.1) would be occupied on a long-term basis by the nuclear power plant and associated infrastructure.
	Impact from ground-disturbing activities, including dewatering, dredging, grading, recontouring, excavation, and construction of new buildings, 550 foot natural draft and mechanical helper cooling towers, and impervious surfaces (Subsection 4.1.1).	Conduct ground-disturbing activities in accordance with regulatory and permit requirements. Use preventive erosion control and stabilization measures to minimize impacts. Minimize potential impacts through avoidance and compliance with permitting requirements and BMPs.	The construction of Unit 3 would result in a SMALL adverse impact from ground-disturbing activities.

Table 10.1-1 (Sheet 2 of 12)
Construction-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impacts Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Site and Vicinity (Continued)			
Hydrological	Adverse impacts associated with construction activities (i.e., earthmoving, vegetation clearing, grading). Activities would increase runoff and silt loads to West Creek and Alligator Bayou. Deforestation would increase erosion, siltation of streams, and leaching of nutrients, and may also increase flood flow. Spoil material and aggregate stockpile areas may result in increased runoff and silt loads into Alligator Bayou (Subsection 4.2.1).	Construction impacts would be reduced and effectively managed by development and implementation of a site-specific construction SWPPP.	Earthmoving and vegetation clearing and grading, and deforestation activities would increase runoff and silt loads to West Creek and Alligator Bayou. This adverse impact is anticipated to be SMALL.
	Adverse impact from a slight increase in localized turbidity in the Mississippi River as existing intake screens are removed and new screens are installed (Subsection 4.2.1).	No mitigation is recommended at this time.	SMALL adverse impact caused by localized turbidity in the Mississippi River.
	Adverse impact associated with stormwater runoff during construction. The runoff would discharge to West Creek. Much of the Unit 3 power block area is impervious, thus, the volume of runoff and sediment discharged to West Creek would increase (Subsection 4.2.1).	Construction impacts would be reduced and effectively managed by development and implementation of a site-specific construction SWPPP.	SMALL adverse impact from stormwater runoff during construction, which would increase the flow of West Creek and increase the potential for sediment runoff.

Table 10.1-1 (Sheet 3 of 12)
Construction-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impacts Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Site and Vicinity (Continued)			
Water Use and Water Quality	Construction is expected to require about 165,000 gpd for batch plant operations using a combination of well water and West Feliciana Parish water (Subsection 4.2.2).	No mitigation recommended at this time.	SMALL adverse impact because water used for construction would not be available for other uses.
	Daily drinking water would total about 9450 gpd. The West Feliciana Parish is to provide this water during construction (Subsection 4.2.2).	No mitigation recommended at this time.	SMALL adverse impact because water from West Feliciana Parish used for construction would not be available for other uses.
	Potential adverse impact to groundwater quality and quantity related to changes in water seepage patterns from expanded impervious areas as a result of construction (Subsection 4.2.2).	Use of the construction SWPPP would limit any loss or potential seepage of construction materials/supplies into the groundwater. Additional mitigation measures are not warranted.	SMALL adverse impact to groundwater quality and quantity because of the increase in impervious areas as a result of construction and the potential for construction-related spills.
	Adverse short-term increases in surface water turbidity as a result of construction effluents (runoff from construction zones and excavation dewatering flow from wells) (Subsection 4.2.2).	The assimilation capabilities of the Mississippi River would minimize the impact of short-term runoff from the construction site. Compliance with the terms of operating and construction stormwater permits and the use of controls in the operating and construction SWPPPs would reduce and effectively manage runoff.	SMALL adverse impact due to a localized increase in turbidity of the Mississippi River from construction effluents.

Table 10.1-1 (Sheet 4 of 12)
Construction-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impacts Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Site and Vicinity (Continued)			
	Adverse impact on water quality of the on-site and nearby water bodies because of increased erosion and sediment transport as well as potential spills of petroleum liquids from construction vehicles (Subsection 4.2.2).	Potential erosion impacts would be minimized through compliance with the SWPPP, as required by the Louisiana Department of Environmental Quality (LDEQ) and the Federal Water Pollution Control Act (FWPCA). Petroleum spills would be prevented and avoided by strict observance of the site Spill Prevention, Control, and Countermeasure (SPCC) Plan.	SMALL adverse impact on water quality of on-site and nearby water bodies.
	Adverse impact related to dewatering of the surficial aquifer. The construction dewatering would cause drawdown over an approximate 4-mi. radius area in the surficial aquifer (Subsection 4.2.2).	Prior to construction dewatering, the Applicant will contact the local registered well owners and develop a mitigation plan, if necessary.	SMALL adverse impact to the surficial aquifer drawdown during dewatering.
Ecological Impacts			
Ecological--Terrestrial	Adverse impacts to vegetation caused by clearing in construction areas (Subsection 4.3.1).	Limit vegetation removal and construction activities to the area within the RBS designated as the construction impact area, whether temporary or permanent. Temporary impact areas could be revegetated with grass or forest plantings as appropriate for the area.	SMALL adverse impact associated with the permanent loss of vegetation caused by construction of RBS Unit 3.

Table 10.1-1 (Sheet 5 of 12)
Construction-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impacts Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Site and Vicinity (Continued)			
Ecological--Terrestrial (Continued)	Permanent adverse impacts to wildlife habitat from losses due to clearing and avian collisions due to construction of 550-ft. natural draft cooling towers (NDCT) (Subsection 4.3.1).	Limit vegetation removal and construction activities to the corridor to avoid impacts to primary nesting periods for migratory birds. Habitats with potential for wildlife occurrence, especially birds, may be field examined just prior to clearing activities for significant nesting areas.	SMALL adverse impact associated with the permanent loss of wildlife habitat due to vegetation clearing. Potential avian collisions during construction of 550-ft. NDCT.
	Tree clearing in wetland areas of the on-site transmission corridor. Degree of impact area would be known when a wetland delineation is complete (Subsection 4.3.1).	Remove trees with as little impact to soils and other vegetation as possible by stump cutting. Based on the outcome of the wetland delineation and consultation with the U.S. Army Corps of Engineers (USACE), a mitigation plan will be developed to minimize and mitigate unavoidable impacts.	SMALL potential adverse impact to wetlands from vegetation clearing.
Ecological--Aquatic	Permanent losses to aquatic biota are expected to be limited to a small man-made pond (approximately 100 x 50 ft.) located on a 3-ac. lot designated for construction of offices (Subsection 4.3.2).	No mitigation is proposed at this time.	SMALL adverse impact from the permanent loss of aquatic biota associated with on-site small, man-made pond.

Table 10.1-1 (Sheet 6 of 12)
Construction-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impacts Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Site and Vicinity (Continued)			
Ecological--Aquatic (Continued)	Temporary adverse impact because of the temporary increase in silt load to the on-site Alligator and Grants Bayou water systems and the Lower Mississippi River (LMR) resulting in limited losses of phytoplankton productivity and zooplankton densities in these systems (Subsection 4.3.2).	Comply with individual Louisiana Pollutant Discharge Elimination System (LPDES) construction stormwater permit. Adhere to procedures outlined in the SWPPP, SPCC and any other BMPs established with regard to silt prevention. Establish BMPs for preventing excess sedimentation from adversely affecting aquatic resources. Silt and sediment in construction effluents are expected to be buffered by the Alligator Bayou before reaching the LMR.	SMALL temporary adverse impact to phytoplankton and zooplankton in Alligator and Grants Bayous and the LMR from increased sediment load.
	Potential erosion of banks and stream beds of the Alligator and Grants Bayous from temporary increase in water flow from dewatering (Subsection 4.3.2).	Adhere to procedures outlined in the SWPPP, SPCC and any other BMPs established with regard to dewatering activities.	SMALL adverse impact from potential erosion of banks and stream beds of the Alligator and Grants Bayous from temporary increase in water flow from dewatering.
Wetlands	Potential adverse impacts to wetlands from the placement of 2 transmission towers in on-site wetlands (Subsection 4.3.2).	Wetland impacts would be minimized by avoidance and compliance with USACE permitting requirements. It is anticipated that mitigation could potentially be the enhancement of existing, on-site wetlands.	SMALL adverse impact from the potential permanent loss of wetlands on-site from construction of the on-site transmission corridor. Adverse impact could be lessened by mitigation through enhancement of on-site wetlands.

**Table 10.1-1 (Sheet 7 of 12)
Construction-Related Unavoidable Adverse Impacts**

Impact Category	Adverse Impacts Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Site and Vicinity (Continued)			
Socioeconomics			
Traffic	Traffic congestion and potential for vehicle accidents because of increased traffic and truck deliveries. Up to 1418 worker vehicles could commute to the site per shift (Subsections 4.4.1 and 4.4.2).	During high traffic periods, stagger construction shifts and use all three plant entrances to mitigate traffic congestion on U.S. Highway 61.	MODERATE to LARGE adverse impact caused by traffic. Construction would increase traffic, resulting in vehicle congestion and a higher potential for vehicle accidents on U.S. Highway 61. The Applicant would pursue transportation studies at the appropriate time and in conjunction with the Louisiana Department of Transportation and Development (LDOTD).
Air Emissions	Temporary adverse impact related to dust from construction activities and exhaust from increased worker vehicle emissions. The concrete batch plant on-site may create the largest amount of dust (Subsection 4.4.1).	Adverse impact would be effectively managed through the use of existing paved roads and the absence of large-scale clearing and leveling of areas.	SMALL temporary adverse impacts to air quality from dust emissions associated with construction activities.
		Water truck sprayers would be used to control dust in the laydown area, parking areas, or construction areas during dry weather periods. As laydown and other areas are no longer needed as construction progresses, the areas would be reseeded to ensure that ongoing dust creation does not occur.	SMALL temporary adverse impact to air quality from dust emissions associated with construction activities.

Table 10.1-1 (Sheet 8 of 12)
Construction-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impacts Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Site and Vicinity (Continued)			
Air Emissions (Continued)		Idling of machinery and equipment would be minimized to reduce air quality impacts as much as possible.	SMALL temporary adverse impact to air quality from dust emissions associated with construction activities.
		The concrete batch plant would be equipped with a dust control system that would be checked and maintained on a routine basis. Off-site dust impacts should be negligible and would not require mitigation.	SMALL temporary impact to air quality from activities associated with the concrete batch plant operations.
Aesthetics	Permanent adverse aesthetic impact of the 550-ft. NDCT on adjacent land uses (primarily residential) (Subsection 4.4.2).	The potential visual impact would be mitigated from some vantage points by the area forest cover and rolling terrain that conceal the tower. Impractical to mitigate.	SMALL, permanent adverse aesthetic impact from the 550-ft. NDCT to adjacent residential areas.
Noise	Temporary adverse impact associated with elevated noise levels produced during construction (Subsection 4.4.2).	Limit the types of construction activities during nighttime and weekend hours, notify all affected neighbors of planned activities, establish a construction noise monitoring program, and implement standard noise control measures for construction equipment (e.g., silencers on diesel engine exhausts).	SMALL adverse impact to existing noise levels because of elevated noise levels produced during construction.

