South Texas Project

Applicant's Environmental Report –

Operating License Renewal Stage

South Texas Project

Units 1 & 2

September 2010

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ACRONYMS AND ABBREVIATIONS

AADT	Average Annual Daily Traffic
ABWR	Advanced Boiling Water Reactor
ac-ft	acre-foot
AQCR	Air Quality Control Region
Bcf	billion cubic feet
BLM	Bureau of Land Management
B.P.	Before Present
Btu	British thermal unit
°C	degrees Celsius
$CaCO_3$	calcium carbonate (limestone)
CAIR	Clean Air Interstate Rule
$CaSO_3$	calcium sulfite
CBC	Christmas Bird Count
CEQ	Council on Environmental Equality
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CO	Carbon monoxide
COL	Combined license
COLA	Combined license application
CPGCD	Coastal Plains Groundwater Conservation
CWA	Clean Water Act
CWIS	cooling water intake structure
DO	dissolved oxygen
DSM	demand-side management
EIS	Environmental Impact Statement
ERCOT	Electric Reliability Council of Texas
°F	Degrees Fahrenheit
FERC	Federal Energy Regulatory Commission
FES	Final Environmental Statement
FES-OP	final environmental statement for operations
FM	farm-to-market road
FR	Federal Register

ACRONYMS AND ABBREVIATIONS (CONTINUED)

FSAR	Final Safety Analysis Report
ft^3	cubic foot
GEIS	Generic Environmental Impact Statement [for License Renewal of Nuclear Plants]
gpm	gallons per minute
GMFMC	Gulf of Mexico Fishery Management Council
Hg	mercury
HL&P	Houston Lighting and Power
IOU	investor-owned utility
IPP	independent power producer
ISD	independent school district
ISO	Independent System Operator
kWh	kilowatt-hour
kV	kilovolt
lb	pound
LCRA	Lower Colorado River Authority
mA	milliamperes
MCR	Main Cooling Reservoir
mg/L	milligrams per liter
MiSA	micropolitan statistical area
MM	million
MSA	metropolitan statistical area
MSL	mean sea level
MWd	megawatt-day
MWe	megawatts-electric
MWt	megawatts-thermal
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NESC	National Electrical Safety Code
NOAA	National Oceanic and Atmospheric Administration
NO_2	nitrogen dioxide
NOIE	non-opt-in entity

ACRONYMS AND ABBREVIATIONS (CONTINUED)

NO_x	oxides of nitrogen
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRHP	National Register of Historic Places
NSPS	New Source Performance Standard
pCi/L	picocuries per liter
PM_{10}	particulates with diameters less than 10 microns
$PM_{2.5}$	particulates with diameters less than 2.5 microns
ppt	parts per thousand
PRB	Powder River Basin
PWR	pressurized water reactor
PUCT	Public Utility Commission of Texas
REP	retail electric providers
RMPF	Reservoir Makeup Pumping Facility
SAMA	severe accident mitigation alternatives
SCR	selective catalytic reduction
SECA	Solid State Energy Conversion Alliance
SGC	Swedish Gas Centre
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SMITTR	surveillance, monitoring, inspections, testing, trending, and recordkeeping
SO_2	sulfur dioxide
STP	South Texas Project
STPNOC	STP Nuclear Operating Company
TCEQ	Texas Commission on Environmental Quality
TEC	Texas Education Code
THC	Texas Historical Commission
TPDES	Texas Pollutant Discharge Elimination System
TPWD	Texas Parks and Wildlife Department
TWDB	Texas Water Development Board

ACRONYMS AND ABBREVIATIONS (CONTINUED)

TxDOT	Texas Department of Transportation
USACE	U.S. Army Corps of Engineers
USCB	U. S. Census Bureau
USEPA	U.S. Environmental Protect Agency
USFWS	U. S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USNRC	U.S. Nuclear Regulatory Commission

1.0 CHAPTER 1 - INTRODUCTION

1.1 PURPOSE OF AND NEED FOR ACTION

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants in accordance with the Atomic Energy Act of 1954, as amended, and NRC implementing regulations. The South Texas Project (STP), Units 1 & 2, near Bay City in Matagorda County, Texas, is operated by STP Nuclear Operating Company (STPNOC), pursuant to NRC Operating Licenses NPF-76 (expires August 20, 2027), and NPF-80 (expires December 15, 2028) under Docket Numbers STN 50-498, and STN 50-499, respectively.

STPNOC has prepared this environmental report in conjunction with its application to NRC to renew the STP Units 1 & 2 operating licenses for an additional 20-year term, in compliance with the following NRC regulations:

- Title 10, Energy, Code of Federal Regulations (CFR), Part 54, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, Section 54.23, Contents of Application-Environmental Information (10 CFR 54.23).

- Title 10, Energy, CFR, Part 51, Environmental Protection Requirements for Domestic Licensing and Related Regulatory Functions, Section 51.53, Post-Construction Environmental Reports, Subsection 51.53(c), Operating License Renewal Stage [10 CFR 51.53(c)].

NRC has defined the purpose and need for the proposed action, the renewal of the operating licenses for nuclear power plants such as STP Units 1 & 2, as follows:

> ...The purpose and need for the proposed action (renewal of an operating license) is to provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by State, utility, and, where authorized, Federal (other than NRC) decision makers....(NRC 1996a)

The renewed operating licenses would allow Unit 1 to operate until August 20, 2047 and Unit 2 to operate until December 15, 2048, providing an additional 20 years of operation beyond their current licensed operating periods of 40 years each.

1.2 ENVIRONMENTAL REPORT SCOPE AND METHODOLOGY

NRC regulations for domestic licensing of nuclear power plants require environmental review of applications to renew operating licenses. NRC regulation 10 CFR 51.53(c) requires that an applicant for license renewal submit with its application a separate document entitled Applicant's Environmental Report - Operating License Renewal Stage. In determining what information to include in the STP Units 1 & 2 Environmental Report, STPNOC has complied with NRC regulations and relied on the following supporting documents:

- NRC supplemental information in the *Federal Register* (NRC 1996a; NRC 1996b; NRC 1996c; and NRC 1999a).
- *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996d and 1999b)
- *Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses* (NRC 1996e)
- *Public Comments on the Proposed 10 CFR Part 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response* (NRC 1996f)

STPNOC has prepared Table 1-1 to verify conformance with regulatory requirements. Table 1-1 indicates where the environmental report responds to each requirement of 10 CFR 51.53(c). In addition, each section of Chapter 4 is prefaced by pertinent regulatory language and applicable supporting document language.

1.3 STP UNITS 1 & 2 LICENSEE AND OWNERSHIP

STP Units 1 & 2 is currently owned by NRG South Texas LP (NRG) (44 percent), CPS Energy (40 percent), and the City of Austin, Texas (16 percent). STPNOC is the plant operator and is authorized to act as agent for the owners and has exclusive responsibility and control over the operation and maintenance of STP Units 1 & 2. STPNOC is the license renewal applicant.

Three transmission service providers own the nine 345-kilovolt (kV) transmission lines that connect the switchyard to the offsite electrical system. CenterPoint Energy owns five lines, AEP Texas Central Company owns two lines, and CPS Energy owns two lines (STPNOC 2008).

1.4 TABLES

Table 1-1. Environmental Report Responses to License Renewal Environmental Regulatory Requirements.

Regulatory Requirement	Responsive Environmental Report Section(s)
10 CFR 51.53(c)(1)	Entire Document
10 CFR 51.53(c)(2), Sentences 1 and 2	3.0 Proposed Action
10 CFR 51.53(c)(2), Sentence 3	7.2.2 Environmental Impacts of Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(1)	4.0 Environmental Consequences of the Proposed Action and Mitigating Actions
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(2)	6.3 Unavoidable Adverse Impacts
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(3)	7.0 Alternatives to the Proposed Action 8.0 Comparison of Environmental Impacts of License Renewal with the Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(4)	6.5 Short-Term Use Versus Long-Term Productivity of the Environment
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(5)	6.4 Irreversible or Irretrievable Resource Commitments
10 CFR 51.53(c)(2) and 10 CFR 51.45(c)	4.0 Environmental Consequences of the Proposed Action and Mitigating Actions 6.2 Mitigation 7.2.2 Environmental Impacts of Alternatives 8.0 Comparison of Environmental Impact of License Renewal with the Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(d)	9.0 Status of Compliance
10 CFR 51.53(c)(2) and 10 CFR 51.45(e)	4.0 Environmental Consequences of the Proposed Action and Mitigating Actions 6.3 Unavoidable Adverse Impacts
10 CFR 51.53(c)(3)(ii)(A)	4.1 Water Use Conflicts (Plants with Cooling Ponds or Cooling Towers Using Makeup Water from a Small River with Low Flow) 4.6 Groundwater Use Conflicts (Plants Using Cooling Water Towers or Cooling Ponds that Withdraw Makeup Water from a Small River)

Table 1-1. Environmental Report Responses to License Renewal Environmental Regulatory Requirements. (continued)

Regulatory Requirement	Responsive Environmental Report Section(s)	
10 CFR 51.53(c)(3)(ii)(B)	4.2	Entrainment of Fish and Shellfish in Early Life Stages
	4.3	Impingement of Fish and Shellfish
	4.4	Heat Shock
10 CFR 51.53(c)(3)(ii)(C)	4.5	Groundwater Use Conflicts (Plants Using >100 gpm of Groundwater)
	4.7	Groundwater Use Conflicts (Plants Using Ranney Wells)
10 CFR 51.53(c)(3)(ii)(D)	4.8	Degradation of Groundwater Quality
10 CFR 51.53(c)(3)(ii)(E)	4.9	Impacts of Refurbishment on Terrestrial Resources
	4.10	Threatened or Endangered Species
10 CFR 51.53(c)(3)(ii)(F)	4.11	Air Quality During Refurbishment (Non-Attainment and Maintenance Areas)
10 CFR 51.53(c)(3)(ii)(G)	4.12	Microbiological Organisms
10 CFR 51.53(c)(3)(ii)(H)	4.13	Electric Shock from Transmission-Line-Induced Current
10 CFR 51.53(c)(3)(ii)(I)	4.14	Housing Impacts
	4.15	Public Utilities: Public Water Supply Availability
	4.16	Education Impacts from Refurbishment
	4.17	Offsite Land Use
10 CFR 51.53(c)(3)(ii)(J)	4.18	Transportation
10 CFR 51.53(c)(3)(ii)(K)	4.19	Historic and Archaeological Resources
10 CFR 51.53(c)(3)(ii)(L)	4.20	Severe Accident Mitigation Alternatives
10 CFR 51.53(c)(3)(iii)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
	6.2	Mitigation
10 CFR 51.53(c)(3)(iv)	5.0	Assessment of New and Significant Information
10 CFR 51, Appendix B, Table B-1, Footnote 6	2.6.2	Minority and Low-Income Populations

1.5 CHAPTER 1 REFERENCES

NRC (U.S. Nuclear Regulatory Commission) 1996a. Environmental Review for Renewal of Nuclear Power Plant Operating Licenses, Federal Register 61(109): 28467–28497. June 5.

NRC (U.S. Nuclear Regulatory Commission) 1996b. Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Correction," Federal Register 61 (147): 39555–39556. July 30.

NRC (U.S. Nuclear Regulatory Commission) 1996c. Environmental Review for Renewal of Nuclear Power Plant Operating Licenses, Federal Register 61 (244): 66537–66554. December 18.

NRC (U.S. Nuclear Regulatory Commission) 1996d. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS), Volumes 1 and 2. NUREG-1437, Washington, DC. May.

NRC (U.S. Nuclear Regulatory Commission) 1996e. Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses, NUREG-1440, Washington, DC. May.

NRC (U.S. Nuclear Regulatory Commission) 1996f. Public Comments on the Proposed 10 CFR Part 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response, Volumes 1 and 2, NUREG-1529, Washington, DC. May.

NRC (U.S. Nuclear Regulatory Commission) 1999a. Changes to Requirements for Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Final Rules, Federal Register 64 (171): 48496–48507. September 3.

NRC (U.S. Nuclear Regulatory Commission) 1999b. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS), Section 6.3, "Transportation" and Table 9 1, "Summary of findings on NEPA issues for license renewal of nuclear power plants," NUREG-1437, Volume 1, Addendum 1, Washington, DC. August.

STPNOC (STP Nuclear Operating Company) 2008. Updated Final Safety Analysis Report, STP Units 1 & 2, Revision 14. April.

2.0 CHAPTER 2 – SITE AND ENVIRONMENTAL INTERFACES

2.1 LOCATION AND FEATURES

STP Units 1 & 2 are in Matagorda County, approximately 10 miles north of Matagorda Bay and 70 miles south-southwest of Houston. The nearest population center, Bay City, is approximately 13 miles north-northeast of the site (Figure 2.1-1). The western bank of the Colorado River forms the eastern STP property boundary. A 13-acre park, developed by the Lower Colorado River Authority (LCRA) and operated by Matagorda County, is located on Farm-to-Market Road (FM) 521 on the west side of the Colorado River. The Port of Bay City terminal is located approximately five miles north-northeast of the STP site (Figure 2.1-2).

The STP site boundary encloses approximately 12,220 acres. Figure 2.1-3 depicts the STP site boundary. The site buildings, operations area, support facilities, and transmission rights-of-way occupy approximately 65 acres. The Essential Cooling Pond occupies approximately 46 acres, while the Main Cooling Reservoir (MCR) occupies an additional 7,000 acres. Another approximate 1,700 acres remain as natural lowland habitat. The remaining portion of the STP site is undeveloped land, some of which is located to the east of the MCR and is leased for cattle grazing. Facilities on the property include the two reactor and steam generator containment buildings, various buildings auxiliary to the reactors such as warehouses, a chemical storage building, switchyard, fuel handling buildings, radioactive waste building, training center, outdoor firing range, administrative buildings, and miscellaneous supporting buildings.