Table 10.1-1 (Sheet 9 of 12)
Construction-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impacts Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Site and Vicinity (Continued)			
Radiation Exposure to Construction Workers	Adverse impact to construction workers from the potential for radiation exposure from a range of sources, including direct radiation, radiation from gaseous and liquid effluents, and radiation associated with RBS Unit 1 on-site dry waste and spent fuel storage (Subsection 4.5.1).	The annual construction worker doses attributable to the operation of RBS Unit 1 for the proposed construction areas for a new facility would be small because the dose would be a fraction of the acceptable limits. Monitoring of individual construction workers is not required.	SMALL adverse impact to construction workers from the potential for radiation exposure from Unit 1 operations during Unit 3 construction.
Transmission Corridor and Off-Site Areas			
Land Use	Construction of off-site transmission right-of-way (ROW) corridor and access roads in previously undisturbed land. It is estimated that 3334 ac. would be affected (Subsection 4.1.2).	Minimize land use impacts through the use of a defined transmission corridor and existing access roads.	The conversion of previously undisturbed land into a transmission corridor and access roads would be a SMALL unavoidable adverse impact.
Land Use (Continued)	Potential adverse impact from on-site and off-site construction caused by soil compaction and erosion; spread of noxious or invasive vegetation (Subsections 4.1.1 and 4.1.2).	Use BMPs and standard industry practices and follow applicable laws and regulations. Prevent erosion by leaving ground cover or grassy vegetation intact as much as possible. Incorporate design measures to avoid concentrated flow that has a high potential to transport sediment. Control measures would be incorporated into the requirements of the Stormwater Pollution Prevention Plan (SWPPP). Restrict construction equipment access points to corridor. Use BMPs to prevent proliferation of noxious and invasive vegetation.	Construction of the transmission corridor would result in potential SMALL adverse impact from soil erosion and the development of noxious or invasive vegetation.

Table 10.1-1 (Sheet 10 of 12)
Construction-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impacts Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Transmission Corridor and Off-Site Areas (Continued)			
Land Use (Continued)	Construction of the transmission corridor would result in impacts to floodplains. The degree of impact is not known because the off-site corridor route has not been finalized. The 148-mi. preferred route is anticipated to intersect 318 water features—29 intersections are with water features larger than 1000 ft. wide (Subsections 4.1.2 and 4.3.1).	Provide transmission corridor work schedule to all landowners along the corridor that could be affected by construction.	Construction of the transmission corridor would likely result in a SMALL adverse impact to floodplains.
	During construction of the transmission corridor, there would be an impact from the reduction in agricultural land use along the expanded corridor (Subsection 4.1.2).	Make landowners aware that they can continue agricultural use under transmission lines after the new corridor is constructed. Limit construction activities and vehicular traffic to the defined transmission corridor area and existing access roads. Plan and schedule construction activities, when practical, to minimize temporary disturbance, displacement of crops, and interference with farming activities. Place new towers parallel to existing towers, where practical, to enhance maneuverability of farm equipment. Restore compacted soil on properties used for cropland. Avoid damaging crops and compensate farmers for crop damage that is unavoidable.	Construction of the transmission corridor would result in a SMALL to MODERATE adverse impact because it would permanently convert agricultural lands to utility use.

Table 10.1-1 (Sheet 11 of 12)
Construction-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impacts Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Transmission Corridor and Off-Site Areas (Continued)			
Hydrological	Adverse impact associated with stormwater runoff, erosion, and siltation from off-site transmission line construction activities (Subsection 4.2.1).	Off-site transmission line water impacts would be reduced by the BMPs established for construction.	SMALL adverse impact from stormwater runoff during construction of off-site transmission line.
Ecological--Terrestrial	A relatively small loss of high-quality upland habitat from clearing along the on-site and off-site transmission corridor ROW (Subsection 4.3.1).	No mitigation recommended at this time.	SMALL adverse impact from the loss of upland habitat.
	Potential adverse impacts to federal and state protected species. Degree of impact cannot be defined until routing is finalized (Subsection 4.3.1).	Routing would avoid known or potential habitat of protected species through consultation with federal and state agencies in finalizing off-site line routing.	SMALL potential adverse impacts to federal and state protected species. Final route planning would continue to address wildlife-related issues and would consider any suggestions or requests that may arise through agency consultations.
	Vegetation clearing of forested areas for construction (Subsection 4.3.1).	Minimize crossing high-quality forest areas. Utilize open habitats (cropland, pasture, etc.) and pine plantations to the greatest extent possible.	SMALL adverse impact caused by the permanent loss of existing forest to transmission corridor ROW expansion.
	Potential adverse impact associated with avian collisions with power lines (Subsection 4.3.1).	Keep new transmission structures and lines adjacent to existing lines so that birds would avoid area. Site new corridor to avoid important, critical, or sensitive habitats and species as much as possible. The Avian Interaction Policy will be followed.	SMALL adverse impact associated with avian collisions with power lines. Final route planning would continue to address wildlife- and habitat-related issues and would consider any suggestions or requests that may arise through agency consultations.

Table 10.1-1 (Sheet 12 of 12)
Construction-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impacts Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Transmission Corridor and Off-Site Areas (Continued)			
Wetlands and Waters	The preliminary Natchitoches route crosses approximately 318 water features potentially regulated by the USACE (Subsection 4.3.2).	Wetland impacts would be minimized by avoidance and compliance with USACE permitting requirements. Access to wetlands would use matting or similar devices to avoid and minimize ground disturbance in wetlands.	SMALL adverse impact caused by ROW clearing adjacent to wetlands and waters from transmission corridor construction. Final design would include spanning the aquatic ecosystems crossed. Transmission tower construction is expected to be limited to terrestrial locations to the maximum extent possible.

Table 10.1-2 (Sheet 1 of 14)
Operation-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impact Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Site and Vicinity			
Land Use	Adverse impact associated with permanently dedicating approximately 43 ac. of land to the RBS Unit 3 until decommissioning (Subsection 5.1.1).	No mitigation measures are practical to reduce this impact. The acres affected are limited to the defined impact area.	SMALL adverse impact from the permanent loss of approximately 43 ac. of land until RBS Unit 3 is decommissioned.
	Permanent adverse impacts expected to land use (primarily forestry and agriculture) in the vicinity of the RBS site (Subsection 5.1.1).	No mitigation is proposed at this time.	SMALL adverse impact from the permanent loss of primarily forestry and agriculture lands due to presence of the RBS facilities.
	Adverse impact related to an increase in the total volume of solid waste generated at the RBS site because of the addition of Unit 3 (Subsection 5.1.1).	All federal, Louisiana, and local requirements and standards would be met regarding handling, transportation, and off-site disposal or recovery at an off-site permitted recycling or recovery facility, as appropriate.	SMALL adverse impact because of the increase in the volume of solid waste generated from the RBS Unit 3 operations. Waste minimization programs and recycling efforts would help minimize the quantity of solid waste generated, thereby minimizing impacts to area landfills accepting the waste.
	Adverse impact related to potential erosion (Subsection 5.1.1).	Observation of erosion control measures, adherence to permits and the SWPPP will prevent erosion and enhance soil stability	SMALL impact associated with potential soil erosion.

Table 10.1-2 (Sheet 2 of 14)
Operation-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impact Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Site and Vicinity (Continued)			
Land Use (Continued)	Adverse impact related to cooling tower drift (Subsection 5.1.1).	Drift eliminators would be incorporated into cooling tower design to minimize the potential for salt deposition.	SMALL impacts primarily associated with salt deposition. The maximum predicted annual salt deposition rate presented in Subsection 5.3.3.1.3 is 2.08 $kg/km^2/mo$. This value is well within the NUREG-1555 acceptable levels of generally not damaging to plants.
	Adverse impact related to potential spills (Subsection 5.1.2).	The site SPCC Plan and LPDES permit contain measures to prevent and address spills. Vehicle-related activities would be conducted in an enclosed building or a bermed and lined area designated for spill containment. Materials would be stored appropriately to prevent spills, and appropriate containers, berms, barriers, and other measures would be used to prevent and mitigate spills.	SMALL impact due to staff training and observance of spill avoidance measures at the RBS Unit 3 site.
Terrestrial Ecosystems	Potential adverse impact to vegetation related to salt deposition from the cooling towers (Subsections 5.1.1 and 5.3.3).	Visual inspection of vegetation in the vicinity of the cooling towers would monitor the impact of salt deposition on area vegetation.	SMALL potential adverse impact to vegetation from salt deposition from cooling towers.

Table 10.1-2 (Sheet 3 of 14)
Operation-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impact Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Site and Vicinity (Continued)			
Terrestrial Ecosystems (Continued)	Potential adverse impact to wetlands (Subsection 5.6.1).	Avoidance, minimization, and mitigation would be determined by USACE permit conditions.	SMALL impacts to wetlands because areas would be accessed by boat, or matting would be placed for equipment.
Aquatic Ecosystems	Potential adverse impact related to the heated effluent that would be discharged into the Mississippi River via the existing discharge pipeline (Subsection 5.3.2).	The thermal plume is unlikely to hinder fish migration or spawning efforts, although some species may avoid the area in the summer when maximum river temperatures are reached. A balanced indigenous population will be protected by LPDES permit limits.	SMALL impacts to aquatic species because the thermal plume modeling results show that the thermal plume from combined operation of Units 1 and 3 would be minimal when compared to the breadth of the LMR.
	Potential adverse impacts from intake operation (Subsection 5.3.1).	A low intake velocity ($\leq$ 0.5 fps) would be maintained, which allows most aquatic organisms to avoid the intake altogether.	SMALL impacts to aquatic organisms because of a low intake velocity. Extensive hydraulic modeling has concluded that the anticipated intake flow for both units (Unit 1 and Unit 3) would be negligible when compared to the average flow of the Mississippi River. The ambient flow of the river would not be altered by Unit 3 operation.

Table 10.1-2 (Sheet 4 of 14)
Operation-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impact Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Site and Vicinity (Continued)			
Aquatic Ecosystems (Continued)		Unit 3 operational environmental impacts to aquatic ecosystems would be minimized by the use of a wedgewire screen with a smaller slot opening [0.11 in. (3 mm)] than the current intake screen in operation for Unit 1.	SMALL impacts to aquatic organisms due to a smaller slotted intake screen and low intake velocities. SMALL impacts to fish species inhabiting the LMR because they are heavy-bodied fishes capable of out-swimming an intake velocity of <0.5 cfs, which is the velocity planned for Unit 1 and 3 operations.
	Potential impact from chemicals in process wastewater discharge (Subsection 5.3.1).	Chemical monitoring as required by the LPDES permit. Any chemicals that exceed permitted concentrations in the effluent would be documented and reported appropriately, and corrective measures would be taken to limit adverse environmental impacts.	SMALL impacts because testing performed at the RBS site to date has not indicated any toxicity to designated indicator organisms. Monitoring discharges in accordance with current and future LPDES permits will ensure that any chemical components contained in the combined Unit 1 and Unit 3 discharge would not adversely affect aquatic resources within the LMR.
Hydrology			
Hydrologic Alterations	Potential adverse impact related to water discharge to the Mississippi River (Subsection 5.2.1).	No mitigation measures required.	SMALL impacts to the Mississippi River because the volume of effluent is extremely small compared to the minimum flow rate in the river.