STP is located in the Texas Coastal Plain Physiographic Province. The topography of the site area is characterized by fairly flat land with an average elevation of 23 feet above mean sea level. The land surrounding the site is used for ranchland and farmland. Given the flat nature of the viewscape, the STP reactors are a prominent feature of the area.

The Texas Prairie Wetlands Project is an approximate 110-acre shallow wetland area accessible from FM 521 near the northeastern portion of the site (Figure 2.2-1). The wetlands were developed by STPNOC in partnership with Ducks Unlimited, Texas Parks and Wildlife Department, U.S. Fish and Wildlife Service, and U.S. Department of Agriculture Natural Resources Conservation Service to create foraging habitat for wintering waterfowl, wading birds, and shorebirds (STPNOC 1997). The wetland area is included on the Great Texas Coastal Birding Trail that spans the entire Texas Gulf Coast.

Section 3.1 provides a description of the plant and some of its key features.

2.2 AQUATIC COMMUNITIES

The surface water bodies of interest, those that could be potentially affected by continued operation of STP 1 & 2, are the Main Cooling Reservoir, the lower Colorado River, and Matagorda Bay (see Figures 2.1-1 and 2.1-2). The sections that follow describe the aquatic communities of each of these surface water bodies.

2.2.1 Main Cooling Reservoir

Heated effluent from STP Units 1 & 2 is discharged to the Main Cooling Reservoir (MCR), an approximately 3.0-mile-long by 3.75-mile-wide impoundment built on a plateau overlooking the Colorado River (see Figure 2.1-3). The MCR occupies much of the original Little Robbins Slough channel and drainage area (NRC 1986). In the course of creating the MCR, much of Little Robbins Slough was relocated. The reconfigured stream now parallels the west embankment of the MCR before turning east, then southeast, ultimately flowing into Robbins Slough (Figure 2.2-1).

The MCR was created as an engineered cooling pond solely for the purpose of dissipating waste heat from the STP nuclear units. A series of dikes inside the MCR (Figure 2.1-3) lengthen the flow path, providing extended circulation and cooling of the water. The MCR has a surface area of approximately 7,000 acres with a design maximum operating elevation of 49 feet above mean sea level (MSL) (Section 3.1.2); the normal operating level is approximately 47 feet MSL. STPNOC diverts water from the Colorado River to the MCR to replace water lost to evaporation and seepage. As discussed in Section 3.1.2, Colorado River water is withdrawn at the Reservoir Makeup Pumping Facility (RMPF) and piped to the MCR by means of four large makeup pumps with a total capacity of approximately 269,000 gallons per minutes (600 cubic feet per second). The makeup pumps at the RMPF operate intermittently, as dictated by weather (patterns of rainfall in the river basin), Colorado River flows, operational considerations, and permit restrictions.

Because the MCR was never intended to be a multiple-use impoundment, or to provide a recreational fishery, no formal surveys of its aquatic communities were conducted until 2007, when STPNOC began to explore the possibility of new generating Units 3 & 4 at the site. In 2007 and 2008, STPNOC conducted surveys of the MCR's fish and invertebrate communities and to evaluate impingement and entrainment at the plant's circulating water intake (ENSR 2008a). The 2007 and 2008 studies were intended to establish a baseline in the reservoir for the purposes of evaluating the impacts of on-going plant operations and the potential impact of building and operating proposed new Units 3 & 4.

The aquatic communities (nekton, ichthyoplankton, and zooplankton) of the MCR were sampled quarterly (May 2007, August 2007, October 2007, and February 2008) using four types of sampling gear: gill nets, trawls, beach seines, and plankton nets (ENSR 2008a). A mix of gear types was employed to ensure that the various aquatic zones (habitats), species, and life stages present were sampled. Samples were collected at fixed stations established in various regions within the MCR. These regions included Region 1 (cooling water discharge area), Region 2 (southwest part of reservoir), Region 3 (central levee/Y-dike), Region 4 (spillway area), and Region 5 (makeup water area and circulating water intake). Regions 1, 3, and 5 were sampled using all four gear types; Regions 2 and 4 were sampled only with trawls and beach seines (ENSR 2008a).

Nekton (juvenile and adult fish and adult blue crabs) were collected using beach seines, gill nets, and trawls. A total of 11,605 finfish and invertebrates representing 25 species were collected over the course of the study using these three kinds of sampling gear (ENSR 2008a). Seines were particularly effective, capturing 10,091 organisms (87 percent of the total) representing 17 species. Trawl samples resulted in the capture of 999 organisms (nine percent of the total) and 12 species, while gill net samples yielded 515 organisms (four percent of the total) and 13 species (ENSR 2008a).

Threadfin shad (*Dorosoma petenense*), inland silverside (*Menidia berylllina*), and rough silverside (*Membras martinica*) were the species observed most frequently in seine samples, representing 64, 20, and 13 percent, respectively, of organisms collected in seines (ENSR 2008a). These small-bodied, schooling species often move inshore to forage and escape predators, and are therefore vulnerable to capture in beach seines. Thirteen other fish species were also collected with beach seines, but in every case represented less than one percent of the total (ENSR 2008a). Five species [bluegill (*Lepomis macrochirus*), naked goby (*Gobiosoma bosc)*, needlefish (*Strongylura marina*), sheepshead minnow (*Cyprinodon variegatus*), and white mullet (*Mugil curema*)] appeared in seine samples, but did not appear in gill net or trawl samples. There were obvious seasonal differences in catch rates. In May, seine samples were dominated by inland silverside; in August and October, by threadfin shad, and in February, by rough silverside.

Trawl samples were dominated numerically by threadfin shad (77 percent), followed by Atlantic croaker (*Micropogonias undulatus*; 9 percent), blue catfish (*Ictalurus furcatus*; 5 percent), freshwater drum (*Aplodinotus grunniens*; 4 percent), and gizzard shad (Dorosoma cepedianum; three percent) (ENSR 2008a). Smaller numbers of common carp (*Cyprinus carpio*), channel catfish (*Ictalurus punctatus)*, and blue crabs (*Callinectes sapidus*) were also collected. May samples were dominated by Atlantic croaker, while August, October, and February samples were dominated by threadfin shad.

Blue catfish (60 percent), common carp (19 percent), ladyfish (*Elops saurus;* 7 percent), black drum (*Pogonias cromis*; 5 percent), Atlantic croaker (3 percent), and blue crab (2 percent) were the species found most often in gill net samples (ENSR 2008a). Seven other species appeared in gill net samples in small numbers. Three species [mangrove snapper (*Lutjanus griseus*), smallmouth buffalo (*Ictiobus bubalus*), and red drum (*Sciaenops ocellatus*)] were collected in gill nets, but were not collected in seine and trawl samples. May samples were dominated by common carp and blue catfish, August samples by blue catfish, October samples by blue catfish and ladyfish, and February samples by blue catfish.

Plankton samples were collected using a low-speed Henson plankton net with a 30-cm opening towed obliquely through the water column. A total of 5,362 planktonic organisms were collected in the MCR (ENSR 2008a). Collections were numerically dominated (85 percent of all zooplankton and ichthyoplankton collected) by larvae of the mud crab, *Rhithropanopeus harrisii.* Small numbers of finfish larvae (17) were collected, and were represented by only two taxa, (Clupeidae) shad and (Gobiidae) gobies. Mud crab larvae occur primarily during the early summer months (May through July), with a few small influxes occurring in the late summer.

The aquatic communities of the MCR have become established over 20-plus years and are presumed to have reached a steady state or equilibrium. Fish/shellfish eggs and larvae are pumped into the MCR with makeup water. Some of these eggs and larvae develop into adults. Some freshwater fish species (e.g., threadfin shad, channel catfish) are apparently able to reproduce in the MCR; but most estuarine and marine species are not. Populations of estuarine and marine fish species are periodically replenished when their eggs and larvae are pumped into the basin with makeup water.

ENSR biologists collected water quality measurements over the 2007 to 2008 period in the course of conducting fish surveys (ENSR 2008a). Temperatures were, as expected, highest in summer (August) and lowest in winter (February). Dissolved oxygen (DO) concentrations were always high at surface, and were relatively high at bottom at most stations, even in August. With one exception (Station 2, August 27, 2007), DO concentrations were high enough to support a wide variety of indigenous fish and shellfish. Salinity showed no variation among stations, and almost no variation among seasons. Salinity measurements over the 12-month period ranged from 1.5 to 1.7 parts per thousand (ppt) and averaged 1.6 ppt (ENSR 2008a). Data are indicative of a shallow, slightly-brackish, wind-blown reservoir that is well mixed year round and presumably never becomes stratified.

Aside from hot side (discharge)/cold side (intake) temperature differences, water quality in the reservoir showed no "regional" differences. Dissolved oxygen levels, an important factor in determining distribution of fish in a reservoir, were relatively high in all regions of the reservoir in all seasons. There were no indications that fish preferred (or avoided) a particular region or zone of the reservoir or that there were fish/shellfish kills associated with high water temperatures in late summer.

2.2.2 Colorado River

The Colorado River rises in Dawson County in the High Plains of west Texas, flows southeastward across the Rolling Plains and Edwards Plateau, turns eastward and then southeastward to cross portions of the Blackland Prairie and Post Oak Savannah, finally moving across the Gulf Coast Prairie and Marshes of Wharton and Matagorda counties to empty into Matagorda Bay. The largest river entirely within the state of Texas, the Colorado River is 862 miles long and has a drainage area of approximately 42,000 square miles (Kammerer 1990). Major tributaries, from upstream to downstream, are the Concho River, Pecan Bayou, San Saba River, Llano River, and Pedernales River.

River flow at a gauging station near Bay City, approximately 20 miles upstream from STP, ranged from 375 cubic feet per second (cfs; lowest annual daily mean) to 14,270 cfs (highest annual daily mean) over water years 1948 to 2004 and averaged (annual daily mean) 2,628 cfs (USGS 2005). Flows tend to be highest in late spring and early summer and lowest in late summer and early fall.

The Colorado River is tidally influenced in the vicinity of the STP site, which is at river mile 14.6, upstream from Matagorda Bay. The tidal influence extends as far as 32 miles upstream of Matagorda Bay under conditions of low flow (HL&P 1974). The extent of tidal influence depends on tidal amplitude at the mouth of the river and the freshwater flow in the river. Tidal elevations are influenced by wind conditions. In general, the heights of both high and low tides are increased by onshore winds and decreased by offshore winds (HL&P 1974).

Saltwater may move as far as 24 miles upstream of Matagorda Bay, along the bottom of the Colorado River (HL&P 1974). Salinities less than 0.5 ppt are generally regarded as limnetic or "fresh," while salinities greater than 0.5 ppt are generally regarded as indicative of brackish water. Salinities in the vicinity of STP are generally near fresh, ranging from fresh up to 8 ppt in most years. During drought periods, when freshwater flows are substantially reduced, salinities can get higher, moving into the 8 to 20 ppt range. Salinity varies by season, with lower salinities normally observed in winter and higher salinities normally seen in the spring.

The Lower Colorado River Authority (LCRA) maintains a network of stations that monitor water quality and meteorological conditions throughout the lower Colorado River watershed, including a station at Selkirk Island, approximately 0.5 mile downstream of the RMPF (Figure 2.2-1). From 1997 through 2006, salinities ranged from “under scale” (fresh) to 19 ppt (LCRA 2007). In some years, such as 1997, all samples were classified as “fresh.” In most years, however, salinities ranged from under-scale/fresh to 5 ppt, with highest values in summer and early fall. In 2000, however, all samples were brackish, with salinities ranging from 2.3 ppt to 19 ppt (LCRA 2007). Flows were high in 1997, with 4,570,000 acre feet (approximately 6,300 cfs) of water flowing into Matagorda Bay from the Colorado River basin, whereas 2000 was a low-flow year, with 718,000 acre feet (approximately 1000 cfs) flowing into Matagorda Bay (LCRA 2007).

The composition of the aquatic communities of the lower Colorado River in the area of the STP site is directly influenced by salinity gradients in the river, which are in turn affected by precipitation and freshwater inflows from upstream in the Colorado River basin. As freshwater flows increase and salinities decrease, the riverine freshwater fish community from upriver locations displaces the estuarine species, which move further downstream. During low-flow periods (droughts), the salinity increases and more marine and estuarine species move into the lower river.

STPNOC and its predecessor company, Houston Lighting & Power (HL&P), conducted extensive pre-operational and operational surveys and studies of the aquatic biota of the lower Colorado River. HL&P conducted baseline surveys of the lower river in 1973 and 1974 in support of an NRC construction permit for STP Units 1 & 2. Sampling stations originally used in 1973 and1974 and subsequently used in other surveys are shown in Figure 2.2-1. NRC used data from these surveys to describe the aquatic communities of the lower Colorado River and to assess impacts of construction and operation of STP in its Final Environmental Statement (FES) related to the Proposed South Texas Project Units 1 & 2 (NRC 1975).

2.2.2.1 FES for Construction

The descriptions of plankton, benthic macroinvertebrate, ichthyoplankton, and nekton (adult and juvenile fish) communities that follow are drawn from the 1975 FES.