Table 10.1-2 (Sheet 5 of 14)
Operation-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impact Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Site and Vicinity (Continued)			
Water Use	Potential adverse impact to Mississippi River from quantity withdrawal (Subsection 5.2.2).	No mitigation measures required.	SMALL impacts because the quantity of water withdrawals and usage of Mississippi River water by RBS Units 1 and 3 is small enough in relation to Mississippi River flow to have no anticipated effect on recreation, navigation, public water supply, or other anticipated usage of the river and its water by others.
	Potential adverse impacts to water quality of Mississippi River and groundwater from plant operations (Subsection 5.2.2).	Runoff control would be managed as described in the operational phase of the SWPPP.	SMALL impacts because compliance with stormwater permit limits would provide protection of the waterways first receiving the runoff and ultimately for the Mississippi River.

Table 10.1-2 (Sheet 6 of 14)
Operation-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impact Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Site and Vicinity (Continued)			
Water Use (Continued)		Measures have been established to limit adverse water use impacts involving whole effluent toxicity testing, radioactive sampling, thermal plume size, dissolved solids from cooling, and river dredging.	SMALL impacts to water quality because whole effluent toxicity testing is anticipated to continue for RBS Unit 3 as it has for RBS Unit 1; sampling results for radioactive constituents through 2006 have shown no river or sediment samples above background levels; thermal plume modeling studies at the RBS site have concluded that hot water discharge plumes from cooling water discharges to the Mississippi River have minimal effect because of the large size and assimilation capacity of the Mississippi River; the highest total dissolved solids value added to the increase of 2.7 mg/l from Units 1 and 3 still results in a value (291 mg/l) that is significantly below the Louisiana water quality criteria of 400 mg/l; and river dredging would be minimized from the engineering design of the embayment. To date, river dredging for current operations has been necessary no more than one time per year.

Table 10.1-2 (Sheet 7 of 14)
Operation-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impact Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Site and Vicinity (Continued)			
Water Use (Continued)		Continued groundwater monitoring.	SMALL impacts to groundwater quality, although monitoring at the RBS for the 20 years of Unit 1 operation has shown no detectable radioactivity levels of plant-related materials in the subsurface soils and water tables.
Socioeconomic			
Physical Impacts	Adverse impact associated with air emissions of criteria pollutants. Sources of air emissions include two standby diesel generators, an auxiliary boiler, two diesel fire pumps, as well as an NDCT and mechanical draft cooling tower (MDCT). The proposed cooling towers would emit small amounts of particulate matter as drift. Given the small magnitude and infrequent operation of the combustion sources, criteria pollutant emissions would have little effect on the nearby ozone nonattainment area and minimal impact on the local and regional air quality (Subsection 5.8.1).	The combustion sources would be designed for efficiency and would only operate on a limited basis throughout the year (often only for testing). The towers would be equipped with drift eliminators designed to limit drift to approximately 0.002 percent or less of total water flow. The height of the cooling tower would allow for good dispersion of the drift and prohibit localized concentrations of particulate matter. Emissions from all equipment would be within regulatory guidelines for the region.	SMALL adverse impact because only minor air emissions would be generated as a result of RBS routine operations.

Table 10.1-2 (Sheet 8 of 14)
Operation-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impact Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Site and Vicinity (Continued)			
Social and Economic Impacts of Station Operation			
Traffic Flows	Potential adverse impact to traffic flows on highways and access roads to the RBS. Traffic at the site and on surrounding roadways would increase as operational staff for the two units commute to the RBS site (Subsection 5.1.1).	Widening of U.S. Highway 61 to four lanes and construction of the new Audubon Bridge and new Highway 10 extension would serve to alleviate congestion.	Increased traffic flow to and from the RBS site, because the increased number of personnel necessary for Unit 3 operations is expected to be SMALL to MODERATE.
		There are several ongoing and planned upgrades to highways, including U.S. Highway 61, in the region that would likely be completed prior to the operation of RBS Unit 3. These upgrades would help minimize traffic impacts.	
		No new public roads are needed for operation of the new unit. Potential increases in traffic would be mitigated through effective traffic management and the addition of congestion-alleviating features such as turn bays at the plant entrance.	

Table 10.1-2 (Sheet 9 of 14)
Operation-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impact Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Site and Vicinity (Continued)			
Public Health	Potential adverse impact related to additional thermal discharges to the LMR associated with the new RBS Unit 3, resulting in limited increases in etiological agents (Subsection 5.3.4).	The operations of the RBS Unit 3 would comply with all relevant Occupational Safety and Health Administration (OSHA) and state regulations.	SMALL potential adverse impact because thermal modeling predicts that the combined effluent for both units would result in a limited thermal discharge plume within a small mixing zone. This limited size would limit the area of conditions necessary for optimal growth of etiological agents.
Recreation Areas	Adverse impact on recreational facilities from plant operations (Subsection 5.8.2).	No mitigation measures required.	SMALL impact on recreation due to plant operation because of the relatively isolated location of the existing plant site and its distance from recreational facilities.
Aesthetics	Adverse impacts as a result of the Unit 3 NDCT, along with the steam plume, which would be visible from off-site locations (Subsection 5.8.2).	No mitigation measures required.	SMALL impact due to visible steam plume from off-site locations.

Table 10.1-2 (Sheet 10 of 14)
Operation-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impact Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Site and Vicinity (Continued)			
Air Quality			
Air Emissions	Potential adverse impact to air quality from plant emissions (Subsection 5.1.1).	Air emissions will be controlled in accordance with local, state, and federal laws and regulations and applicable air permit requirements. Maintenance of unpaved roads would reduce dust emissions. Cooling tower salt deposition and drift would not significantly affect surrounding agricultural lands and vegetation. No mitigation measures required.	SMALL impact due to normal plant air emissions affecting plant air quality on the site or in the vicinity of RBS Unit 3.
Radiation Exposure to Operational Workers	SMALL potential adverse impact to workers caused by small quantities of mixed waste, if generated, that would be temporarily stored on-site because of the lack of treatment options or disposal sites. For this reason, impacts resulting from occupational exposure to chemical hazards and radiological doses could be higher than otherwise expected.	Occupational chemical and radiological exposures could occur during the testing of mixed wastes to determine if the constituents are chemically hazardous. In those cases, appropriate hazardous chemical control and radiological control measures would be applied.	SMALL potential adverse impact to workers from radiation exposure.

Table 10.1-2 (Sheet 11 of 14)
Operation-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impact Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Transmission Corridor and Off-Site Areas			
Land Use	Potential adverse impact to off-site land use may occur as the operations workforce and their families relocate to local communities. Increase in development for commercial and residential purposes (Subsection 5.8.2).	Communicate regularly with local and regional governments to exchange information that can be incorporated into community and parish comprehensive planning and zoning processes.	SMALL potential adverse impact to off-site land use from an increase in development for commercial and residential properties.
	Adverse impacts to vegetation from transmission line maintenance activities (Subsection 5.1.2).	Transmission corridor maintenance inspections would be conducted using aerial or ground surveys. This would reduce the need to cut vegetation along the entire corridor at one time.	SMALL adverse impact to the vegetation that is removed, as necessary, to support transmission operations.
	Potential adverse impacts to planning and zoning (Subsection 5.1.2).	New transmission structures would continue to be in compliance with the land use plans and zoning requirements of West Feliciana, Pointe Coupee, Avoyelles, Grant, and Rapides Parishes. The area crossed by the new off-site transmission corridor would be removed from residences and development as much as possible along most of the route and primarily traverses agricultural lands.	SMALL impacts on surrounding land use since agriculture can still be practiced in the transmission corridor under the new line.

Table 10.1-2 (Sheet 12 of 14)
Operation-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impact Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Transmission Corridor and Off-Site Areas (Continued)			
Land Use (Continued)	Potential adverse impact to recreation and aesthetics (Subsection 5.1.2).	No mitigation is required.	SMALL potential adverse impact from the new transmission line since it would be visible to observers in the area.
	Adverse impact related to potential spills (Subsection 5.1.2).	Entergy's Transmission Group has established measures to prevent and address spills along the transmission corridor and off-site areas, primarily through preventive measures.	SMALL impact due to staff training and observance of spill avoidance measures.
	Adverse impact to wildlife and birds from transmission towers and lines (Subsection 5.1.2).	When the route is finalized at a time closer to operation of the lines, bird concentrations along the new off-site transmission corridors would be investigated and measures would be taken to mitigate anticipated effects in areas where impacts might occur. The Avian Interaction Policy will be followed. Periodic cutting of vegetation for corridor maintenance would affect wildlife through replacement of forested edge habitat with short meadow type habitat.	SMALL adverse impact to wildlife and birds from transmission towers and lines.

Table 10.1-2 (Sheet 13 of 14)
Operation-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impact Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Transmission Corridor and Off-Site Areas (Continued)			
Ecological Impacts			
Terrestrial Ecosystems	Potential adverse impact to birds and other wildlife because of the new transmission line (Subsection 5.1.2).	To reduce wildlife disturbance, the number of maintenance vehicles and staff would be minimized, noise would be minimized, and maintenance work would be performed only where needed.	SMALL adverse impact to wildlife disturbed by noise and activities associated with transmission line maintenance. There are no threatened, endangered, or otherwise protected species or habitats affected by the transmission system.
		When the route is finalized closer to operation of the lines, bird concentrations along the off-site transmission corridors would be investigated and measures would be taken to mitigate anticipated effects in areas where impacts might occur. The Avian Interaction Policy will be followed.	
Electrical Impacts	SMALL potential impacts because the transmission line would produce small amounts of ozone and nitrogen oxides, electromagnetic fields, and corona noise (Subsection 5.1.2).	No mitigation required.	SMALL potential impact from transmission line operation.

Table 10.1-2 (Sheet 14 of 14)
Operation-Related Unavoidable Adverse Impacts

Impact Category	Adverse Impact Based on Applicant's Proposal	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Transmission Corridor and Off-Site Areas (Continued)			
Radio, Television, Cellular Phone, and Wireless Internet Interference	SMALL potential impact to electrical devices because interference is not a widespread phenomenon along transmission lines.	No mitigation required unless complaints arise. The Applicant would then investigate the cause and, if necessary, replace the defective component.	SMALL potential impact to electrical devices from transmission line operation.
Members of the Public	Adverse impact related to noise, electromagnetic frequency effects, interference, and shock hazards (Subsection 5.6.3).	The new transmission lines would comply with National Electrical Safety Code (NESC) criteria and would, therefore, minimize potential impacts to nearby residents from corona noise, electromagnetic frequency effects, electric shock, and interference with radio, TV, cellular phones, and wireless Internet signals.	SMALL adverse impact to radio, TV, cellular phones, and wireless Internet signals in nearby residences after installation of new transmission lines.

10.2 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

This section describes the expected irreversible and irretrievable environmental and material resource commitments used in the construction and operation of RBS Unit 3. The term "irreversible commitments of resources" describes environmental resources that would potentially be changed by the construction or operation of Unit 3 and that could not be restored at some later time to the resource's preconstruction or preoperation state. "Irretrievable resources" are generally materials that would be used for the new unit in such a way that they could not, by practical means, be recycled or restored for other uses.

Impacts from construction and operation of RBS Unit 3 would be similar to those of any major construction project, and the expected loss of resources used in construction is anticipated to have a SMALL impact, with respect to the availability of such resources. The main resource irretrievably committed by operation of RBS Unit 3 is uranium, which is available in sufficient quantities so that the irreversible and irretrievable commitment of uranium would have a SMALL impact.

The irreversible and irretrievable commitments of resources resulting from construction and operation of Unit 3 at RBS are considered below. A summary of irreversible and irretrievable commitments of environmental resources is presented in Table 10.2-1; the irreversible and irretrievable commitments of material resources are presented in Table 10.2-2.

10.2.1 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF ENVIRONMENTAL RESOURCES

Irreversible environmental commitments resulting from the construction and operation of RBS Unit 3 include the dedication of resources as described in the following subsections.

10.2.1.1 Hydrological and Water Use

As stated in Sections 2.3, 4.2, and 5.2, the Mississippi River would be the primary source of nonpotable water during operation of Unit 3. The combined maximum water withdrawal from the Mississippi River for the operation of Units 1 and 3 is 58.9 Mgd of water. Water consumption at the RBS is dominated by evaporative losses from the cooling tower system. With a normal loss of approximately 18,848 gpm in the water balance for Unit 3 attributed to evaporation and cooling tower drift, this leaves a projected flow of approximately 9034 gpm for discharge or approximately 13 Mgd for the proposed maximum combined discharge for Units 1 and 3. Thus, the net water use is 45.9 Mgd.

The Applicant is connected to the West Feliciana Parish Water System as the source of potable water for the RBS; this source would also supply potable water during the construction and operation of Unit 3. The daily drinking water consumed during construction is anticipated to be 9450 gpd. The maximum expected peak usage rate of potable water for the operation of Unit 1 and Unit 3 is 315 gpm.

In both cases mentioned above, the water consumption for construction and operation of RBS Unit 3 would be an irreversible and irretrievable commitment of an environmental resource, but this commitment would be of SMALL consequence with respect to the availability of such resources in the region. Impacts of water use from construction and operations are described in detail in Sections 4.2 and 5.2, respectively.

10.2.1.2 Ecological

Construction would temporarily adversely affect the abundance and distribution of local flora and fauna at the RBS. Similar impacts would occur within the new off-site transmission corridor. These impacts would result in the irreversible commitment of these resources as individual organisms. Even after the implementation of mitigation measures, a commitment of individual aquatic biota would occur during the operation of RBS Unit 3 as a result of entrainment and impingement at the intake; however, these minimal effects would be localized and of SMALL consequence.

The construction and operation of Unit 3 is not predicted to result in the extirpation or extinction of any species. Therefore, no overall irreversible or irretrievable commitment of these biological resources would be considered likely to occur. Ecological impacts of construction and operations are discussed in Section 4.3 and Subsection 5.1.1.4, respectively.

Upland forested areas of the site would also be affected. The woodland habitat to be lost to construction represents a small fraction of the total availability of this habitat in the region of RBS Unit 3 and, though irreversible, would be of SMALL consequence with respect to the availability of such resources in the region.

Forested and potentially regulated wetland/water areas along the proposed new off-site transmission route to Natchitoches are the most significant acreages represented; forests comprise about 468 ac., or 14 percent, of the proposed route. Of the 468 ac., about two-thirds is pine plantation. Wetlands and other waters that would potentially be regulated account for 684 ac., or approximately 20 percent of the route. However, the Natchitoches route has the fewest long crossings (greater than 1000 ft.), 29 total. Of the 29, only two are wooded. The wooded portion is approximately 3277 ft. in length and would require the placement of an estimated one tower in each wetland. The area occupied by the tower base would result in the permanent loss of a 50 by 50 ft. wetland area, or less than 0.1 ac. per tower. Seven emergent herbaceous wetlands greater than 1000 ft. in length are to be crossed, which would result in an estimated eight towers being placed in wetlands, for a total of 10 towers placed in wetlands. Placement of these towers would result in a total of 1 ac. of permanent wetlands impact caused by tower construction. ROW clearing for transmission line construction can potentially occur in areas adjacent to open water; however, indirect impacts to aquatic resources are expected to be minimized through preventive measures developed and implemented through a construction SWPPP. The overall impacts resulting from construction of the transmission line are considered SMALL because route selection has utilized developed or otherwise open lands to the maximum extent possible to avoid impacts to environmental resources.

10.2.2 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF MATERIAL RESOURCES

The irretrievable commitment of material resources during construction of RBS Unit 3 generally would be similar to that of other large power-generating facilities, such as hydroelectric and coal-fired power plants that are constructed throughout the United States. The construction of RBS

Unit 3 is estimated to require 355,000 cu. yd. of concrete, 71,000 tons of rebar, 6,280,000 linear ft. of cable for the Reactor Building, and up to 246,000 linear ft. of piping greater than 2.5 in. for a single ESBWR reactor. The irretrievable commitment of construction materials in the quantities associated with those expected for a nuclear power plant would be of SMALL consequence with respect to the availability of such resources in the United States.

The main resource that would be irreversibly and irretrievably committed by operation of RBS Unit 3 is uranium. The World Nuclear Association, which studies supply and demand of uranium, states that the world's present measured resources of uranium, in the cost category somewhat above present spot prices and used only in conventional reactors, are enough to last for some 70 years. There was very little uranium exploration between 1985 and 2005, so the significant increase in exploration that is currently being conducted could readily double the known economic resources. On the basis of analogies with other metal minerals, a doubling in price from present levels could be expected to create about a tenfold increase in measured resources over time (Reference 10.2-1). As this information suggests, the uranium that would be used to generate power at RBS Unit 3, while irretrievable, would be of SMALL consequence with respect to the long-term availability of uranium worldwide.

U.S. Department of Energy (DOE) uranium estimates indicate that sufficient resources exist in the United States to fuel all operating reactors and reactors being planned for the next 10 years at a uranium concentrate (U_3O_8) cost (2002 dollars) of $30.00 per pound or less. The resource categories designated as reserves and estimated additional resources can supply these quantities of uranium (Reference 10.2-2).

10.2.3 REFERENCES

10.2-1 World Nuclear Association, "Supply of Uranium," March 2007, Website, http://www.world-nuclear.org/info/inf75.html, accessed February 6, 2008.

10.2-2 U.S. Department of Energy, Energy Information Administration, *Uranium Industry Annual 2002*, DOE/EIA-0478(2002), Washington, D.C., May 2003.

10.2-3 National Ready Mixed Concrete Association, Website, http://www.nrmca.org/concrete/07_2007_1_files/sheet004.htm, accessed March 31, 2008.

10.2-4 U.S. Department of Commerce, Economics and Statistics Administration, U.S. Census Bureau, "Steel Mill Products: 2006," July 2007.

10.2-5 U.S. Department of Commerce, Economics and Statistics Administration, U.S. Census Bureau, "Insulated Wire and Cable: 2006," June 2007.

Table 10.2-1 (Sheet 1 of 2)
Irreversible and Irretrievable Commitments of Resources

Environmental Resource	Commitment
Hydrology and Water Use	Construction is expected to require a maximum quantity of 165,000 gpd from the West Feliciana Parish Water System. The combined maximum water withdrawal from the Mississippi River for the operation of Units 1 and 3 is 58.9 million gpd of water. The projected discharge flow is approximately 9034 gpm or approximately 13 Mgd for the proposed maximum combined discharge for Units 1 and 3 back to the Mississippi River. The Applicant is connected to the West Feliciana Parish Water System as the source of potable water for Unit 1. The West Feliciana Parish Water System would also be the source of potable water for Unit 3. The daily drinking water consumption during construction is anticipated to be 9450 gpd. The maximum expected peak usage rate of potable water for the operation of RBS is 315 gpm. The water used would be considered an irreversible committed resource, although the impact of this water use on the resource would be of SMALL consequence with respect to the water available from the Mississippi River and through the West Feliciana Parish Water System.
Ecological	Construction would temporarily adversely affect the abundance and distribution of local flora and fauna at the RBS. Similar impacts would occur within the new off-site transmission corridor. These impacts would result in the irreversible commitment of these resources as individual organisms; however, this would be of SMALL consequence with respect to the abundance of the same flora and fauna in the region. A commitment of individual aquatic biota would occur during the operation of RBS Unit 3 as a result of entrainment and impingement at the intake; however, these minimal effects would be localized and of SMALL consequence.

Table 10.2-1 (Sheet 2 of 2)
Irreversible and Irretrievable Commitments of Resources

Environmental Resource	Commitment
Ecological (Cont.)	Upland forested areas of the site and the off-site transmission ROW would also be affected. The woodland habitat to be lost to construction represents a small fraction of the total availability of this habitat in the region of RBS Unit 3 and, though irreversible, would be of SMALL consequence with respect to the availability of such resources in the region.

Table 10.2-2
Commitments of Materials

Material	Quantities Used	U.S. Production Estimated
Concrete	355,000 cu. yd.	456,412,000 cu. yd. (as ready mix concrete) (Reference 10.2-3)
Rebar	71,000 tons	6,969,893 metric tons (Reference 10.2-4)
Cable for Reactor Building	6,280,000 linear ft.	315,030 thousands of pounds (copper-containing); 308,173 thousands of pounds (aluminum-containing) (Reference 10.2-5)
Pipe >2.5 in. diameter	246,000 linear ft.	1,151,882 metric tons (alloy steel - oil country goods and line pipe; mechanical tubing) (Reference 10.2-4)

10.3 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY OF THE HUMAN ENVIRONMENT

This section presents a discussion of the Unit 3 short-term uses of the environment and their relationship to long-term environmental productivity. This discussion includes an evaluation of the extent to which the proposed project's use of the environment would preclude options for future use of the environment. For the purposes of this section, "short-term" refers to the period from start of construction to the end of the plant's life, including prompt decommissioning; "long-term" refers to the period extending beyond the end of the plant's life, including the period up to and beyond that required for delayed plant decommissioning.

Short-term uses of the environment for the construction and operation of Unit 3 include the unavoidable adverse impacts identified in Section 10.1. These uses include the development of land that would not be available for other uses until the facilities are decommissioned, impacts to lands that provide habitat for wildlife, the consumptive use of water during construction, the loss of aquatic biota at the intake structure during plant operation, and temporary impacts to the aquatic ecosystem from periodic maintenance dredging during the life of the project. Other short-term uses of the environment include the irreversible and irretrievable commitments of resources identified in Section 10.2, with the exception of those commitments that involve the consumption of depletable resources as a result of plant construction and operation, which would be considered long-term uses of the environment.

The RBS site was originally developed for two nuclear generating units. Preliminary work for the construction of Units 1 and 2 began in 1973. Unit 1 is licensed to operate until midnight on August 29, 2025. Construction of Unit 2 was officially cancelled in 1984. The construction of Unit 3 at RBS is consistent with the intended short-term use of the RBS site; that is, electrical power generation. The construction and operation of Unit 3 at the site would further extend the short-term preemption of this land. However, as discussed below, the overall benefits of power production and the realization of economic productivity are considered greater than those benefits that would be derived from other likely uses of the site during this period.