Phytoplankton

Diatoms were the dominant group of phytoplankton at all Colorado River stations in 1973 and 1974, but green algae, blue-green algae, and dinoflagellates were sometimes abundant locally (NRC 1975). Densities and numbers of species (species richness) were lowest in summer, increased slightly in the fall, declined in response to October floods, increased in February at upriver stations, and remained high until summer.

Zooplankton

Zooplankton in 1973 and 1974 displayed a general trend toward increasing densities and species richness from upstream to downstream, as freshwater, estuarine, and marine forms were all present at more downstream stations (NRC 1975). Late spring samples yielded highest densities at most stations, with another smaller peak in early fall. Post-larval brown shrimp were collected in greatest numbers at mid-river and downriver stations during May through August. The more immature stages (zoea and megalops) of commercially valuable shrimp and crab appeared in greatest densities from February through May. Densities were far greater at downriver stations than at upriver stations.

Ichthyoplankton

Eggs and larvae of 59 taxa of (mostly) estuarine-dependent fishes were collected in 1973 and 1974. As with zooplankton, ichthyoplankton densities and species richness increased from upstream to downstream. Upriver Stations 1, 2, and 3 contributed less than one percent of the total catch of eggs and larvae. Large numbers of eggs and larvae were present in fall and spring. Recreationally and commercially important species of ichthyoplankton included croaker, menhaden, shad, sardines, anchovies, blue and channel catfish, seatrout, drums, and flounder (NRC 1975).

Macroinvertebrates

River (also known as Ohio) shrimp (*Macrobrachium ohione)*, a forage species, dominated 1973 and 1974 collections at Stations 1 through 4, especially in fall and spring, but were rarely collected at downriver stations. Marine and estuarine forms (primarily shrimp and crabs) showed an overwhelming preference for the higher-salinity downriver areas. Brown shrimp occurred in greatest numbers during middle and late spring, while white shrimp were most abundant in late summer and fall (August through November). The benthos of the lower Colorado River was characterized by low densities and low species diversity. Lowest benthic densities and measures of species diversity were observed at Stations 1 through 4 in the vicinity of the STP site, and were attributed to “large and frequent” changes in bottom salinity (NRC 1975). Density and species richness of benthic organisms tended to increase downstream of STP, presumably due higher and more stable salinity levels that allowed the establishment of more-diverse marine and estuarine benthic assemblages.

Fish

Colorado River flow, through its influence on salt wedge intrusion, appeared to be the most important factor in determining the number and kinds of fish caught at the various sampling stations in 1973 and 1974. During periods of high river flow, relatively few fish were collected at upriver stations (adjacent to the STP site), and most of these were freshwater species. Sampling at downriver stations closer to Matagorda Bay during periods of high flow yielded higher numbers of both freshwater and estuarine fish species. With regard to freshwater fish species, three species of catfish (channel, blue, and flathead), buffalo (*Ictiobus spp*.), and several species of sunfish were “important in numbers and value” (NRC 1975). Lower river discharges allowed the salt wedge to move further upstream, bringing with it estuarine and marine fishes. Consequently, periods of low river flow were associated with highest catches of fish. Important marine and estuarine species included Gulf menhaden (*Brevoortia patronus*), striped mullet (*Mugil cephalus*), seatrout, drums, croakers, pompano (*Trachinotus carolinus*), flounder, and tarpon (*Megalops atlanticus*) (NRC 1975).

Because the 1973 and 1974 baseline surveys were carried out during a period of unusually high flows in the Colorado River, NRC made supplemental surveys a condition of the construction permit for STP. These surveys were conducted over the 1975 and 1976 period and summarized in NUS (1976). After the MCR and RMPF were completed in 1983, HL&P conducted limited fish surveys and impingement and entrainment studies at the RMPF intake, the results of which were reported in McAden et al. 1984 and McAden et al. 1985.

2.2.2.2 FES for Operations

The 1975–1976 and 1983–1984 surveys and studies are described in the Final Environmental Statement related to the Operation of STP Units 1 & 2 (NRC 1986), and summarized in the following sections.

Macrozooplankton

The only macrozooplankton of potential commercial concern in the area of STP are the early life stages of the blue crab, the white shrimp (*Litopenaeus setiferus*), and the brown shrimp (*Farfantepanaeus aztecus*). The megalops stage of the blue crab occurred at all stations, but decreased in frequency of occurrence and density upriver from Station 5 (NRC 1986). Brown shrimp post-larvae were always taken at Station 5, but Stations 1 (upstream of STP site) and 2 (in vicinity of current makeup water intake) yielded post-larvae in only three and four samples, respectively. Post-larval white shrimp were taken at all stations, but rarely occurred at Stations 1 through 3. Densities of blue crab megalops and white and brown shrimp post-larvae were usually greatest in the area of the salt wedge, and moderate to high densities of megalops frequently occurred along the river banks. During the 1983–1984 study, the post-larval stages of the brown shrimp, white shrimp, and megalops and juvenile stages of the blue crab were collected only sporadically and never in high densities. Numbers of crab and shrimp larvae increased with increased salinity.

Ichthyoplankton

Estuarine-marine species were predominant throughout the sampling area (Stations 1 through 5) during 1975 and 1976, primarily as a result of an extended period of saltwater influence (NRC 1986). Densities were highest from May through October 1975 and March through April 1976. The mean annual abundance of estuarine-marine species increased downstream with increasing salinity. Species of commercial importance that use the area from Stations 1 through 5 as an estuarine nursery ground are Gulf menhaden, Atlantic croaker, sand seatrout (*Cynoscion arenarius*), spotted seatrout (*Cynoscion nebulosus*), spot (*Leiostomus xanthurus*), sheepshead (*Archosargus probatocephalus*), black drum, red drum, and southern flounder (*Paralichthys lethostigma*). The most abundant ichthyoplankton in the study area in 1975–1976 were menhaden, anchovy, croaker, and naked goby. Freshwater drum and several cyprinid species were abundant during freshwater conditions in early May and August. During 1983 and 1984, the most abundant ichthyoplankton were bay anchovy, darter goby (*Gobionellus boleosoma*), and naked goby. Details on temporal and spatial variation in densities of common ichthyoplankton are provided in NUS 1976, McAden et al. 1984, and McAden et al. 1985.

Nekton

Fish and macroinvertebrates were collected using seines and trawl nets at five lower Colorado River stations in 1975 and 1976 and at Station 2 in 1983 and 1984 (NRC 1986). Trawl samples in 1975 and 1976 were dominated by white shrimp, menhaden, anchovy, croaker, and mullet. With one exception (menhaden), abundance of estuarine-marine species decreased upriver from Station 5. Many of the commercially important estuarine-dependent species such as red drum and southern flounder were collected only at Station 5. Trawl samples indicated than menhaden, the most abundant species, had relatively higher densities at Station 1. Seining samples indicated the greatest abundance of menhaden at Station 4. Bay anchovy, the second most abundant species and an estuarine resident, were more abundant at Station 5. Trawl samples also indicated that brown shrimp were relatively more abundant at Station 1; seining samples indicated that blue crabs were relatively more abundant at Station 1. During 1983 and

1984, 5 shrimp, 2 crab, and 1 crayfish species were collected by seines and trawls in the vicinity of Station 2. River shrimp were most common, followed by white shrimp.

2.2.2.3 2007-2008 Aquatic Ecology Monitoring Study

As part of an assessment of potential impacts of building and operating proposed Units 3 and 4, STPNOC conducted a one-year study (2007-2008) of fish and shellfish in a portion of the lower Colorado River adjacent to and downstream of the STP site (ENSR 2008b). The study area was a nine-mile-long stretch of the river that extended from the Gulf Intracoastal Waterway north to the FM 521 bridge, which is approximately 1.5 miles east of the STP powerblock. The 9-mile-long study area was divided into three 3-mile-long segments to allow the analysis of upstream-downstream differences. Fish and invertebrates were sampled monthly from June 2007 to May 2008 Species richness, diversity, and relative abundance were estimated by gear type for the entire study area as well as the three individual river segments (ENSR 2008b).

Seines, trawls, gill nets, and hoop nets were used during the study to collect fish and invertebrates. Within each segment of the river, sampling locations were chosen randomly. The broad spatial coverage allowed an evaluation of fish and macroinvertebrate assemblages relative to river flows as well as to the freshwater-saltwater interface in the lower part of the river (ENSR 2008b). Monthly sampling ensured that seasonal variation in species richness and catch rates could be detected.

A total of 59 fish species, 9 crustacean species, 1 cephalopod (squid) species, and 1 freshwater turtle species were collected during the 2007 and 2008 study. In the segment that includes the STP site (Segment C), 35 fish and 6 crustacean species were collected, as well as 1 squid. All but 3 of the 35 fish species collected near the STP site were also present in Segment A, farthest downstream. The 5 most abundant fish species in Segment C (menhaden, striped mullet, blue catfish, Atlantic croaker, and black drum) were also collected in Segments A and B. Two freshwater fish species, longnose gar (*Lepisosteus osseus*) and flathead catfish (*Pylodictis olivaris*), were caught only in Segment C, and were represented by 1 and 2 individuals, respectively. One species (silver jenny, *Eucinostomus gula*) was collected in Segment A but not in Segment B, again represented by a single individual (ENSR 2008b).

In most instances, collections were dominated (>60 percent) by 3 to 4 species. Dominant species included Gulf menhaden, white shrimp, grass shrimp, striped mullet, black drum, and Atlantic croaker, and were dependent on gear type. Drum, smallmouth buffalo, gar, and catfish species tended to dominate the gill net and hoop net catches, whereas Gulf menhaden, shrimp, and mullet species were prevalent in the trawl and seine catches. Despite the fact that most catches were dominated by a few species, a large number of species contributed (> 1 percent) to the overall faunal composition for each of the gears, an indication that sampling gear were not overly selective for particular species. Despite demonstrating overall lower species richness, more species contributed at the 1 percent level to the composition of hoop net and gill net catches than to trawl and seine samples (ENSR 2008b).

The 2007 and 2008 study funded by STPNOC is the most comprehensive study of the aquatic resources of the lower Colorado River since the U.S. Army Corps of Engineers (USACE) re-routed the lower Colorado River in 1991. The study showed that species diversity and abundance of fishes in the lower Colorado River overall are higher today than in the 1970s or 1980s (ENSR 2008b), suggesting that operations at STP have not caused any substantive declines in important species.

During the 2007 and 2008 monitoring study, surface water temperatures ranged from 11.6°C in January to 31.0°C in August (ENSR 2008b). Salinity was generally lower during winter and higher during spring. Salinity readings at the surface were fairly stable, ranging from 0.0 ppt to about 7 ppt, with the highest salinities occurring downstream, below Navigation Mile Marker 2, and the lowest occurring above Navigation Mile Marker 8. Bottom salinities, which ranged up to 25 ppt, declined toward upstream stations in nearly all months. An analysis of catch rate using various gears showed that catch rate declined as flow increased. The relationships between catch rate and DO or salinity did not show any strong trends overall; however, bag seine catch rates did appear to show a slight positive trend with salinity (ENSR 2008b).

The 2007 and 2008 study documented the stability of the dominant species of fish and macroinvertebrates near the STP site. White shrimp, menhaden, and croaker, which were among the dominant fish and invertebrate species identified in 1974, were still abundant at the site in 2007 and 2008. Menhaden was the most common fish species collected in Segment C in 2007 and 2008, and white shrimp was the most common invertebrate. River shrimp and bay anchovy were relatively less abundant in the 2007 and 2008 study than in the mid-1970s, but were still present. Given the large inter-annual variability in salinity and species assemblages documented in all of the studies, some shifting of the relative abundances among the top species is expected.

2.2.3 Matagorda Bay

The Colorado River flows into Matagorda Bay approximately 10 miles downriver of the STP site. Matagorda Bay is the third largest estuarine system in Texas, after the Laguna Madre Bay and Galveston Bay systems (GulfBase 2007). Freshwater input to Matagorda Bay comes primarily from the Colorado and Lavaca Rivers, but numerous smaller streams also contribute. The average daily inflow from all sources is approximately 5300 cfs (GulfBase 2007). It is relatively shallow, with an average depth of about 2 meters (6.5 feet). The average salinity is approximately 19 ppt.

The Matagorda Bay system (the Bay) encompasses a number of smaller embayments: East Matagorda Bay, Karankawa Bay, Tres Palacios Bay/Turtle Bay, and Lavaca Bay. The Bay has a surface area of 422 square miles (GulfBase 2007). Matagorda Bay is separated from the Gulf of Mexico by the Matagorda Peninsula, with most water exchange occurring through five tidal inlets.

The Matagorda Bay estuary supports marine and estuarine fishery species of economic importance, including Gulf menhaden, bay anchovy, sheepshead, Atlantic croaker, sand and spotted seatrout, black drum, and red drum. Seagrass beds line the northern shores of Matagorda Peninsula and Matagorda Island, and the eastern shore of Matagorda Bay, providing essential forage and cover for juvenile fish of recreational importance (TPWD 1999). The dominant species is shoalgrass (*Halodule beaudettii*), with healthy stands of widgeon-grass (*Ruppia maritima*) and turtlegrass (*Thalassia testudinum*). In 1999, an estimated 3830 acres of seagrasses were found in Matagorda and East Matagorda Bays (TPWD 1999).

Juveniles and adult marine fish forage in the tidal salt marsh habitat in Matagorda Bay. The decaying leaves of marsh plants, and the organic waste produced by fishes and invertebrates, provides a nutritional base for the complex food web that supports recreationally and commercially important fisheries (USACE 2005). The commercial shrimp industry is Texas' most valuable commercial fishery with landings during 2000 valued in excess of $230 million (TPWD 2002).