Benefits of Construction

The benefits of construction and operation of Unit 3 are evaluated and presented in Section 10.4. The principal short-term benefit of construction and operation of a new unit would be the production of electrical energy and the economic productivity of the site. The jobs created by the construction and operation of a new facility would represent a significant input of resources to the local economy. In addition, tax revenues from the facility would present an economic stimulus to West Feliciana Parish, the region, and Louisiana.

The areas to be developed for Unit 3 are adjacent to the operating Unit 1 nuclear plant; therefore, the use of the land is precluded from commercial development and agriculture. In the absence of Unit 3, some proposed construction areas at the site could potentially be used for silviculture or wildlife habitat. However, the economic benefit of the electrical production project would be relatively LARGE compared with the productivity from any other potential uses.

Long-Term Productivity Impacts

The maximum long-term impact to productivity from other uses of the land within the RBS site would result if the facility were not decommissioned in a timely manner. The result of any delay in decommissioning would be that the land occupied by facility structures would not be available for any other use. Compliance with the requirements of 10 CFR 50.82 dictate that a new unit would be decommissioned in a timely manner following the end of its useful life. Typical of current industry approaches for multi-unit sites, the decommissioning of Unit 3 would be expected to include other facilities on-site. It is reasonable to expect that the site would be released for unrestricted use and that such actions would be undertaken in a timely manner, thus minimizing the impact to long-term productivity.

The loss of biologically productive woodlands would be considered an impact to the long-term biological productivity of the site because it is unlikely that the current soil productivity supporting this woodland habitat would be restored in a reasonable time frame. It is likely that the site would be used for other industrial uses following decommissioning and not reverted back to use as wildlife habitat.

As stated in Section 10.4, the operation of Unit 3 would also result in a long-term benefit to air quality and greenhouse gas levels through emissions avoidance by not relying on natural gas, coal-fired, or other fossil-fueled electrical generation.

Overall, the enhancement of regional productivity resulting from the electrical energy produced by Unit 3 would not be equaled by any other use of the site. In addition, most long-term impacts resulting from land-use preemption by plant structures would be eliminated by removing these structures or by converting them to other productive uses.

Summary of Relationship between Short-Term Uses and Long-Term Productivity of the Human Environment

The short-term and long-term benefits of the construction and operation of Unit 3 outweigh the short-term and long-term impacts to environmental productivity. The short-term benefit of the production of electrical energy and the economic productivity of the site would be relatively LARGE compared with the productivity of the RBS site from any other probable uses. The construction and operation of Unit 3 would result in the positive long-term enhancement of regional productivity through the generation of electrical energy, with benefits that would likely extend beyond the life of the project. Table 10.3-1 compares the project's principal short-term uses to the long-term productivity of the human environment.

10.3.1 REFERENCES

None.

Table 10.3-1 (Sheet 1 of 2)
Short-Term Uses and Long-Term Productivity of the Human Environment

	Short-Term Uses and Benefits	Relationship to Maintenance and Enhancement of Long-Term Environmental Productivity
Land Use	The construction and operation of Unit 3 and the new off-site transmission ROW would preclude these lands from being available for other uses.	Construction and operation of Unit 3 does not necessarily represent a long-term impact to productivity of the human environment because the land might be available for other uses after the reactors are decommissioned.
	The construction and operation of the preferred transmission route (Natchitoches Route) would convert approximately 1538 ac. of existing cultivated crops and land used for hay/pasture to industrial use.	Construction and operation of the transmission route where it impacts cultivated cropland and land used for hay/pasture production does not necessarily represent a long-term impact because the acreage might be available again for agriculture production if the transmission lines are decommissioned upon decommissioning of the reactors.
Hydrological and Water Use	Construction is expected to require a maximum quantity of 165,000 gpd from the West Feliciana Parish Water System. The combined maximum water withdrawal from the Mississippi River for the operation of Units 1 and 3 is 58.9 million gpd of water.	The consumptive use of water during construction and operation does not result in any significant long-term impacts to water resources. Upon shutdown and decommissioning of Unit 3, the water would be available for other uses in gradually increasing amounts.
	The West Feliciana Parish Water System would also be the source of potable water for Unit 3. The daily drinking water consumption during construction is anticipated to be 9450 gpd. The maximum expected peak usage rate of potable water for the operation of Unit 3 is 315 gpm.	

Table 10.3-1 (Sheet 2 of 2)
Short-Term Uses and Long-Term Productivity of the Human Environment

	Short-Term Uses and Benefits	Relationship to Maintenance and Enhancement of Long-Term Environmental Productivity
Ecological		
Terrestrial Flora and Fauna	The construction of Unit 3 and its associated infrastructure would result in impacts to habitat for plants and animals.	The construction of Unit 3 and the associated on-site and off-site transmission lines would result in the long-term loss of biologically productive woodlands and wetlands because soil conditions could take hundreds of years to redevelop.
		The wildlife species found on the RBS, in the region, and along the proposed Natchitoches transmission route are not rare and would recover from displacement by the project.
Aquatic	Impacts to the aquatic ecosystem would result from the operation of the intake structure and dredging of the embayment.	The construction and operation of Unit 3 does not result in any significant long-term impacts to biota or their habitats. Upon decommissioning of Unit 3, the use of the intake structure and dredging would cease; therefore, it is anticipated that the aquatic ecosystems would return to a natural state.
Socioeconomic	Electrical power would be generated.	The long-term benefits of electrical power generation include helping to meet growing industrial, commercial, and residential baseload needs; the effects of which are expected to live beyond the life of the project. Additional long-term benefits include those related to air emissions avoidance by not relying on natural gas, coal-fired, or other fossil-fueled electrical generation to meet energy demands.
	Increased state and local tax revenues, plant expenditures, and employee spending in the community during construction and operation would result in both short-term and long-term growth in the local economy.	Tax revenues, plant expenditures, and employee spending would lead to long-term growth in the local and regional economy, infrastructure (e.g., roads), and services that may continue after the reactor is decommissioned.

10.4 BENEFIT-COST BALANCE

10.4.1 BENEFITS

The benefits (monetary and non-monetary) associated with construction and operation of the proposed Unit 3 are described in this section and outlined in Table 10.4-1. The beneficial impacts of avoided air pollutants are summarized in Table 10.4-2. The internal and external costs associated with construction and operation of Unit 3 are summarized in Table 10.4-3. The principal benefits and costs are summarized in Table 10.4-4.

10.4.1.1 Monetary Benefits

The following subsections consider the monetary benefits of constructing and operating Unit 3.

10.4.1.1.1 Tax Payments

The state of Louisiana and the parishes surrounding Unit 3 would experience an increase in the amount of taxes collected from labor, services, construction materials, and supplies purchased for the project. The state sales tax rate is 4 percent and the local sales tax rate for West Feliciana is also 4 percent. Effective July 1, 2008, the machinery and equipment purchased by a utility will be exempt from the state 4 percent sales tax. The parish has the authority also to exempt the purchase of machinery and equipment from the local sales tax. To date, West Feliciana has not opted to exempt the purchase of machinery and equipment from its 4 percent local sales tax.

Louisiana and West Feliciana Parish would benefit from property taxes related to the incremental increase in value to the entire RBS site from the additional unit 10 years after the unit is placed in service. Louisiana has an incentive program, the Industrial Property Tax Exemption program, to encourage capital investment in the state. The Industrial Property Tax Exemption abates, up to 10 years, local property taxes (Ad Valorem) on a manufacturer's new investment and annual capitalized additions. This exemption applies to all improvements to the land, building, machinery, equipment, and any other property that is part of the manufacturing process.

In Louisiana, an individual's personal income is taxed at graduated rates not to exceed 6 percent. According to the U.S. Department of Labor, construction workers in the region can be expected to earn about $45,175 annually. During peak construction, 3150 workers would add about $7.5 million in taxes to the state's annual economy. Operational workers would contribute additional taxes to the state's annual economy. It is anticipated for Unit 3 that the approximate number of workers would be 500. The 2006 NEI study (Reference 10.4-1) lists an average permanent employee wage of about $69,000 per year. At this wage, 500 operations workers would contribute $1.32 million in annual personal income taxes.

The tax revenues generated from construction and operation of Unit 3 would benefit the state and local government agencies because they would support the development of infrastructure and services in the community and promote further economic development.

10.4.1.1.2 Local and State Economy

In addition to the direct employment benefits discussed in the previous subsection, there would be employment and income multiplier impacts from the construction jobs at the RBS and the local expenditures made by the construction workforce and the purchase of materials, supplies, and services during the construction phase. As discussed in Subsection 4.4.2.4.6, the Regional Input-Output Modeling System (RIMS II) model was used to analyze the employment and income multiplier impacts to the region of neighboring parishes.

Using a levelized annual employment number of 1600 jobs for the construction period and an estimated 2005 annual salary of $45,175, the project would generate approximately $94.3 million per year in direct wages. Over a 5-year period, the project would produce approximately 8000 job-years and $472 million in direct earnings. According to RIMS II model output data, the $472 million in direct annual construction earnings is projected to generate total primary impact area earnings of $853.7 million, and the 8000 jobs at the RBS Unit 3 would generate a total of 15,237 regional jobs.

As noted earlier, the anticipated number of operational employees for Unit 3 is 500. The 500 full-time operating positions for the RBS Unit 3 would create direct economic benefits to the region, because these would be stable, high-paying positions that would be much sought after. The periodic maintenance staff needed to support the refueling and maintenance requirements of Unit 3 would provide additional direct employment and wage benefits to the neighboring parishes. It has been assumed that 100 workers represent a levelized, full-time equivalent maintenance staff, increasing the operational plus maintenance full-time equivalent staff to 600 workers. The average direct salary for the RBS Unit 3 operational and workforce staff, based on 2005 dollars, is $62,640. Over the first 30 years of Unit 3 operations, the direct payroll for the RBS Unit 3 operational and workforce staff would exceed $1.13 billion.

There would also be indirect jobs created on a long-term basis because of the economic multiplier effects of Unit 3 operation. These employment and earnings impacts were estimated through the RIMS II model. The RIMS II model results indicate that, over a 30-year period, a total of 50,818 job-years would be generated and total income effects would be $1.965 billion. For the primary impact area, Unit 3 operations would constitute a MODERATE benefit.

10.4.1.2 Non-Monetary Benefits

The following subsections consider the non-monetary benefits of constructing and operating Unit 3.

10.4.1.2.1 Net Electrical Generating Benefits

As discussed in Section 8.4, there is a growing baseload deficit (between demand and supply) in the Entergy Electric System (EES). Unit 3 is expected to generate approximately 1520 megawatts electric (MWe) net (Subsection 5.7.1). Assuming an average capacity factor of 90 percent, the plant average annual electrical-energy generation is approximately 12,000,000 megawatt-hours. This new unit would provide a benefit to the EES by helping to meet the growing industrial, commercial, and residential baseload needs (Section 8.4).

10.4.1.2.2 Fuel Diversity, Dampened Price Volatility, and Enhanced Reliability

Energy diversity is key to providing a reliable and affordable electrical power supply system. Achieving a balanced mix of electrical generation technologies lowers the risk of future price fluctuations and adverse consequences that can result from fossil fuel supply disruptions (Reference 10.4-2). History indicates that energy supply systems are more exposed to price fluctuations and potential fuel supply disruptions if there is an over-reliance on any single energy source. Overall, a balanced energy portfolio has been the key to providing the United States with a growing supply of affordable electricity for the past 30 years (Reference 10.4-3).

Implementing a fuel diversity strategy is primarily a matter of maintaining a balance of fuel mixes. The SSRP indicates that approximately 20 percent of electricity generated by Entergy subsidiaries in the region was a result of burning coal, 30 percent was generated by natural gas and oil, and 50 percent was generated by nuclear power (Reference 10.4-4). The high natural gas prices and the intense, recurring periods of price volatility experienced in recent years have been driven, at least in part, by demand for natural gas used in the electric generation sector. The large number of new gas-fired electric plants built in the United States during the last decade has bolstered electric sector demand for natural gas. Natural gas plants have accounted for more than 90 percent of all new electric generating capacity added over the past 5 years. Natural gas has many desirable characteristics and should be part of, but not dominate, the fuel mix because "over-reliance on any one fuel source leaves consumers vulnerable to price spikes and supply disruptions" (Reference 10.4-5).

Natural gas-fired plants rely on a fuel whose price is subject to change almost on a daily basis. This change in fuel price is directly translated into variable costs for the electricity produced. While the price of uranium also changes, nuclear power plants do not rely on replacing fuel on a daily basis. Nuclear fuel costs have many components, including uranium mining and milling, conversion to UF_6, enrichment services, fuel fabrication, and spent fuel management and disposition. Historically, all of these costs have added up to less than 10 percent of the total nuclear generation cost (or approximately 25 percent of the production cost) when one considers only fuel and O&M costs (Reference 10.4-6). This relatively low percentage of total costs attributable to fuel costs provides a price stability that is not available from generating plants fueled with natural gas. Although nuclear plants are capital-intensive to build, and this fact must be taken into account in cost-effective resource planning, the operating costs are relatively stable (Reference 10.4-5).

Development of a new nuclear power plant at the RBS advances the Congressional goal of obtaining a diversified mix of electrical generating sources. The RBS also furthers the stated goal of creating new nuclear baseload generating capacity.

10.4.1.2.3 Effects on Regional Productivity

The construction of the new facility would employ, at peak construction, about 3150 people; 2363 people would be hired locally, and 788 would relocate to the primary impact area. Temporary construction workers and their families would increase rental and property demand, spending on goods and services, and sales taxes that benefit the local economy. The operation of Unit 3 requires additional people beyond those required to operate Unit 1, whose benefit to the region would extend through the life of the plant.

10.4.1.2.4 Air Pollution and Emissions Avoidance

Natural gas and coal-fired electrical generation plants produce air pollutant emissions (e.g., nitrogen oxides, sulfur dioxide, carbon dioxide, and methyl mercury). With respect to all industrial sources, fossil-fueled power plants account for the following emissions in the United States:

- Sulfur dioxide: 64 percent.
- Nitrogen oxides: 26 percent.
- Mercury: 33 percent.
- Carbon dioxide: 36 percent.

Coal-fired plants generate the majority of power plant emissions (Reference 10.4-7).

Modern nuclear reactors produce relatively small levels of pollutant air emissions when compared to the principal viable energy alternatives, coal and natural gas. Nuclear power generation, therefore, leads to significant local and national air quality benefits, particularly with respect to greenhouse gases (carbon dioxide and other greenhouse gases are produced by generation of electricity from fossil fuels) that contribute to global warming (Reference 10.4-8). With respect to aesthetics, nuclear reactors have the benefit that they do not contribute to smog.

Section 9.3 analyzes alternatives to the proposed action, such as coal- and natural gas-fired plants. The effects of avoided air pollutant emissions from building Unit 3 in lieu of equivalent fossil fuel plants may be seen in the hypothetical comparisons contained in Table 10.4-2.

10.4.1.2.5 Greenhouse Gases and Global Warming Advantages

Fossil fuel air emissions, particularly carbon dioxide, are widely believed by the scientific community to contribute to the greenhouse effect and, consequently, global climate change and global warming. According to one recent study, if environmental policies, agreements, or regulations greatly restrict carbon emissions in the future, the cost of building and operating fossil-fired plants is likely to increase (Reference 10.4-9). Currently, nuclear power is the only available and proven technology that provides a viable alternative to fossil-fired plants for baseload electrical generation without emitting large volumes of greenhouse gases.

10.4.1.3 Other Benefits

Section 10.3 describes the relationship between short-term uses and long-term productivity of the human environment. Additional benefits of deploying Unit 3 include an associated reduction in dependence on foreign energy sources and vulnerability to energy disruptions.

As the nation's liquefied natural gas imports increase, there is a related impact on the "energy security" of the country (Reference 10.4-9). With greater reliance on and import of natural gas, there is also a related economic impact on the nation's balance of trade. Energy generation from Unit 3 represents a potential for reducing the foreign trade deficit by way of decreased reliance on imported natural gas. In addition, the deployment of Unit 3 has the effect of reducing the rate of depletion of the nation's finite fossil fuel supplies.

These benefits are described in Table 10.4-1 and are summarized in Table 10.4-4.

10.4.2 COSTS

This subsection identifies both internal and external costs associated with the construction and operation of the proposed Unit 3. The term "internal" generally refers to the monetary costs associated with a project, while the term "external" refers to non-monetary environmental costs of constructing and operating a new plant. These costs are outlined in Table 10.4-3 and are summarized in Table 10.4-4.

Cost data presented in this section are based on the referenced studies.

Many of the cost attributes described in this section are detailed in Sections 10.1, 10.2, and 10.3.

10.4.2.1 Internal Costs

This subsection describes the monetary costs of constructing and operating Unit 3. Internal costs include capital costs of the plant and transmission lines and operating costs (staffing, maintenance, and fuel) as well as decommissioning costs.

There are many cost studies in the available literature, with a wide range of cost estimates. Because of the depth of their analyses and the fact that other studies tend to be based on them, the following four studies are among the most informative sources:

- Organization for Economic Co-operation and Development (OECD) Study (Reference 10.4-10).
- Massachusetts Institute of Technology (MIT) Study (Reference 10.4-8).
- University of Chicago (UC) Study (Reference 10.4-9).
- Energy Information Administration (EIA) Study (Reference 10.4-11).

It should be noted that until detailed design engineering is performed for the project, a precise cost estimate cannot be developed.

10.4.2.1.1 Construction

The projected internal monetary costs related to the construction of Unit 3 are provided in Section 3.1 of Part 1 (General and Administrative Information) of this COLA.

10.4.2.1.2 Operation

Operational expenses, which would be incurred throughout the life of the plant, include costs for O&M, fuel, and decommissioning (Reference 10.4-8). Operational costs for power plants are frequently expressed as the levelized cost of electricity, which is the price at the busbar needed to cover operating costs and annualized capital costs. Overnight capital costs account for approximately one-third of the levelized cost, and interest costs on the overnight costs account for another 25 percent (Reference 10.4-9). Fuel costs, along with fixed and variable O&M costs, account for the remainder.

Specifically regarding fuel costs, the UC study (Reference 10.4-9) provides reasonable estimates of this component of the overall levelized costs of electricity. This study lists fuel costs along with O&M costs under the assumption that no policies benefiting nuclear power are in effect. These costs are included in calculations of the levelized costs of electricity.

This study lists cost parameters for fuel and O&M costs as follows:

- Nuclear Fuel Cost - $4.35 per MWh.
- Nuclear Fixed O&M Cost - $60 per installed kW capacity.
- Nuclear Variable O&M Cost - $2.10 per MWh.

The studies described above show a wide disparity in the range of operational cost estimates. The EIA study (Reference 10.4-11) shows that the levelized costs of nuclear power exceed those for other fuels, but projects that nuclear operating costs will become competitive with coal and natural gas by the year 2030. The OECD study (Reference 10.4-10) lists a range of $21 to $50 per MWe hour (in 2005 dollars). The UC study (Reference 10.4-9) lists a range of $44 to $58 per MWe hour (in 2003 dollars). The MIT study (Reference 10.4-8) lists $67 per MWe hour (in 2002 dollars). Factors affecting this range include choices for discount rate, construction duration, plant lifespan, capacity factor, cost of debt and equity, the split between debt and equity financing, depreciation time, tax rates, and premium for uncertainty. These estimates also include decommissioning, but because of the effect of discounting a cost that occurs as much as 40 years into the future, decommissioning costs have relatively little effect on the levelized cost. Decommissioning costs are described in Section 5.9. The aforementioned studies suggest a range of $50 to $60 per MWe hour as a reasonable estimate of levelized costs.

The previously cited studies also provide coal- and natural gas-fired generation costs for comparison with nuclear generation costs. The OECD study (Reference 10.4-10) shows nuclear costs competitive with those of natural gas and coal. The other studies show nuclear costs exceeding cost estimates for natural gas and coal. Many of the studies in which nuclear cost is considered not to be competitive with other generation sources also contain scenarios for which nuclear is shown to be not only competitive but the generation source of choice compared to natural gas or fossil fuels. The scenarios presented in these studies include those where natural gas prices exceed the $5 to $7 per million Btu price range, and the event where caps might be placed on the emission of greenhouse gases such as carbon dioxide that would materially affect the cost of operating a coal-fired plant.

The MIT study (Reference 10.4-8) indicated that new nuclear power is not economically competitive but suggested steps that the government could take to improve nuclear economic viability. Since the study was published, the government has undertaken these steps as follows:

- The U.S. Department of Energy (DOE) provided financial support for plants testing the NRC licensing processes for early site permits and combined licenses.
- The U.S. government endorsed nuclear energy as a viable carbon-free generation option.
- The Energy Policy Act of 2005 instituted a production tax credit for the first advanced reactors brought on-line in the United States. The Energy Policy Act of 2005 provides for a 1.8 cent per kilowatt-hour production tax credit for qualifying new nuclear generating units (Reference 10.4-12). The Secretary of Energy is allowed to enter into contracts for standby support for delays for up to a total of six reactors of no more than three different reactor designs. The Secretary of Energy would pay up to 100 percent of costs related to delays caused by the NRC for the first two reactors that have received a license and for which construction has begun. The next four reactors would receive up to 50 percent of costs related to such delays. Finally, Title XVII of the Act provides for loan guarantees for up to 80 percent of eligible project costs. Eligible projects include those that avoid, reduce, or sequester air pollutants.

Consequently, the recent government steps and incentives have broadly altered the key assumptions in the MIT study. The conclusions of the MIT study do not take into account the recent government incentives (Reference 10.4-8).

Measures to control adverse impacts related to operation are discussed in Section 5.10. There are monetary costs associated with the design and implementation of these measures, which include such activities as training employees in environmental compliance and safety; treatment, storage, and disposal of any hazardous wastes generated; and acquisition and compliance with required operational permits and environmental requirements.

10.4.2.2 External Costs

This section describes the external (non-monetary) environmental and social costs of constructing and operating Unit 3. Impacts of construction and operation of the proposed project at RBS are described in Sections 4.6 and 5.10. Section 10.1 also provides details regarding potential mitigation and the unavoidable adverse impacts after mitigation have been considered. Many mitigation measures would be built into the project design, such as scheduling to ensure that construction is completed in the shortest possible time; using construction BMPs to limit erosion, fugitive dust, runoff, spills and air emissions; and providing first-aid stations at the construction site.