In the northern and eastern sections of the Bays, oyster (*Crassostrea virginica*) reefs provide additional forage and shelter. Oyster reefs increase the habitat value for finfishes substantially by providing structural complexity, attachment sites for invertebrate prey species, crevices for spawning and rearing fry, shelter from predators, and other services. In the early 20th century, Matagorda Bay produced about half of the oysters in Texas (USACE 2005). An accidental hydrologic alteration in the late 1920s degraded conditions for oysters as well as other estuarine-dependent organisms. Oyster production was further restricted by excessive removal of shell substrate, saltwater intrusion via the Matagorda Ship Channel and the Gulf Intracoastal Waterway, and the explosion of oyster parasites and predators. In 1991, a project to restore the original function of Matagorda Bay was undertaken. The Colorado River was rerouted back into the Matagorda Bay so that freshwater flows of water and sediment would once again pour into the Bay and nourish the tidal marshes (Wilber and Bass 1998). The project was considered a success, and oyster production has increased since then (USACE 2005).

In the open-water habitats of Matagorda Bay, invertebrates thrive in silty substrates. Plankton blooms support a complex benthic invertebrate food web that includes filter feeders, deposit feeders, scavengers, and mobile predators (including polychaete worms, mollusks, crabs, and shrimp). Crabs and shrimp prey upon the polychaetes and mollusks. Roving schools of spotted seatrout, redfish, and flounder forage heavily in these open areas. Matagorda Bay is second only to Galveston Bay in commercial fisheries value in Texas.

The relative abundance of important fish and shellfish in various salinity zones in the Matagorda Bay estuary is summarized in Table 2.2-1 (based on data in Nelson 1992). The importance of this profile is that the salinity of the water at the STP site will determine to a large extent the composition and life stages of species present in the area. Regardless of which species or life stages are in the estuary at a given time, high freshwater flows tend to keep many of them from moving up the river as far as the STP site. Conversely, low river flows, and the concomitant saltwater intrusion, allow greater movement of estuarine and marine species upriver.

The USACE diverted the lower Colorado River into the eastern arm of Matagorda Bay in 1991 to create habitat, increase nutrients and moderate salinity; the overall goal was to improve fisheries productivity. Wilber and Bass (1998) evaluated several long-term data sets that included fisheries abundance in various parts of the bay before and after the diversion. The expectation was that the diversion would be shown to have had a significant positive effect on at least some important species such as white shrimp, brown shrimp, blue crab, croaker, anchovy, or menhaden. However, none of the data sets indicated significant shifts in species abundance, despite substantial habitat changes, such as the growth of a deltaic marsh at the end of the diversion cut. This study points out that, relative to other Gulf of Mexico estuaries, the Colorado River has a small average discharge (76.5 cubic meters per second [m^3/s]) compared with the size of Matagorda Bay (1,070 km); in fact, when the flow is less than 14 m^3/s (500 cfs) at the Wharton gauge, the Colorado River does not discharge at all. The authors noted that there were no diversion-related differences in abundance for any important species monitored by the Texas Parks and Wildlife Department (TPWD), and that blue crab and shrimp landings “did not exhibit any unusual deviations from historical inter-annual variability.”

A cooperative group of several Texas government agencies prepared an independent analysis of the long-term fisheries-independent data collected by the TPWD in Matagorda and East Matagorda Bays (LCRA 2006). The study concluded that the health and productivity of Matagorda Bay was generally good, and gave as evidence the approximately $63 million that Matagorda Bay generates annually in commercial seafood harvests, and the $115 million annually the Bay contributes to the sport fishing industry. The current level of freshwater inflows have helped maintain the health and productivity of the bay, although the study acknowledges that a host of complex factors that are not yet fully understood interact to affect the overall productivity of the bay.

The LCRA study conducted in 2006 provides a summary of the economic value of the ecological services provided by Matagorda Bay, with particular reference to its role as habitat for estuarine-dependent fish and shellfish. For example, commercial fishermen in Texas landed an estimated 95.2 million pounds of fish, shrimp, crabs, and oysters in 1999. Shrimp are the most valuable resource along the Texas coast, accounting for 81 percent of the harvest and 88 percent of the dockside value in 1999 (LCRA 2006). Commercial shrimpers in the Matagorda Bay system landed one-fourth of the total shrimp catch from all Texas bays, representing 27 percent of the dockside value, on average, from 1995 to 1999. As reported in the LCRA study, a Texas A&M University study in 1995 estimated that the Matagorda estuary contributed 1,847 jobs and $71.86 million to commercial fishing (gulf and bay). Since the LCRA study was published in 2006, both landings and positive economic impact have increased.

Diadromous Species

Based on a literature review and surveys conducted by HL&P in the 1970s and 1980s, no anadromous fishes ascend the Colorado River to spawn upstream or downstream of the STP site. There are relatively few true anadromous species (e.g., Gulf sturgeon [*Acipenser oxyrinchus desotoi*], Alabama shad [*Alosa alabamae*], and striped bass [*Morone saxatilis*]) in the Gulf of Mexico, and these species spawn in rivers flowing into the Gulf of Mexico further east, in Louisiana, Mississippi, Alabama, and Florida (USFWS undated). One migratory fish species, the American eel, does ascend Gulf Coast streams in Texas, including the Colorado River.

Small numbers of eel larvae are carried by winds and currents from the Atlantic Ocean into the Gulf of Mexico, almost certainly via the Yucatan Strait. From the Gulf of Mexico they “wander” into Gulf Coast and Central American estuaries and rivers (Nedeau 2005). American eels are uncommon in Texas. In 30 years of sampling coastal waters, the Coastal Fisheries Division of TPWD encountered only 7 eels, in Matagorda/San Antonio Bays and Corpus Christi Bay (3 in 1984, 1 in 1986, 1 in 1988, 2 in 2001). The Inland Fisheries Division of TPWD encountered only 15 eels in 20 years of sampling in freshwater reservoirs and streams (2 in the 1980s, 10 in 1990, and 3 in 2003–2004) (NatureServe 2008). LCRA biologists have collected eels as far upstream in the Colorado River as Altair, Texas, despite the fact that there is a 15- to 20-foot-tall dam (built to store water for irrigation and prevent salt water from moving upstream) two miles south of the State Highway 35 Bridge (Wedig 2007).

Habitat Importance

Many marine fish and estuarine fishes that are federally managed by the Gulf of Mexico Fishery Management Council (GMFMC) and National Marine Fisheries Service (NMFS) rely on coastal bays and tidal rivers during part of their lives. The tidally influenced sections of the Colorado River and its tributaries, as well as Matagorda Bay and East Matagorda Bay, have been designated Essential Fish Habitat (EFH), meaning that the GMFMC and NMFS have determined that these areas contain habitat essential to the long-term survival and health of certain recreationally and/or commercially important marine fish species managed by the two organizations. Discussion of EFH is in §600.10 of the regulations implementing the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act; P.L. 104-297). The GMFMC and NMFS are responsible for designating E F H for each life stage of these federally managed marine fish species. EFH should not be confused with “critical habitat,” which describes a geographic area crucial to the survival of a federally listed (threatened or endangered) species that has been afforded legal protection under the Endangered Species Act.

The generic amendment of the Fishery Management Plans for the Gulf of Mexico prepared by the GMFMC (GMFMC 1998) defined EFH for federally managed species, including shrimp, red drum, reef fish, and coastal migratory pelagic species. Habitats in the lower Colorado River near the STP site include estuarine water column, estuarine mud and sand bottoms (unvegetated estuarine benthic habitats), estuarine shell substrate (oyster reefs and shell substrate), estuarine emergent wetlands, and seagrasses. Managed species that are considered important with respect to this ER include brown shrimp, white shrimp, and red drum. EFH has been designated for all life stages (egg, larvae, post-larvae, juvenile, and adult) of these species. In addition to providing essential fish habitat for the federally managed species listed above, the Matagorda Bay estuary provides nursery and rearing habitat for other important estuarine species (listed in Table 2.2-1), as well as for non-harvested forage species that support the harvested species.

Categories of EFH in the lower Colorado River and Matagorda Bay that could be impacted by the project include estuarine water column, estuarine mud, and sand bottoms (unvegetated estuarine benthic habitats), estuarine shell substrate (oyster reefs and shell substrate), estuarine emergent wetlands, and seagrasses. Detailed information on EFH is provided in the 1998 generic amendment of the Fishery Management Plans for the Gulf of Mexico prepared by the GMFMC (GMFMC 1998).

Each estuary along the Gulf of Mexico coast has a particular species assemblage (Nelson 1992). The relative significance of important aquatic species in a regional context can be described in a variety of ways, such as the monetary value or poundage of commercial catches, or the recreational value of certain species in a given bay. In some cases, critical habitat for an endangered species may occur in one estuary but not another. That is not the case for Matagorda Bay. None of the important species considered in this ER are endemic to Matagorda Bay, nor does critical habitat occur in Matagorda Bay. All of the species listed as common to abundant in Table 2.2-1 are also found in Galveston Bay to the north of Matagorda Bay. The NRC (1986) concluded that (1) the lower Colorado River was not a unique nursery area for estuarine-marine organisms, and (2) species expected to be most affected by operations at STP (e.g., Gulf menhaden, croaker, bay anchovy, striped mullet) were ubiquitous and abundant along the Texas and Gulf coasts.

2.3 GROUNDWATER RESOURCES

STP is on approximately 12,220 acres of relatively flat coastal plain terrain in the Lower Colorado River Valley. The site is underlain by a thick wedge of southeasterly dipping, sedimentary deposits that comprise the Gulf Coast Aquifer System. This aquifer system contains numerous local aquifers in a thick sequence of mostly unconsolidated Coastal Plain deltaic sediments of alternating and interfingering beds of clay, silt, sand, and gravel. The sediments reach a thickness of thousands of feet and contain groundwater that ranges from fresh to saline. Large amounts of groundwater are withdrawn from the aquifer system for municipal, industrial, and irrigation needs (TWDB 2006a).

As part of the U.S. Geological Survey's (USGS) Regional Aquifer-System Analysis program, the Gulf Coast Aquifer System was subdivided into a series of permeable zones and confining units. The hydrolgeologic units commonly used to describe the aquifer system (from shallow to deep) are as follows (TWDB 2006b):

- Chicot Aquifer
- Evangeline Aquifer
- Burkeville Confining Unit
- Jasper Aquifer
- Catahoula Confining Unit (restricted to where present in the Jasper Aquifer)
- Vicksburg-Jackson Confining Unit

2.3.1 Groundwater Supply and Sources

The principal aquifer used in Matagorda County and the site vicinity is the Chicot Aquifer, which occurs in the Beaumont Formation that extends to a depth greater than 1,000 feet in the vicinity of the STP site. In the site vicinity, the Chicot Aquifer is divided into two aquifer units, the Shallow Chicot Aquifer and the Deep Chicot Aquifer. The base of the Shallow Chicot Aquifer has limited production capability, and it is used for livestock watering and occasional domestic use. Potentiometric heads are generally within 15 feet of ground surface. The Deep Chicot Aquifer is the primary groundwater production zone and lies below depths of 250 to 300 feet. A zone of predominantly clay materials, usually greater than 150 feet thick, separates the Shallow and Deep Aquifers (STPNOC 2008b). The Deep Chicot Aquifer is used as the primary source of water for the region due to higher aquifer yield and improved water quality.

Recharge to the Shallow Chicot Aquifer is considered to be within a few miles north of the STP site. Discharge is to the Colorado River alluvium material east of the site. Recharge to the Deep Chicot Aquifer is further north in Wharton County, where the aquifer outcrops. Discharge from the Deep Chicot Aquifer is to Matagorda Bay and the Colorado River estuary, approximately five miles southeast of the STP site. The Shallow Chicot Aquifer in the site area is primarily used for livestock watering and other low-yield requirements because of low productivity and poor water quality (TWDB 2006a). Regional water quality data for 12 wells screened in the Shallow Chicot Aquifer within 10 miles of the STP site (TWDB 2009) indicate that 5 of the wells have chloride concentrations in excess of the U.S. Environmental Protection Agency's Secondary Drinking Standard of 250 milligrams per liter (mg/L). Nine of the 12 wells have total dissolved solids concentrations in excess of the Secondary Drinking Standard of 500 mg/L.

The Shallow Chicot Aquifer has been divided into Upper and Lower zones. Both zones respond to pumping as confined or semi-confined aquifers with somewhat different potentiometric heads. The Upper zone of the Shallow Chicot Aquifer is comprised of interbedded sand layers to depths of approximately 50 feet below ground surface. The Lower zone of the Shallow Chicot Aquifer consists of interbedded sand layers between depths of approximately 50 to 150 feet below ground surface.

Aquifer pumping tests performed in the Upper and Lower zones of the Shallow Aquifer at the site indicate well yields from 10 to 30 gallons per minute (gpm). These tests also indicate a variable degree of hydraulic connection between the Upper and Lower zones of the Shallow Chicot Aquifer (STPNOC 2008b).

The 7,000-acre MCR is unlined and may act as a local recharge source to the Shallow Chicot Aquifer at the site. Seepage discharge from the MCR is composed of two parts:

(a) seepage that is collected and discharged through approximately 770 relief wells that have been installed in the embankment around the reservoir to relieve excess hydrostatic pressure. Seepage from these wells is collected in toe and drainage ditches around the periphery of the MCR embankment and subsequently discharged to surface water at various locations, and

(b) seepage through the Upper zone of the Shallow Chicot Aquifer bypasses the relief wells and continues down gradient.