10.4.2.2.1 Land Use

Unit 3 is designed to occupy 43 ac. of the 3330-ac. RBS site. About half of the land to be occupied by the new unit has been previously cleared during construction of Unit 1. Most of the remaining land use is upland forest. Loss of this habitat is an external cost of the construction of Unit 3. A detailed description of the land use impacts is provided in Section 4.1. The cost in land use for a nuclear-powered generating plant is about the same as that for a natural gas-fired plant and less than that for a coal-fired plant of comparable size.

The new off-site 148 mi. transmission ROW route would occupy 3334 ac. and was chosen to accommodate the new line and towers in areas of sparser population density. The primary land uses throughout the corridor include agricultural fields, forest, and open space.

10.4.2.2.2 Hydrological and Water Use and Discharge

Sections 4.2 and 5.2 address hydrologic alterations for construction and operation. As discussed in these sections, there are some costs associated with providing water for various needs during construction and operation. The majority of water used for Unit 3 operations would be surface water drawn from the Mississippi River. This water use represents only a small fraction of available water even at low flow conditions and was judged to be SMALL. There are also costs associated with the consumption of potable water from the West Feliciana Parish Water System. Use of surface water by the site should not affect off-site users in terms of either water availability or water quality. Relatively small levels of nonradioactive and radioactive effluents are introduced into the Mississippi River (after treatment). Water quality effects of chemical effluents discharged to the Mississippi River during Unit 3 operations are discussed in Subsection 5.2.2 and are judged to be SMALL. Cooling water blowdown that discharges to the Mississippi River would result in a thermal plume. Effects of a thermal plume on the Mississippi River would be SMALL and localized.

10.4.2.2.3 Air Emissions

As indicated in Table 10.4-2, a new nuclear unit the size of Unit 3 provides a substantial reduction of emissions compared to natural gas- and coal-powered generation alternatives. Some of the benefits of reduced emissions related to use of nuclear power for electricity generation are offset by emissions related to the uranium fuel cycle (e.g., emissions from mining and processing the fuel). However, similar types of emissions are associated with mining and production of coal and, to some extent, drilling for natural gas.

Diesel generators, auxiliary boilers and equipment, and vehicles would produce air emissions that have a SMALL impact on workers and local residents (Subsection 5.8.1.2). Cooling towers would produce drift that deposits some salt on the surrounding vicinity. However, the level is unlikely to result in any measurable impact on plants and vegetation. Cooling towers also produce steam plumes that may partially obstruct the viewscape. These impacts from cooling towers would be SMALL (Section 5.3).

10.4.2.2.4 Terrestrial and Aquatic Biology

Ecological effects related to plant construction and operations are discussed in Sections 4.3 and 5.3, respectively. Some cost due to mortality of wildlife during construction is anticipated. These losses should not be large enough to affect the long-term stability of wildlife populations. The cooling system, including the makeup water intake structure, is designed to reduce loss of aquatic biota as a result of impingement and entrainment to levels deemed acceptable by the LDEQ and the EPA. The construction of the new embayment and the intake structures and maintenance dredging of the embayment should result in minor and temporary effects to aquatic biology. Impacts to terrestrial and aquatic species from nuclear power plants with closed-cycle cooling are smaller than impacts from comparably sized coal- or natural gas-fired plants (Section 9.2 and Table 9.2-1). Impacts to terrestrial and aquatic species from Unit 3 construction and operations are anticipated to be SMALL.

10.4.2.2.5 Hazardous and Nonradioactive Emissions, Effluents, and Wastes

Relatively small amounts of air emissions from diesel generators, auxiliary boilers and equipment, and vehicles are generated from nuclear power plant operation. Cooling tower drift deposits some salt on the surrounding vicinity, but the level is unlikely to result in any measurable impact on plants and vegetation (Section 5.3). Cooling towers also produce an atmospheric vapor plume. Small amounts of hazardous effluents are components of the proposed plant discharges into the Mississippi River. Relatively small amounts of hazardous wastes would be generated that need to be managed and disposed of pursuant to the Resource Conservation and Recovery Act (RCRA). Section 3.6 discusses nonradioactive waste systems.

10.4.2.2.6 Hazardous and Radioactive Emissions, Effluents, and Wastes

Operation of the proposed plant would include minor radioactive air emissions to the atmosphere (Subsection 5.4.2.2). Relatively small levels of radioactive effluents would be generated and discharged into the Mississippi River after treatment (Subsection 5.4.2.1).

Low-level radioactive wastes would be generated and stored, treated, and disposed of in a licensed landfill. High-level radioactive spent fuel would be generated and isolated (or possibly reprocessed) in a geological repository for thousands or tens of thousands of years. Section 3.5 discusses the radioactive waste management system.

10.4.2.2.7 Materials, Energy, and Uranium

Construction of the nuclear unit results in an irreversible and irretrievable commitment of materials and energy (Section 10.2). Operation of the reactors contributes to the depletion of uranium.

10.4.2.2.8 Postulated Accidents

The potential radiological effects of various types of postulated accidents are discussed in Chapter 7. The analysis concluded that the potential radiological environmental impacts from a postulated accident from the operation of one additional nuclear unit at the RBS site would be SMALL. The probability of such accidents is very small. The costs of postulated accidents would be large.

10.4.2.2.9 Socioeconomic Costs

Sections 4.4 and 5.8 address socioeconomic costs related to construction and operation of a new unit at the RBS. Because of the site's industrial nature and its isolated location, impacts on aesthetics and recreation would be SMALL. Impacts on public services and infrastructure would also be SMALL throughout the region unless West Feliciana Parish unexpectedly receives a share of the in-migrating construction workers substantially higher than the projected level. In that case, impacts on housing and education in West Feliciana Parish would be SMALL.

10.4.2.3 Alternatives

10.4.2.3.1 Energy Alternatives

As discussed in Section 9.2, available information was reviewed on the environmental impacts of power generation alternatives compared to the construction of Unit 3 at the RBS site. On the basis of that review and from an environmental perspective, none of the viable energy alternatives are obviously superior to construction of a new baseload nuclear power generation plant.

10.4.2.3.2 Design Alternatives

Alternatives to proposed system designs, including heat dissipation, circulating water, and transmission systems, are evaluated in Section 9.4. Review of these system design alternatives identified no obviously superior, cost-beneficial design alternatives.

10.4.2.3.3 Site Alternatives

As required by 10 CFR 52.17(a)(2), Entergy completed an analysis of alternatives to the proposed RBS site for the construction and operation of a new nuclear facility. The NRC mandates that reasonable alternatives to this action be evaluated. Consistent with this requirement, the site selection decision process focused on those alternative sites that are considered to be reasonable with respect to the purpose of this application for a new nuclear facility. Section 9.3 presents the site alternatives analysis.

Because of these conclusions, energy and design alternatives were not further evaluated regarding benefits and costs.

10.4.3 CONCLUSION

As discussed in Section 8.4, there is a growing baseload demand and growing baseload supply shortfall for the region of interest. With the addition of Unit 3, the RBS can continue to meet electric power needs in the region. The tax revenues generated from construction and operation of Unit 3 would benefit state and local governments by supporting development of infrastructure and services that promote further economic development. These tax benefits could aid in offsetting the socioeconomic costs associated with the influx of additional construction and operations workers for the new unit.

Unit 3 is designed to generate electricity in a manner that results in significant reduction in emissions when compared to comparably sized coal- or natural gas-fired alternatives. These reductions outweigh emissions associated with fuel cycle emissions related to mining and processing nuclear fuel. As discussed in this section, Unit 3 also has important strategic implications in terms of lessening the dependence of the United States on foreign energy supplies, and their potential interruption, as well as vulnerability to volatile price changes or changing political agendas.

On balance, the benefits of construction and operation of Unit 3 significantly outweigh the monetary, environmental, and social costs. Both the principal benefits and costs are summarized in Table 10.4-4.

10.4.4 REFERENCES

10.4-1 Nuclear Energy Institute, "Economic Benefits of Grand Gulf Nuclear Station," 2006, Website, http://www.nei.org/filefolder/grand_gulf_economic_benefits_report.pdf, accessed July 3, 2008.

10.4-2 Edison Electric Institute, "Fuel Diversity," Website, http://www.eei.org/industry_issues/energy_infrastructure/fuel_diversity/index.htm, accessed February 14, 2008.

10.4-3 Center for Energy and Economic Development, "Fuel Diversity," Website, http://www.ceednet.org/ceed/index.cfm?cid=7500,7583, accessed February 14, 2008.

10.4-4 Entergy Electric System, "Strategic Supply Resource Plan for the Planning Period 2007 - 2016," Plan Summary Document, October 20, 2006.

10.4-5 Nuclear Energy Institute, "Nuclear Energy's Role in Reducing Demand for Natural Gas Through Diversification of Energy Sources Used for Electricity Generation," Conference on Natural Gas Supply and Demand, U.S. Senate, Energy and Natural Resources Committee, January 24, 2005.

10.4-6 The Keystone Center, "Nuclear Power Joint Fact-Finding," June 2007, Website, http://www.keystone.org/spp/documents/FinalReport_NJFF6_12_2007(1).pdf, accessed April 3, 2008.

10.4-7 U.S. House of Representatives, "Securing America's Energy Future," Majority Staff Report to Committee on Government Reform and Subcommittee on Energy and Resources," May 8, 2006, Website, http://www.nei.org/documents/House_Energy_Report_5-8-06.pdf, accessed February 15, 2008.

10.4-8 Massachusetts Institute of Technology, "The Future of Nuclear Power, An Interdisciplinary MIT Study," 2003, Website, http://web.mit.edu/nuclearpower/, accessed February 15, 2008.

10.4-9 University of Chicago, "The Economic Future of Nuclear Power; A Study Conducted at The University of Chicago," August 2004, Website, http://np2010.ne.doe.gov/reports/NuclIndustryStudy.pdf, accessed February 15, 2008.

10.4-10 International Energy Agency, Organization for Economic Co-operation and Development, and International Energy Agency, *Projected Costs of Generating Electricity; 2005 Update*, Website, http://www.iea/org/Textbase/publications/free_new_Desc.asp?PUBS_ID=1472, accessed February 15, 2008.

10.4-11 U.S. Department of Energy, Energy Information Administration, "Annual Energy Outlook 2004," January 2004, Website, http://www.eia.doe.gov/oiaf/archive/aeo04/pdf/0383(2004).pdf, accessed February 15, 2008.

10.4-12 U.S. Department of Energy, Office of Nuclear Energy, "Energy Policy Act of 2005 (summary information)," Website, http://www.ne.doe.gov/energyPolicyAct2005/neEPACT2a.html, accessed September 5, 2007.