During the design phase, total seepage of the MCR was estimated to be 3,530 gpm, or approximately 5,700 acre-ft/yr. Of this value, approximately 68 percent, or 3,850 acre-ft/yr, would be discharged through the relief wells (STPNOC 2008b).

2.3.2 Offsite Groundwater Usage

Groundwater use in Matagorda County is primarily for agricultural purposes (irrigation) and is drawn predominantly from the Chicot Aquifer. Apart from the water withdrawals for STP Units 1 & 2, there are no current public water supply wells within three miles of the site. There are three public water wells installed in the Deep Chicot Aquifer located approximately 3.75 miles southeast of the site. These wells supply potable water to the Exotic Isle Subdivision, the Selkirk water system, and the Selkirk Island Utilities. These wells vary in depth from 548 to 800 feet. The closest nonpublic well-water supply wells to the site are a 500-foot deep livestock well that is 1,800 feet north of STP Well 5, and a 400-foot deep livestock well that is 2,230 feet west of STP Well 6 (CPGCD 2009). Both livestock wells are screened from 200 to 300 feet above the screened intervals of STP Wells 5 and 6.

2.3.3 Plant Groundwater Usage

Groundwater is used on the site to support STP Units 1 & 2 plant operations. The groundwater is pumped from the Deep Chicot Aquifer using five production wells (Production Wells 5 through

8, and the well that supplies fire protection water to the Nuclear Training Facility [NTF]). As summarized in Table 2.3-1, the wells range in depth from 600 to 700 feet, and have design yields of 200 to 500 gpm.

STPNOC is currently permitted by the Coastal Plain Groundwater Conservation District (CPGCD) to use up to 9,000 acre-feet of groundwater over an approximately three year period. Table 2.3-2 presents the combined monthly groundwater withdrawals from the five wells between 2005 and 2009. The total annual groundwater use for 2005 to 2009 ranged from 702 gpm to 807 gpm with an average use of 765 gpm.

2.3.4 Plant Groundwater Quality

Tritium is produced in the reactor coolant system and is released via liquid discharges to the MCR. Radioactive liquid effluent discharges are by batch and are sampled and analyzed prior to discharge for radionuclides in accordance with NRC regulations. All radioactive liquid effluents are diluted into the 7,000-acre MCR.

Tritium is the only radionuclide detected in shallow groundwater at the site. There are two general routes for tritium to enter the groundwater from the plant: 1) the Main Cooling Reservoir (MCR) water infiltrating into soils and the underlying shallow aquifer, and 2) other identified sources within the protected area.

Main Cooling Reservoir

The MCR contains tritium with a maximum concentration of 17,410 picocuries per liter (pCi/L) reported in 1996, which is below the U.S. Environmental Protection Agency's (USEPA) drinking water standard of 20,000 pCi/L.

The MCR contributes low concentrations of tritiated water to soil and the Shallow Chicot Aquifer. The MCR has had measureable levels of tritium for about 20 years, and tritium first began to appear in relief wells about two years later. Since construction, STP has been monitoring tritium migration from the MCR into the Shallow Chicot Aquifer downgradient to the west, south, and southeast of the MCR near the site boundary via a series of monitoring wells.

In 2006, extensive monitoring around the MCR indicated that tritium had migrated to two wells (MW-258 and MW-259) about 700 feet west of the MCR and near the western property boundary. In 2007 and 2008, STPNOC developed a Conceptual Site Model (CSM) to characterize radionuclides in groundwater at the site and to design a groundwater monitoring network in accordance with the National Energy Institute (NEI) Industry Ground Water Protection Initiative (NEI 07-07).

Groundwater data evaluated as part of CSM indicates that most of the wells around the MCR have reported low concentrations of tritium. In 2008, the two wells MW-258 and MW-259 near the western site boundary had reported tritium concentrations of 260 pCi/L and 400 pCi/L, respectively. Two other monitoring locations (MW-235 and MW-251) near the MCR also had reported elevated concentrations of tritium. MW-235 is located 600 feet south of the MCR and had reported tritium concentrations up to 740 pCi/L in 2007 with concentrations increasing to 1,000 pCi/L in 2008. However, trend analyses show that tritium concentrations in MW-251, which is located 600 feet southeast of the MCR, have been relatively stable over time, with the highest concentration reported at 5,000 pCi/L in 2006. Although these two locations contain elevated tritium, there are additional wells in the area that indicate that tritium does not extend beyond the site boundary to the south and southeast (Mactec 2009).

In 2008, a nested well pair (MW-805 U/L) was installed in the Upper (U) and Lower (L) zones of the Shallow Chicot Aquifer near the western berm of the MCR. Tritium data collected from the two wells from 4th quarter 2008 to 4th quarter 2009 indicate that tritium was reported in MW-805L from 467 pCi/L to 2,830 pCi/L, respectively. This well is slightly beyond the site boundary between the county road and an irrigation canal and the measured tritium level remains well below the EPA drinking water limit. Tritium has not been reported in MW-805U since it was installed (STPNOC 2010b).

Plant Systems

Tritium is present in the shallow aquifer beneath the protected area and the source is most likely releases associated with the total dissolved solids (TDS) pipeline and secondary system steam condensate. The TDS lines had historic documented releases that were subsequently repaired; however, limited volumes of radioactive water were released to the environment.

Tritium has been reported in wells installed in the protected area at concentrations ranging from 5,140 pCi/L to 15,300 pCi/L in the Upper zone of the shallow aquifer, and from 571 pCi/L to 1,870 pCi/L in the Lower zone of the shallow aquifer. Tritium has not been detected in groundwater collected from the Deep Chicot Aquifer (Mactec 2009).

In 2008, three monitoring wells (MW-801 through MW-803) were installed near Unit 1 to better characterize groundwater quality in the Upper zone of the Shallow Chicot Aquifer immediately downgradient of the TDS pipeline and tanks. Tritium has not been detected in the three wells since they were installed (STPNOC 2010b).

2.4 CRITICAL AND IMPORTANT TERRESTRIAL HABITATS

STP is located in Matagorda County, Texas, approximately 10 miles from the Texas Gulf Coast. Site terrain is flat with an approximate elevation of less than 60 feet above mean sea level (MSL). The site was cropland and rangeland prior to facility construction. Topographic features near STP include the Colorado River to the east (along property boundary) and Matagorda Bay, approximately 10 miles to the south. The STP site lies in a largely rural area, with the dominant land use being agricultural fields and pasture.

The STP site encompasses approximately 12,220 acres, of which 300 acres consists of facilities and infrastructure (parking and storage areas, old laydown sites, etc.) supporting Units 1 & 2 (Figure 2.1-3). The site landscape is dominated by the 7,000-acre Main Cooling Reservoir (MCR). The MCR is contained within tall earthen embankments and the reservoir side of this embankment is lined with “soil-cement” to prevent erosion. The MCR has approximately seven miles of internal baffles to ensure efficient circulation of the cooling water. Other water features on-site include the 46-acre Essential Cooling Pond, and Kelly Lake, which is a 34-acre natural water body. A 133-acre dredge material disposal area is located adjacent to the Colorado River and receives infrequent use during river dredging operations associated with the site. Working with federal, state, and private conservation groups, STPNOC built a managed 110-acre shallow wetland area (Texas Prairie Wetlands Project) in the northeastern portion of the site in 1996 to create foraging habitat for wintering waterfowl, wading birds, and shorebirds (STPNOC 1997). Other water features within the plant boundary include an extensive network of drainage ditches and several small depression wetlands scattered throughout the northern portion of the site. The US Army Corps of Engineers (USACE) has determined that 24,639 linear feet of ditches and 17.6 acres of depression wetlands within a 1,406-acre northern component of the STP property are jurisdictional waters of the United States (USACE 2009).

Given the location of the site in the coastal prairie ecosystem of eastern Texas and its pre-STP history as crop- and rangeland, it is not surprising that a large portion of the site is relatively open and not forested. Approximately 976 acres of the northern and western portions of the site is considered scrub-shrub habitat (ENSR 2008), dominated by sea myrtle (*Baccharis hammelifolia*), southern dewberry (*Rubus spp*), and patches of bluestem grasses (*Andropogon spp.*), all plants common to disturbed soils. Grass communities and maintained/disturbed areas each occupy 460 to 480 acres of the site, and another 760 acres is occupied by maintained grasses on the berm surrounding the MCR. Approximately 1,200 acres of the STP are occupied by bottomland forest habitats situated between the Colorado River and MCR. This habitat is characterized by sugarberry/hackberry (*Celtis spp.),* pecan (*Carya illinoensis*), cottonwood (*Populus deltoides*), American elm (*Ulmus americana*) and various oak (*Genus Quercus*) species. Terrestrial habitats found on STP are typical to those in the region and there are no critical, unusual, or rare terrestrial habitats at the site.

Wildlife found on the STP site is typical of that reported for the Texas coastal prairie ecosystem. Mammals commonly observed on STP site include white-tailed deer (*Odoocoileus virginianus*), feral hog (*Sus scrofa*), rabbit (*Silvilagus spp.),* squirrel (*Sciurus spp.),* and cotton rats (*Sigmodon hispidus)* (ENSR 2008).

Common birds at the STP site include cardinals (*Cardinalis cardinalis*), mourning doves (*Zenaida macroura*), bobwhite quail (*Colinus virginianus*), red-winged blackbirds (*Agelaius phoeniceus*), grackles (*Quiscalus spp.),* black vultures (*Coragyps atratus*), and turkey vultures (*Cathartes aura*) (HL&P 1974). Wading birds are frequently observed around STP water features, including great blue heron (*Ardea herodias*), great egret (*Ardea alba*), roseate spoonbill (*Ajaia ajaja*), white ibis (*Eudocimus albus*), and little blue heron (*Egretta caerulea*).

The MCR is used as a nesting site and a resting/freshwater area. White pelicans (*Pelecanus erythrorhynchos*), laughing gulls (*Larus atricilla*), cormorants (*Phalacrocorax spp.),* American coots (*Fulicia americana*), and several species of waterfowl are commonly observed on the MCR. After the reservoir was filled in the 1980s, the waterfowl community of the MCR shifted from dabbling to diving ducks (Baker and Greene 1989). Nine species of birds nest on the dikes within the MCR, with total nest numbers ranging from approximately 1,200 to 2,300 in recent years (USFWS 2007). The two primary species nesting on the dikes are laughing gulls and gull-billed terns (*Sterna nilotica*) which typically make up approximately 85 percent of the nesting birds. Other birds nesting on the MCR dikes include Caspian tern (*Sterna caspia*), Forster's tern (*Sterna fosteri*), black-necked stilt (*Himantopus mexicanus*), black skimmer (*Rhynchips niger*), least tern (*Sterna antillarum*), royal tern (*Sterna maxima*), and killdeer (*Charadrius vociferous*).

The Texas Gulf Coast is an important region for migratory birds as a travel corridor, a stopover location, and as an endpoint for birds migrating to/from northern regions (Shackelford et al. 2005). Portions of the STP site are located within the Matagorda County-Mad Island Christmas Bird Count (CBC) circle, and the CBCs have provided data on wintering birds at STP. Within the boundary of STP, 215 avian species have been documented during CBCs from 1993 through 2007 (ENSR 2008). During this 15-year period, an average of 122 bird species were observed on-site per year, with a range of 60 to 142 species per year, and total individual birds observed averaged nearly 900,000 birds per year, and ranged from approximately 1,300 to 8,630,000. The especially high maximum number (8.6 million birds) was due to red-winged blackbirds and brown-headed cowbirds (*Molothrus ater*), which were present at estimated counts of greater than 4 million each in 2003.

The transmission corridors/lines built to connect STP Units 1 & 2 to the grid are described in Section 3.1. The approximately 480 miles of transmission rights-of-way occupy three main corridors: identified here as Eastern, Western, and Northwestern. These primarily pass through agricultural lands and pasture/rangeland; however, one of the Northwestern lines reaches the Texas "Hill Country" with different habitats such as karst areas and Edwards Aquifer springs. No lands designated by the USFWS as "critical habitat" for endangered or threatened species are crossed by these corridors, nor do they cross any state or federal parks, wildlife refuges or preserves, or wildlife management areas.

The maintenance of the right-of-way system associated with STP Units 1 & 2 is accomplished by four transmission service providers: AEP Texas Central Company, City Public Services of the City of San Antonio, City of Austin, and CenterPoint Energy. All four transmission service providers periodically survey the transmission corridors (typically every 3 to 5 years) and reduce woody vegetation, as needed, along the corridors. However, since most of the transmission lines traverse agricultural lands and rangelands, there is limited need for corridor maintenance.

2.5 THREATENED OR ENDANGERED SPECIES

Table 2.5-1 presents federally and state-listed animal and plant species that have been recorded in the 15 Texas counties containing STP and its associated transmission lines. The list is based on databases maintained by the USFWS (USFWS 2008) and the Texas Parks and Wildlife Department (TPWD) (TPWD 2008). The county occurrences are based either on actual recorded occurrences or historical ranges of species, and it is possible that other protected species might exist in the counties crossed by existing corridors.

Only three federally listed species have been observed on the STP site since the facility was built: the bald eagle (*Haliaeetuus leucocephalus*), American alligator (*Alligator mississippiensis*), and brown pelican (*Pelecanus occidentalis*). There is no federally designated critical habitat (or proposed critical habitat) for any threatened or endangered species within or adjacent to STP.

Bald eagles have been observed over the MCR and a pair of bald eagles has occasionally nested on-site near the Colorado River and off-site along the river near STP since the 1990s. No longer federally listed as an endangered species, the bald eagle still receives federal protection under the Bald and Golden Eagle Protection Act (USFWS 2007a) and is listed as threatened by the state of Texas.

American alligators are federally listed as threatened due to similarity of appearance to the threatened American crocodile (*Crocodylus acutus*), which is found only in Florida. Alligators are often observed in the MCR and on-site wetlands and were monitored during the MCR construction and filling period in the 1980s (Baker and Greene 1989).

Brown pelicans, federally listed as threatened, are occasionally observed at the MCR where they presumably come to rest, forage on fish, and/or drink freshwater. Brown pelicans have not been known to nest at STP. Their closest known breeding colony is on Matagorda Bay (USFWS 2007b).

Two additional federally protected species, piping *plovers (Charadrius melodus*) and whooping cranes (*Grus americana*), have been recorded in Matagorda County, but have not been observed on-site. Piping plovers (threatened) typically migrate from their breeding areas in the Great Lakes region and winterover along the Gulf Coast. Critical habitat (wintering) exists for them along the Matagorda Bay and Matagorda Peninsula, approximately 7 to 8 miles south of STP (USFWS 2001). The mud flats and sandy beaches they use during winter do not exist at the STP site. Critical wintering habitat for the endangered whooping crane, which nests in Canada, is located approximately 35 miles south of STP in Aransas and Calhoun Counties (CWS and USFWS 2007). Whooping cranes could traverse the STP or its transmission lines en route to/from its wintering habitat, but have not been observed at STP.

Some species that historically occurred in Matagorda County have been extirpated due to hunting and loss of their specific habitats as humans settled the area and altered the natural landscape to a more open and managed agricultural landscape. Once found throughout eastern Texas, the red wolf's (*Canis rufus*) decline was linked to these land use changes which reduced their more forested habitats and enhanced that of the coyote (*Canis latrans*), resulting in a population overlap. Subsequent interbreeding between the two canine species has effectively resulted in the extirpation of the red wolf from Texas (Davis and Schmidley 1997). The ocelot (*Leopardus pardalis*) was a neotropical cat found in large, dense thickets of thorny shrubs. With the loss of vast areas of this habitat, ocelots are now limited to a few isolated areas in southern Texas (Campbell 2003). The Louisiana black bear (*Ursus americanus luteolus*), one of 16 subspecies of American black bear, was once common in the forested area of the eastern region of Texas. Due to hunting and habitat loss, this subspecies was presumed to be extirpated from this area by the 1940s, and any recent sightings are thought to be dispersing juveniles from Louisiana (Campbell 2003). The Eskimo curlew (*Numenius borealis*), a victim of over-hunting and the conversion of open and coastal prairie habitats to agriculture, was once an abundant migrant of the Texas prairie. It may now be extinct. The last verified sighting of an Eskimo curlew occurred on the "coast of Texas" in 1987 (Campbell 2003). Given the changes to habitats in and around the STP site, none of these species would be impacted by continued STP Units 1 & 2 site operations.

Five sea turtle species are known from coastal Matagorda County: the loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), hawksbill sea turtle (*Eretmochelys imbricate*), and the Kemp's ridley sea turtle (*Lepidochelys kempii*). All nest on sandy ocean beaches and thus are not affected by the operation of STP Units 1 & 2.

State-listed species observed on the STP include wood storks (*Mycteria americana*), reddish egrets (*Egretta rufescens*), white-faced ibis (*Plegadis chihi*), and white-tailed hawks (*Buteo albicaudatus*); all of which are state-listed as threatened. Wood storks were documented in the riverine bottomlands during Units 1 & 2 construction (HL&P 1974), but have not been observed in more recent surveys. The remaining three state-listed species have been observed on-site during winter (CBC) surveys (ENSR 2008). Nesting by these species has not been observed on STP property nor is it anticipated.

The transmission corridors associated with STP Units 1 & 2 do not cross any areas designated as critical habitat for threatened or endangered species by the USFWS, nor do they cross in federal or state parks, wildlife preserves, refuges or sanctuaries.

2.6 DEMOGRAPHY

2.6.1 Regional Demography

The Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) presents a population characterization method that is based on two factors: "sparseness" and "proximity" (NRC 1996). "Sparseness" measures population density and city size within 20 miles of a site and categorizes the demographic information as follows:

Demographic Categories Based on Sparseness

		Category
Most sparse	1.	Less than 40 persons per square mile and no community with 25,000 or more persons within 20 miles
	2.	40 to 60 persons per square mile and no community with 25,000 or more persons within 20 miles
	3.	60 to 120 persons per square mile or less than 60 persons per square mile with at least one community with 25,000 or more persons within 20 miles
Least sparse	4.	Greater than or equal to 120 persons per square mile within 20 miles
Source: NRC 1996		

"Proximity" measures population density and city size within 50 miles and categorizes the demographic information as follows:

Demographic Categories Based on Proximity

		Category
Not in close proximity	1.	No city with 100,000 or more persons and less than 50 persons per square mile within 50 miles
	2.	No city with 100,000 or more persons and between 50 and 190 persons per square mile within 50 miles
	3.	One or more cities with 100,000 or more persons and less than 190 persons per square mile within 50 miles
In close proximity	4.	Greater than or equal to 190 persons per square mile within 50 miles
Source: NRC 1996		

The GEIS then uses the following matrix to rank the population category as low, medium, or high.

GEIS Sparseness and Proximity Matrix

		Proximity			
		1	2	3	4
Sparseness	1	1.1	1.2	1.3	1.4
	2	2.1	2.2	2.3	2.4
	3	3.1	3.2	3.3	3.4
	4	4.1	4.2	4.3	4.4

Low Population Area **Medium Population Area** **High Population Area**

Source: NRC 1996

STPNOC used SECPOP2000, a code developed for the NRC by Sandia National Laboratories, to calculate population within 20 and 50 miles of STP. Geographic information system (GIS) software (ArcGIS® 9.2) was used to determine land area within these radii in order to calculate population density. Approximately 35,291 people live within 20 miles of STP, at a population density of 36 persons per square mile (TtNUS 2009). The GEIS sparseness matrix identifies this density as in the most sparse category, Category 1 (less than 40 persons per square mile and no community with 25,000 or more people within 20 miles).

STPNOC determined that 255,118 people live within 50 miles of STP, with a population density of 32 persons per square mile (TtNUS 2009). Based on the GEIS proximity matrix, the population density is classified as Category 1 (no city with 100,000 or more people and less than 50 persons per square mile within 50 miles). Therefore, according to the GEIS sparseness and proximity matrix, with STP regional population classifications of sparseness Category 1 and proximity Category 2, STP lies in a low population area.

All or parts of nine counties fall within 50 miles of STP, located in south-central Matagorda County, 70 miles southwest of Houston (Figure 2.1-1). The nearest population concentration is the Matagorda-Sargent Census County Division (CCD), eight miles south-southeast of the STP site, with a 2000 population of 3,335 (USCB 2000a). A CCD is a subdivision of a county that is a relatively permanent statistical area established cooperatively by the USCB and state and local government authorities. It is used for presenting decennial census statistics in those states that do not have well-defined and stable minor civil divisions that serve as local governments. The nearest municipality is Bay City, Texas, 13 miles north-northeast of STP, with a 2000 population of 18,667 (USCB 2000a).

The 50-mile vicinity includes, in its entirety, the Bay City, Texas micropolitan statistical area (MiSA) and portions of the Houston-Baytown-Sugar Land, Texas metropolitan statistical area (MSA), the Victoria, Texas MSA, and the El Campo, Texas MiSA. The Bay City, Texas MiSA had a 2000 population of 37,957. From 1990 to 2000, the MiSA grew 2.8 percent. The Houston-Baytown-Sugar Land, Texas MSA had a 2000 population of 4,715,407. The Houston-Baytown-Sugar Land MSA, the 8th largest MSA (of 362) in the United States, grew 25.2 percent from 1990 to 2000. The Victoria, Texas MSA had a 2000 population of 111,663, an increase of 12.3 percent from the 1990 population. The El Campo, Texas MiSA had a 2000 population of 41,188, having grown 3.1 percent from 1990 to 2000 (USCB 2003).

Based on the residential distribution of STP employees, Matagorda and Brazoria counties have the greatest potential to be socioeconomically affected by license renewal. Table 2.6-1 presents historical and projected population data along with calculated average annual growth rates for Matagorda and Brazoria Counties. Population data for the state of Texas is also included in this table for the purpose of comparison. From 1990 to 2000, the population of Matagorda and Brazoria Counties grew at average annual rates of 0.3 percent and 2.3 percent, respectively. For the same period, the population of Texas grew at an average annual rate of 2.1 percent (TtNUS 2009).

Population projections prepared by the Texas State Data Center, Office of the State Demographer project the average annual growth rate of Matagorda County's population to slow from 0.9 percent to 0.3 percent between 2010 and 2040. Brazoria County's average annual growth rate is expected to slow from 1.8 percent to 1.1 percent (TtNUS 2009).

Table 2.6-2 presents a breakdown of employee residence compared with the total number of STP employees and total county populations. By far, the majority of the employees reside in Matagorda County (61.8 percent), with the second highest number of employees choosing to reside in Brazoria County (21.6 percent). Wharton and Fort Bend counties follow a distant third and fourth with 4.5 and 3.9 percent. Employees living in other Texas counties make up 7.0 percent of the total STP employees and 1.2 percent of employees reside out of state (STPNOC 2008; STPNOC 2009). In Matagorda County, STP employees represent 2.2 percent of the total county population. In other Texas counties, the percentage of STP employees is insignificant (Table 2.6-2).

2.6.2 Minority and Low Income Populations

NRC has issued guidance on environmental justice analysis in "Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues" (NRC 2004). NRC previously concluded that a 50-mile radius could reasonably be expected to contain potential impact areas, and that the state was appropriate as the geographic area for comparative analysis. STPNOC has adopted these parameters for identifying the minority and low-income populations that could be affected by STP operations.

STP used 2000 census data from the USCB with GIS software (ArcGIS® 9.2) to determine minority percentages by block group within 50 miles of STP. If any part of a block group fell within 50 miles of STP, then STPNOC included that block group in the analysis. The 50-mile radius includes 231 block groups (Table 2.6-3) (TtNUS 2009).

2.6.2.1 Minority Populations

The NRC's Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues defines a "minority" population as: American Indian or Alaskan Native; Asian; Native Hawaiian or other Pacific Islander; Black Races, and Hispanic Ethnicity (NRC 2004). Additionally, NRC's guidance requires that (1) all other single minorities are to be treated as one population and analyzed, (2) multi-racial populations are to be analyzed, and (3) the aggregate of all minority populations is to be treated as one population and analyzed. The guidance indicates that a significant minority population exists if either of the following two conditions exists:

- The minority population in the census block group or environmental impact site exceeds 50 percent.
- The minority population percentage of the environmental impact area is significantly greater (typically at least 20 percentage points) than the minority population percentage in the geographic area chosen for comparative analysis.

Census data for Texas characterize 11.5 percent of the population as Black or African American, 0.6 percent as American Indian or Alaskan Native, 2.7 percent as Asian, 0.1 percent as Native Hawaiian or other Pacific Islander, 11.7 percent as “some other race,” 2.5 percent as multiracial (two or more races), 29.0 percent as aggregate of minority races, and 32.0 percent as Hispanic ethnicity (USCB 2000b). Therefore, in all cases except for Hispanic, the “greater than 20 percentage points” is the limiting criterion in identifying significant minority populations. For Hispanic ethnicity, any block group having a Hispanic population greater than 50 percent was identified as having a significant Hispanic population.

For each of the 231 block groups within the 50-mile radius, STPNOC calculated the percentage of the block group’s population represented by each minority. If any block group percentage exceeded the Texas percentage by more than 20 percent, or exceeded 50 percent, then a significant minority population was determined to exist for that race or ethnicity.

Table 2.6-3 presents the number of block groups, by county, within the 50-mile radius that exceed the criteria for significant minority populations. Nineteen block groups within 50 miles of STP have significant Black or African American populations; one block group has a significant Asian population; six block groups have significant other race populations. Twenty-two block groups have significant aggregate of races populations (the combination of Black, American Indian or Alaskan Native, Asian, Native Hawaiian or other Pacific Islander, “some other race,” and multi-racial categories). There are 30 block groups within 50 miles of STP having significant Hispanic populations. Figures 2.6-1 through 2.6-5 display the minority block groups within the 50-mile radius.

2.6.2.2 Low-Income Populations

NRC guidance defines a low-income population based on statistical poverty thresholds (NRC 2004) if either of the following two conditions is met:

- The low-income population in the census block group or the environmental impact site exceeds 50 percent.
- The percentage of households below the poverty level in an environmental impact area is significantly greater (typically at least 20 percentage points) than the low-income population percentage in the geographic area chosen for comparative analysis.

STPNOC determined the percentage of low-income households in each census block group within 50 miles of STP and compared the results with the criteria presented above using the state of Texas as the geographical area for comparative analysis. STPNOC determined that

14.0 percent of households in Texas are low-income (USCB 2000c). Using the limiting criterion of 34 percent (14 percent plus 20 percent), six census block groups within the 50-mile radius have a significant percentage of low-income households (TtNUS 2009). Table 2.6-3 identifies and Figure 2.6-6 locates the block groups containing a significant number of low-income households.