Table 10.4-1
Monetary and Non-Monetary Benefits of Unit 3

Benefit Category	Unit 3 Project as Proposed
Construction Workers	An influx of 3150 workers (Subsection 10.4.1.1.1) would create an incremental increase in indirect jobs, permanent or temporary, within the region.
Operational Workers	An influx of 500 direct jobs (Subsection 10.4.1.1.1) would result in an incremental increase in indirect jobs in the region.
Net Generating Capacity	1520 MWe (Subsection 10.4.1.2.1).
Annual Electricity Generated (operating at 85 to 93 percent capacity)	~12,000,000 MWh (Subsection 10.4.1.2.1).
Fuel Diversity	An increase in fuel mix diversity would reduce potential energy disruptions and other adverse consequences (Subsection 10.4.1.2.2).
Emissions Reduction	Sulfur oxides, nitrogen oxides, carbon monoxide, mercury, and particulates associated with fossil fuel-powered generating plants would be avoided (Subsection 10.4.1.2.4). A significant beneficial impact in terms of avoidance of air emissions would be realized.
Electrical Reliability	Electrical reliability would be enhanced (Subsection 10.4.1.2.2).
Price Volatility	The potential for price volatility would be reduced (Subsection 10.4.1.2.2).
Global Warming and Climate Change	A significant beneficial impact in terms of avoidance of greenhouse gases would be realized (Subsection 10.4.1.2.5).
Aesthetics	Nuclear plants do not produce the smog that is associated with fossil-fueled plants (Subsection 10.4.1.2.4).
Socioeconomics	Increased tax revenue would support improvements to public infrastructure and social services. The increased revenue would spur future growth and development (Subsection 10.4.1.1.1).
Dependence on Foreign Energy	Dependence on foreign energy would be reduced and vulnerability to energy disruptions would be less (Subsection 10.4.1.3).
Foreign Trade Deficit	The foreign trade deficit would be reduced (Subsection 10.4.1.3).
Fossil Fuel Supplies	Usage of finite fossil fuel supplies would be offset (Subsection 10.4.1.2.2).

Table 10.4-2
Air Pollutant Emissions Avoided During Operation

Pollutant	Coal Emissions (tons per year/ 2032 MWe)[a]	Natural Gas Emissions (tons per year/2032 MWe)[a]	Nuclear Emissions (tons per year)
SO_2	13,340	120	22
NO_x	12,800	460	30
CO	1650	610	3
Particulate Matter with Diameter Less than 10 Microns (PM_{10})	390	70	67

Source of pollutant, coal emissions, and natural gas emissions data: NUREG-1817, Tables 8-1 and 8-2.

a) Data evaluated came from four 508 MWe coal-fired plants operating at 80 percent capacity; combined, this value is equivalent to the RBS Unit 3 project at 1600 MWe.

Table 10.4-3 (Sheet 1 of 2)
Internal and External Costs of Unit 3

Cost Category	Cost
Internal Costs	
Levelized Overnight Capital Costs	A levelized overnight capital cost of $3250 to $4000 per kWe selected as a reasonable estimate (Subsection 10.4.2.1.1).
Construction Costs	$5.2 to $6.5 billion (Subsection 10.4.2.1.1).
Levelized Cost of Operation	Levelized operational costs are estimated at $50 to $60 per MWe hour (Subsection 10.4.2.1.2).
External Costs	
Land and Land Use	Unit 3 would occupy approximately 43 ac. of the approximately 3330-ac. existing RBS site. SMALL impact (Subsection 10.4.2.2.1).
	The proposed 148-mi. transmission ROW expansion would occupy approximately 3334 ac. of different land use types, including agricultural lands, forest, and wetlands.
	Irretrievable geological resources during uranium mining and fuel cycle. SMALL impact (Subsection 10.4.2.2.7).
Hydrological and Water Use and Discharge	There is some cost associated with providing water for various needs during construction and operation. Cooling water is taken from the Mississippi River after treatment. Potable water would be provided by the West Feliciana Parish. SMALL impact (Subsection 10.4.2.2.2).
	Relatively small levels of hazardous and/or radioactive effluents introduced into the Mississippi River. SMALL impact (Subsection 10.4.2.2.6).
	Thermal plume resulting from cooling water blowdown discharged to the Mississippi River. The effect of this thermal plume is SMALL and localized (Subsection 10.4.2.2.2).
Terrestrial and Aquatic Species	Some cost to wildlife from mortality during construction and operations is anticipated. However, these costs do not affect long-term wildlife populations. Wildlife mortality, including aquatic biota, during construction and operation is expected to be SMALL (Subsection 10.4.2.2.4).

Table 10.4-3 (Sheet 2 of 2)
Internal and External Costs of Unit 3

Cost Category	Cost
Radioactive Effluents and Emissions	Radioactive waste is generated. The plant produces radioactive air emissions. Relatively small levels of radioactive effluents are introduced into the Mississippi River after treatment. SMALL impact (Subsection 10.4.2.2.6).
Hazardous and Radioactive Waste	Storage, treatment, and disposal of low-level radioactive waste. SMALL impact (Subsection 10.4.2.2.6). Geological resources for disposal of radioactive spent fuel. SMALL impact (Subsection 10.4.2.2.6).
Air Emissions	Air emissions from diesel generators, auxiliary boilers and equipment, and vehicles that have a SMALL impact on workers and local residents (Subsection 10.4.2.2.3). Cooling tower drift that deposits some salt on the surrounding vicinity, but the level is unlikely to result in any measurable impact on plants and vegetation. Cooling tower atmospheric plume discharge. SMALL impact (Subsection 10.4.2.2.3).
Materials, Energy, and Uranium	Irreversible and irretrievable commitments of materials and energy, including depletion of uranium. SMALL impact (Subsection 10.4.2.2.7).
Postulated Accidents	The costs of postulated accidents would be large. However, the probability of such accidents is very small. Therefore, the overall probability-weighted costs of postulated accidents are SMALL (Subsection 10.4.2.2.8).
Socioeconomic	Construction of Unit 3 may pose additional costs to public and social services in the area. However, increased tax revenues generated directly and indirectly by plant construction and operation could aid in offsetting these costs. MODERATE beneficial impact (Subsection 10.4.2.2.9). Impacts on aesthetics and recreation would be SMALL. Impacts on public services and infrastructure would also be SMALL throughout the region (Subsection 10.4.2.2.9).

Table 10.4-4 (Sheet 1 of 3)
Summary of Principal Benefits and Costs for Constructing and Operating Unit 3

Attribute	Benefits and Costs
BENEFITS	
Net Electrical Generation	Provides a relatively clean and abundant form of baseload electricity that is relatively cost-competitive with fossil fuels (Subsection 10.4.1.2.2).
	Provides electrical generation of approximately 12,000,000 MWh (Subsection 10.4.1.2.1).
Regional Productivity	An influx of 3150 construction workers also creates indirect jobs; permanent or temporary (Subsection 10.4.1.1.1).
	An influx of 500 direct operational jobs also results in an increase in indirect jobs (Subsection 10.4.1.1.1).
	Provides relatively clean, reliable, price-competitive source of energy. Creates jobs and stimulates local economy (Subsection 10.4.1).
Fuel Diversity	Increases fuel mix diversity that reduces potential energy disruptions and other adverse consequences (Subsection 10.4.1.2.2).
Electrical Reliability	Enhances electrical reliability (Subsection 10.4.1.2.2).
Price Volatility	Dampens potential for price volatility (Subsection 10.4.1.2.2).
Air Pollution	Provides a major beneficial impact in terms of significant reduction in power plant air emissions (Subsection 10.4.1.2.4).
Aesthetics	Does not contribute to viewscape obscuring smog, as is the case with fossil-fueled plants (Subsection 10.4.1.2.4).
Global Warming and Climate Change	Provides significant beneficial impact in terms of avoidance of greenhouse gases (Subsection 10.4.1.2.5).
Dependence on Foreign Energy	Reduces dependence on foreign energy and vulnerability to energy disruptions (Subsection 10.4.1.3).
Foreign Trade Deficit	Reduces foreign trade deficit (Subsection 10.4.1.3).
Fossil Fuel Supplies	Offsets usage of finite fossil fuel supplies (Subsection 10.4.1.3).
Land and Land Use	Consumes about the same amount of land as a comparable gas-fired plant and less land than a comparable coal-fired plant (Subsection 10.4.2.2.1).

Table 10.4-4 (Sheet 2 of 3)
Summary of Principal Benefits and Costs for Constructing and Operating Unit 3

Attribute	Benefits and Costs
BENEFITS	
Hydrological and Water Use	Produces a cleaner form of energy (lower air emissions) than either coal- or gas-fired plants, which benefits water quality (Subsection 10.4.2.2.2).
Terrestrial and Aquatic Species	Produces a relatively clean form of energy with smaller levels of impacts on terrestrial and aquatic species than is expected from either a comparable coal- or gas-fired plant (Subsection 10.4.2.2.4).
Materials, Energy, and Uranium	Reduces the amount of finite fossil fuels used if a comparable coal- or gas-fired plant were built instead (Subsection 10.4.2.2.7).
Socioeconomic	Increased tax revenues will be generated directly and indirectly by plant construction and operation. Increased tax revenue supports improvements to public infrastructure and social services. Increased taxes and revenue spurs future growth and development (Subsection 10.4.2.2.9).
COSTS	
Capital and Operating Costs	Levelized overnight capital costs are estimated at $3250 to $4000 per kWe. Construction costs are estimated at $5.2 to $6.5 billion (Subsection 10.4.2.1.1). Levelized operational costs are estimated at $50 to $60 per MWe hour (Subsection 10.4.2.1.2).
Aesthetics	Produces a relatively small vapor plume that can obscure the viewscape (Subsection 10.4.2.2.3).
Fossil Fuel Supplies	Consumes finite supplies of uranium (Subsection 10.4.2.2.7).
Land and Land use	Unit 3 would occupy approximately 43 ac. of the approximately 3330-ac. existing RBS site (Subsection 10.4.2.2.1).
Hydrological and Water Use	Consumes some water through cooling tower evaporation. Produces a thermal plume, and small amounts of chemicals and radioactive waste are discharged into the Mississippi River after treatment (Subsection 10.4.2.2.2).
Terrestrial and Aquatic Species	Some cost to wildlife from mortality as a result of construction and operation of the plant (Subsection 10.4.2.2.4).

**Table 10.4-4 (Sheet 3 of 3)
Summary of Principal Benefits and Costs for Constructing and Operating Unit 3**

Attribute	Benefits and Costs
COSTS	
Hazardous and Radioactive Waste	Relatively small quantities of hazardous and low-level and high-level radioactive waste are generated that require storage, treatment, and disposal (Subsection 10.4.2.2.5 and 10.4.2.2.6).
	Storage, treatment, and disposal of high-level radioactive spent nuclear fuel (Subsection 10.4.2.2.6).
	Commitment of underground geological resources for disposal of radioactive spent fuel (Subsection 10.4.2.2.6).
Materials, Energy, and Uranium	Irreversible and irretrievable commitments of materials and energy, including depletion of uranium (Subsection 10.4.2.2.7).
Postulated Accidents	The costs of postulated accidents would be large. However, the probability of such accidents is very small. Therefore, the overall probability-weighted costs of postulated accidents are SMALL (Subsection 10.4.2.2.8).
Socioeconomic	Construction of Unit 3 places additional burdens on public infrastructure and social services. The growth and development changes the local character of surrounding community. SMALL impact (Subsection 10.4.2.2.9).