2.7 AREA ECONOMIC BASE

Information about an area's economic base is relevant to how an area could respond to a demand for additional housing (Regulatory Guide 4.2, Supplement 1, Section 4.14, Housing Impacts, is the only impact analysis section that discusses economic base information). A demand for additional housing would be driven by an increase in plant employment in response to refurbishment or license-renewal-term activities. Because STPNOC has determined that there would be no refurbishment (ER Section 3.2), and no additional employees needed to support license renewal (ER Section 3.4), area economic base information is not needed.

2.8 HOUSING

A demand for additional housing would be driven by an increase in plant employment in response to refurbishment or license-renewal-term activities. This is consistent with Regulatory Guide 4.2, Supplement 1, Section 4.14.1, Refurbishment (housing impacts) and Section 4.14.2, License Renewal Term (housing impacts). Because STPNOC has determined that there would be no refurbishment (ER Section 3.2) or additional license renewal term employees (ER Section 3.4), housing information is not needed.

2.9 EDUCATIONAL SYSTEM

A demand for educational system services would be driven by an increase in plant employment in response to refurbishment activities. This is consistent with Regulatory Guide 4.2, Supplement 1, Section 4.16, Education Impacts from Refurbishment. Because STPNOC has determined that there would be no refurbishment (ER Section 3.2), educational system information is not needed.

2.10 TAXES

2.10.1 Counties and Special Districts

According to the Texas Legislative Council, all privately owned property in Texas is subject to property taxation by the county and school district in which it is located, unless specifically exempted by the Texas Constitution. Also, most private property owners in Texas pay property taxes to local jurisdictions like cities and special districts within whose boundaries they reside. Property tax revenues are the major tax revenue source for counties, school districts, and special districts. The sole local source of tax revenue for school districts is the property tax. Exemptions from property taxes are governed by the state (TLC 2002).

In Texas, county appraisal districts determine the value of properties, and local jurisdictions set the tax rates. Each county appraisal district sets property values and sends those values to the local taxing jurisdictions within that county. The governing body of each local jurisdiction sets the tax rates for that jurisdiction which, when applied to property values, will generate the needed property tax revenues (TLC 2002). Generally, property owners make a consolidated payment to the County Tax Assessor, who retains the County's portion and distributes the special district funds to the special districts.

The owners of STP Units 1 and 2 pay the majority of property taxes on the plant and the site to the following taxing jurisdictions: Matagorda County, Matagorda County Hospital District, Navigation District #1, Drainage District #3, Palacios Seawall District, and the Coastal Plains Groundwater District. Tables 2.10-1 through 2.10-3 present tax data for STP Units 1 and 2 and these taxing jurisdictions.

Table 2.10-1 presents annual rates per $100 of property value and levies and fees on the STP plant site for Matagorda County, Matagorda County Hospital, and the four special taxing districts noted above, along with payments by the STP owners to each of the districts. Table 2.10-2 presents each district's total property tax levies, STP payments, and the proportion of the total constituted by STP. Between 2003 and 2008, Matagorda County levied a total of approximately $8.1 million to $10.9 million annually in property taxes, and the Matagorda County Hospital District levied approximately $4.1 million to $7.0 million (see Table 2.10-2).

As Table 2.10-2 shows, STP payments represent a major portion of property tax revenues for each of the districts. For Matagorda County, STP percentages of these revenues range from a high of 75.1 percent in 2004 to a low of 55.6 percent in 2008. For the Matagorda County Hospital District, STP provided from 59.6 percent of property tax revenues in 2003 to 37.0 percent in 2008. Note that, in 2001, STPNOC negotiated an agreement with Matagorda County (to begin in 2002) to remit a county service fee in lieu of property taxes to the county, with a revenue cap of $6.1 million. STPNOC has a similar agreement with the local hospital district, capped at $2.6 million, to compensate the hospital for its extensive support of STP's emergency response requirements (MCJ 2006; MCJ 2008).

From 2003 through 2008, the Navigation District #1 total property tax levies were between $370,191 and $547,517 annually (see Table 2.10-2). For the years 2003 through 2008, STP's property taxes have represented 68.0 to 87.1 percent of the Navigation District #1's property tax levies.

From 2003 through 2008, the Drainage District #3 property tax levies were between $229,254 and $288,179 annually (see Table 2.10-2). During this period, STP's property taxes have represented 80.1 to 86.8 percent of the Drainage District #3's property tax levies.

From 2003 through 2008, the Palacios Seawall District property tax levies ranged from $276,122 to $499,121 annually (see Table 2.10-2), with STP's property taxes representing 68.0 to 94.8 percent of the Palacios Seawall District's total levies.

From 2003 through 2008, the Coastal Plains Groundwater District property tax levies were between $136,040 and $187,828 annually (see Table 2.10-2). STP's tax payments represented between 22.4 and 33.3 percent of the district's total levies.

Matagorda County also receives tax revenues from sales taxes and other sources, and had total tax revenues from all sources between $16.2 million and $18.5 million from 2003 to 2007, the latest year for which total revenues were available (see Table 2.10-3). Over this period, the STP owners' property tax payments to Matagorda County alone (not including payments to the special districts) have represented approximately one-third (ranging from 32.9 percent to 37.9 percent) of the County's total revenues.

In addition to tax payments to the districts discussed above, STP's owners pay taxes to other districts within Matagorda County. These payments are generally for undeveloped portions of the STP plant site that lie within other taxing districts and for other STP-related property within the County. As shown in Table 2-10-4, these payments represent a very small proportion of those districts' total levies in 2007 and 2008, ranging from 2.80 percent for the Matagorda Independent School District (ISD), in 2008, to less than 1.0 percent for the remaining districts.

2.10.2 Independent School Districts

According to the Texas Comptroller's website (TLO 2009), Texas funds school districts according to district wealth, which is determined by the assessed valuation of property taxes. After a county appraisal district sets a district's total assessed valuation, and it is validated by the State Property Tax Board, the district's total assessed valuation is divided by the total number of students (weighted average daily attendance) to determine its wealth per student. Each year, the Texas Legislature establishes a per-student wealth benchmark to determine if a school district is to be designated as a "property-rich" or "property-poor" district, according to the guidelines of Texas Education Code (TEC) Chapter 41 or Chapter 42, respectively. Districts with a wealth per student at or above the benchmark fall under Chapter 41 and are designated as property-rich school districts. Districts with a wealth per student below the benchmark are designated as property-poor school districts and are governed by the provisions of Chapter 42. The state's funding formula is applied to each district. The state requires Chapter 41 school districts to send a share of their local tax monies to the state as a part of the equalization of wealth provisions stipulated by law. Chapter 42 school districts receive funding from the state (TLO 2009).

Although there are five ISDs in Matagorda County, these districts can only tax properties within their boundaries. Therefore, the STP owners pay taxes on the plant only to the Palacios ISD (although much smaller payments are also made to the Tidehaven and Matagorda ISDs, as discussed above and shown in Table 2.10-4).

The Palacios ISD is a property-rich (Chapter 41) school district, so the ISD must send part of its local tax collections to the state for redistribution to property-poor districts. The taxes are paid in full to the Palacios ISD, which distributes the required portion to the state of Texas. Table 2.10-5 shows the Palacios ISD's total revenues, the portion sent to the State and the STP owners' contributions from 2003 to 2008. During this period, the Palacios ISD's total property tax revenues remaining within the district were between $7,326,341 and $9,073,797. The STP owners paid between $6,074,778 and $7,176,966. The payments from STP have represented 71.4 to 84.6 percent of the ISD's property tax revenues remaining within the district.

2.10.3 Future Tax Assessments

The Electric Reliability Council of Texas region is deregulated (see Chapter 7), and this status is not expected to change (see Chapter 7). The STP site is located within the ERCOT region. Therefore, STP's property taxes are expected to continue to be primarily based on the market value of the station property and on agreements with the county regarding service fees in lieu of property taxes over the license renewal period (MCJ 2006; MCJ 2008).

2.11 LAND USE PLANNING

This section focuses on land use in Matagorda County because STP Units 1 & 2 owners pay property taxes to taxing jurisdictions in Matagorda County (see Section 2.10). The land use analysis in Chapter 4 is primarily focused on tax revenues in the region that could potentially have been used (or be used) to fund land conversion activities.

The STP site is in south-central Matagorda County, 8 miles north-northwest of the town of Matagorda, 11 miles north-northeast of Palacios, 13 miles south-southwest of Bay City, 80 miles southwest of Houston, and 14 miles north of the Gulf of Mexico (Figure 2.1-1). The site sits between Farm-to-Market Road 1095 to the west, and the Colorado River to the east (Figure 2.1-2). The site is approximately 12,220 acres and includes the plant, a railroad spur, a barge slip, and a cooling reservoir.

Matagorda County is located in the coastal prairie region of Texas and covers 1,612 square miles. It is bounded on the north by Wharton County, on the east by Brazoria County and the Gulf of Mexico, on the west by Calhoun and Jackson counties, and on the south by the Gulf of Mexico and Tres Palacios, Matagorda, and East Matagorda bays (TSHA 2008). Bay City is the county seat and largest city, and is located at the convergence of State Highways 35 and 60; Bay City is 50 air miles southwest of Houston (TSHA 2008).

Except for a slight undulation in the north, most of the county is level, with elevations ranging from sea level at the Gulf of Mexico to about seventy feet at points along the Wharton County line. Major watercourses in the county include Caney, Peach, Peyton's, Turtle, Cash's, and Big and Little Boggy creeks, the Tres Palacios and Colorado rivers, Live Oak and Linville bayous, and Little Robbins Slough. The Colorado River bisects the county from north to south. Part of Matagorda Peninsula, a narrow barrier island, runs northeast and southwest for sixty-five miles along Matagorda and East Matagorda bays and is bisected by the Colorado River channel (TSHA 2008).

The county has natural resources, productively used as cropland, pasture, and rangeland, and marshes. These areas provide habitat and wetlands to support waterfowl and marine animals and provide area visitors and residents protected wildlife habitats (i.e., the Big Boggy National Wildlife Refuge and the Mad Island Wildlife Management Area) (TSHA 2008), recreational hunting, fishing, and water sport attractions.

Table 2.11-1 presents land-use data for Matagorda County. Figure 2.11-1 presents the locations of the various land uses in the county. Agricultural land and rangeland account for about 70 percent of the land area in the county. Barren and forest land account for about 15 percent, and water and wetlands account for about 12 percent. Urban or built-up land accounts for only about 2 percent. Matagorda County is primarily rural in nature.

In Texas, the zoning ordinance is the primary tool used to control the use of property through restrictions and development standards. A zoning ordinance may be adopted by a city, but not by a county, and it applies to all areas within a city's limits. Thus, there are no zoning restrictions outside of city limits (REC 1999). Counties can, however, adopt subdivision regulations and other tools to control development.

Only the City of Palacios, in Matagorda County, has adopted a zoning ordinance for the area within its city limits (City of Palacios Undated). Neither Matagorda County nor Bay City has zoning at this time. Matagorda County does, however, have subdivision regulations for areas outside of city limits (Gonzales 2007). Bay City has city codes, which include subdivision and mobile home/RV ordinances (Bay City Undated). Neither Matagorda County nor its cities have land-use plans.

2.12 SOCIAL SERVICES AND PUBLIC FACILITIES

2.12.1 Public Water Supply

Because STP obtains all potable water from groundwater (Section 2.3) and more than 80 percent of station employees reside in Matagorda and Brazoria counties, the analysis of public water supply systems is limited to Matagorda and Brazoria counties. Table 2.12-1 details water suppliers in the two counties, their current capacities, and their average daily production. Currently, there is excess production capacity in all of the major water supply facilities.

Water assessment and planning in Texas is performed on a regional basis; therefore, Matagorda and Brazoria counties are discussed within the context of their respective regions.

The Texas Water Development Board (TWDB) develops water supplies and prepares plans to meet the state's future water needs. In 1997, the Texas legislature established a water planning process to address water supply issues, such as droughts and population growth. The state's population is expected to increase to more than 39 million people by the year 2050 (TWDB 2008).

For planning purposes, the TWDB divided Texas into 16 water planning regions, "Region A" through "Region P." Each region is represented by a Regional Water Planning Group that prepares a regional water plan for its region. Regional Water Planning Groups are composed of representatives from a variety of interests, including agriculture, industrial, environmental, public, municipality, business, water district, river authority, water utility, county, and power generation. Regional Water Planning Group plans have engineering, socioeconomic, hydrological, environmental, legal, and institutional components. They include direction for water conservation strategies, meeting future water supply needs, and responding to future droughts (TWDB 2008).

Matagorda County

Matagorda County is one of 14 counties included in Region K, the Lower Colorado Regional Planning Area. Region K stretches from Mills County to Matagorda County, following the Colorado River Basin. Major cities in the region include Austin, Bay City, Pflugerville, and Fredericksburg (TWDB 2006). A summary of Region K demand and supply is provided below, as presented in the state's 2007 water plan (TWDB 2006).

Region K Demand

By 2010, approximately 5 percent of the Texas population is projected to reside in Region K. Between 2010 and 2060, Region K's population is projected to increase nearly 100 percent, to 2,713,905. Annual water demand, however, is projected to increase less significantly due to the Region K water management strategies (discussed below). By 2060, the region's total water demand is projected to increase by 21 percent, from 1,078,041 acre-feet in 2010 to 1,301,682 acre-feet (TWDB 2006).

Region K Supply

The region has a large number of surface water and groundwater sources available. In 2010, surface water is projected to provide about 77 percent of supply and groundwater about

23 percent. The principal surface water supply sources are the Colorado River and its tributaries, including the Highland Lakes system. There are nine reservoirs in Region K from which water supply is obtained. In determining water supply from the Colorado River, the planning group assumed voluntary subordination of its major senior water rights to those in Region F for planning purposes only. There are five major and five minor aquifers that supply groundwater to users in Region K. The five major aquifers are the Edwards-Trinity (Plateau) and Trinity in the western portion of the region, the Edwards (Balcones Fault Zone) and Carrizo-Wilcox in the central portion, and the Gulf Coast in the eastern portion. The total supply to the planning area is estimated to be 1,182,078 acre-feet in 2010, declining 25 percent to 887,972 acre-feet in 2060, because of reservoir sedimentation and expired water supply contracts (TWDB 2006). Per the terms of the 2006 Amended and Restated Contract between the STPNOC and the Lower Colorado River Authority, STPNOC's water supply contract is valid for as long as the STP site is generating electricity by the Project Participants.

Region K Water Management Strategies

As demand is expected to exceed supply, the Lower Colorado Regional Water Plan includes water management strategies that provide 861,930 acre-feet of additional water supply by the year 2060 at a total capital cost of approximately $358 million for the region's portion of the project. These strategies include, but are not limited to, reuse, seawater desalination, conservation, and the LCRA/San Antonio Water System Project (TWDB 2006).

The LCRA/San Antonio Water System Project is the primary recommended water management strategy. It consists of off-channel reservoirs, agricultural water conservation, additional groundwater development, and new and/or amended surface water rights. New surface water would be captured in off-channel reservoirs for use by San Antonio, while the groundwater would remain within the region to meet agricultural needs (TWDB 2006).

Conservation strategies represent 23 percent of the total amount of water resulting from all recommended water management strategies (TWDB 2006).

STP Site

STP Units 1 & 2 withdraw groundwater for potable water primarily from the deep-confined aquifer within the Beaumont formation (Section 2.3). In 2009, STP Units 1 & 2 withdrew 368,766,200 gallons of water from five active onsite groundwater wells. Five percent of this water was used for "sanitary and drinking" purposes. STPNOC is permitted to withdraw an average of 2.7 million gallons per day (Section 2.3).

Brazoria County

Brazoria County is one of 15 counties in planning Region H, which includes portions of the Trinity, San Jacinto, and Brazos river basins. The Houston metropolitan area is located within this region. A summary of Region H demand and supply as presented in the state's 2007 water plan is provided below (TWDB 2006).

Region H Demand

Approximately 23 percent of the state's population is projected to reside in the region in 2010. By 2060, Region H is projected to grow by 89 percent, to a population of 10.9 million. Total water demand for the region is projected to increase 47 percent, from 2,314,094 acre-feet in 2010 to 3,412,457 acre-feet in 2060 (TWDB 2006).

Region H Supply

In 2010, the total water supply is projected to be 2,712,744 acre-feet, decreasing approximately 6 percent to 2,562,755 acre-feet by 2060. This decrease is primarily due to reduced supplies in the Gulf Coast Aquifer because of district subsidence regulations. The decline in groundwater supply will result in the increased use of surface water to meet future needs. In 2010, surface water is projected to provide 2,051,666 acre-feet of supplies and, groundwater, 661,078 acre-feet. By 2060, surface water is projected to provide 2,053,040 acre-feet and groundwater 509,715 acre-feet. Region H has four major reservoirs, with the largest supplies of available surface water coming from the Lake Livingston/Wallisville System in the Trinity River Basin and run-of-river water rights in the Trinity and Brazos river basins (TWDB 2006).

Region H Water Management Strategies

As demand is expected to exceed supply, the Region H Planning Group has recommended 23 water management strategies that would provide 1,300,639 acre-feet of additional water supply to meet all projected needs by the year 2060, at a total capital cost of $5.5 billion (TWDB 2006).

One type of strategy is conservation. Recommended municipal and irrigation water conservation strategies provide for 178,868 acre-feet per year of demand, with municipal conservation accounting for 100,987 acre-feet of savings, and irrigation conservation accounting for 77,881 acre-feet per year by 2060 (TWDB 2006).

2.12.2 Transportation

STP is served by a transportation network of state and US highways and Farm-to-Market (FM) and County Roads. Figure 2.12-1 shows the road and highway transportation system in the 50-mile region. No interstate highways are within the 50-mile vicinity, but there are two US highways: US Highway 59 (US 59), which runs northeast-southwest connecting Fort Bend, Wharton, Jackson, and Victoria counties and US 87, which runs northwest-southeast and connects Victoria and Calhoun counties. A number of FM and county roads intersect these highways and connect to the towns within these counties, providing outlying areas access to the state and US highway system. For example, TX-60 runs north-south connecting from US 59 to FM 521 providing access to the STP site.

Table 2.12-2 lists the Matagorda County roadways that STP workers would use to access the plant, the road characteristics, the 2006 Average Annual Daily Traffic (AADT) counts, and hourly road capacity. Figure 2.12-1 locates the AADTs. Workers commuting from Matagorda County would take one of five routes that connect to FM 521 and access to the site. Vehicle volume on the roads, as measured by AADT counts within a 24-hour period, reflect the urban and rural character of the counties. There is no Transportation Research Board “Level of Service” determination for these Texas roads.

Workers commuting from Matagorda County would take one of five routes that connect to FM 521 and access to the site (Figure 2.12-1; road characteristics and traffic statistics for each route segment are provided in Table 2.12-2). Workers arriving from the east side of Matagorda County and all of Brazoria County would likely take TX-60 south, exiting onto FM 521 west to the STP site. As indicated on Figure 2.12-1, workers could also take less direct routes and exit TX-60 at other points. Workers from the north would likely travel TX-35 west exiting onto FM 1468 south or FM 1095 south, intersecting FM 521 east to the site entrance. Workers arriving from the west side of Matagorda County would likely travel south on TX-35 and east on FM 521.

2.13 METEOROLOGY AND AIR QUALITY

STP is in Matagorda County, a coastal county located on the Gulf of Mexico in Texas. Texas is the second largest state in the United States, with a total land area of 267,340 square miles. The state has variations in geography commensurate with its size and diverse character. There are 10 climatic divisions of Texas, with Matagorda County falling into the Gulf Coastal Plain, primarily a combination of prairies and marshes. Behind the barrier beach is a set of lagoons and estuaries that form a rich habitat for migratory and resident birds, including a major wintering area for the endangered whooping crane. While tornadoes and floods are the primary weather hazards in the rest of the state, the Gulf Coastal Plain is most vulnerable to hurricanes (NCDC 2003).

The climate at the STP site is subtropical maritime and characterized by short mild winters and long hot summers. The humidity is generally high and rainfall is abundant throughout the year. The summer weather is normally dominated by tropical maritime air masses associated with the Bermuda High. Days are typically hot and humid, and convective showers and thunderstorms are relatively frequent (STPNOC 2008b). Summer climate extends from May through September, with the highest temperatures occurring during July and August (83.8°F and 83.7°F, respectively). The winter climate extends from December through February, with the coldest weather occurring in January (55.7°F on average) (NCDC 2004). The Gulf of Mexico modifies outbreaks of polar air masses to such an extent that temperatures below 32°F occur, on average, less than four times per year (STPNOC 2008b). The fall climate occurs in October (72.6°F) and November (64.6°F), and spring climate occurs in March (65.4°F) and April (70.2°F) (NCDC 2004). These transitional seasons are short and characterized by mild, pleasant weather (STPNOC 2008b). Average annual precipitation in Bay City for 1971–2000 was 48.03 inches, with the least amount of rainfall recorded, on average, in the month of February (2.97 inches) and the most recorded in September (5.61 inches) (NCDC 2004). Meteorological information, as it relates to the analysis of severe accidents, is included in Attachment F.

Under the Clean Air Act, the U.S. Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) that specify maximum concentrations for carbon monoxide (CO), particulate matter with aerodynamic diameters of 10 microns or less (PM_{10}), particulate matter with aerodynamic diameters of 2.5 microns or less ($PM_{2.5}$), ozone, sulfur dioxide (SO_2), lead, and nitrogen dioxide (NO_2). Areas of the United States having air quality that meet or are better than the NAAQS are designated by EPA as “attainment areas.” Areas having air quality that is worse than the NAAQS are designated by EPA as “non-attainment areas.” Areas that were designated non-attainment and subsequently re-designated as attainment due to meeting the NAAQS are termed “maintenance areas.” States with maintenance areas are required to develop an air quality maintenance plan as an element of the State Implementation Plan. The Texas Commission on Environmental Quality (TCEQ) has primary responsibility for regulating air emission sources within the state. The TCEQ, with assistance for other entities around the state, conducts ambient air monitoring in Texas, operating 200 sites throughout the State with 217 monitors (TCEQ 2010).

STP is located in Matagorda County, Texas. Matagorda County is within the Metropolitan Houston-Galveston Intrastate Air Quality Control Region (AQCR), which also includes Austin, Brazoria, Chambers, Colorado, Fort Bend, Galveston, Harris, Liberty, Montgomery, Walker, Waller, and Wharton counties (40 CFR 81.38). The Metropolitan Houston-Galveston Intrastate AQCR is in attainment for all criteria pollutants with the exception of the 8-hour ozone standard.

The counties of Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller are classified as "severe" non-attainment (40 CFR 81.344). These counties are located northeast or north-northeast of Matagorda County, with the closest being Brazoria County, which is approximately 21 miles northeast of STP

On January 6, 2010, EPA proposed strengthened national air quality standard for ground-level ozone. States must make a recommendation to EPA by January 2011 for areas to be designated as in attainment, non-attainment, or unclassifiable. EPA will issue final designations by July 2011 (75 *Federal Register* 2938; January 19, 2010). Matagorda County's attainment designation for ozone would not be expected to change following the issuance of new EPA standards.

STP has a number of stationary emission sources, such as standby emergency diesel generators, an auxiliary boiler to furnish steam for start-up when the nuclear steam supply is unavailable, and several petroleum fuel storage tanks. As reported and submitted to TCEQ, actual total emissions from all sources at STP from 2004 to 2009 were 62.86 tons per year (tpy), 58.15 tpy, 56.24 tpy, 47.07 tpy, 60.68 tpy, and 59.97 tpy, respectively (STPNOC 2005; STPNOC 2006; STPNOC 2007; STPNOC 2008a; STPNOC 2009; and STPNOC 2010). With the exception of volatile organic compounds (VOC), the highest emissions were reported in 2004: 1.11 tpy of particulate matter (PM_{10}), 12.41 tpy of carbon monoxide (CO), 46.62 tpy of oxides of nitrogen (NOx), and 0.78 tons per year of sulfur dioxide (SO_2) (STPNOC 2005). The highest VOC emissions (2.07 tpy) were reported in 2009 (STPNOC 2010). Since 1988, the EPA, states, and federal land management agencies (e.g., National Park Service, U.S. Forest Service, and Bureau of Land Management) have conducted monitoring of visibility impairment at national parks and wilderness areas across the United States. The 156 national parks and wilderness areas are referred to as "Mandatory Class I Federal Areas" where visibility is an important value. The closest Class I area to STP is the Big Bend National Park located in west Texas (EPA 2008).

2.14 HISTORIC AND ARCHAEOLOGICAL RESOURCES

2.14.1 Regional Historical Context

Prehistoric

Based on early taxonomic divisions within coastal archaeology, the Texas gulf coast has been divided into three basic zones: upper, central, and lower coasts. This review of prehistory includes the central Texas coast, which is most commonly discussed as extending from the Colorado River south to the northern reaches of Baffin Bay. This area includes the barrier islands and coastal fringes and continues inland for approximately 25 miles. The chronological framework for indigenous archaeology presented below is based on a previously summarized central Texas coast chronology (Peter and Prior 2008).

The Texas coastal region underwent dramatic changes in geomorphology throughout the late Pleistocene and early Holocene. By the peak of glaciation within the Pleistocene (ca. 20,000 Before Present [B.P.]), sea levels were at least 100 meters below current levels. Global warming trends ca. 18,000 years ago triggered sea level increases, which by 9,000 years ago allowed for the initial formation of the modern bay systems of the central Texas coast. Sea levels continued rising throughout the early Holocene and did not approximate modern levels until ca. 3,000 B.P. The shallow water estuary/barrier island chain systems characteristic of the central Texas coast began to approximate their modern forms ca. 3,000 years ago. Due to the dynamic nature of the Texas coast during the early Holocene, evidence of Paleoindian archaeology (ca. 9200–5500 B.C.) is sparse on the central Texas coast and primarily consists of isolated, scattered finds.

For the first two millennia of the Early Archaic period (ca. 5500–2200 B.C.), sea levels continued to slowly rise, and the active channels of rivers were still below their current depths. Phytolith data indicate that throughout the Early Archaic period the environment underwent a gradual transition to drier conditions. Given the amount of general geomorphological and climatic change occurring throughout the Early Archaic, it has been difficult for archaeologists to locate occupations dating to this period. Intact sites attributed to the Early Archaic are rare for the central Texas coast.

Sites with Middle Archaic (ca. 2200–1100 B.C.) components are slightly more numerous than previous periods. Dated oyster reef deposits indicate that by the end of the Middle Archaic, productive estuary resource systems were well established. With the gradual stabilization of sea levels and establishment of active estuary systems throughout the Middle Archaic, the central Texas coast likely became a more predictable environment for the procurement of marine and brackish-water fish and mollusks. Throughout this and previous periods, Pleistocene terraces were the preferred locations for sites.

The number of archaeological sites attributed to the Late Archaic period (ca. 1100 B.C.–A.D. 1000) on the central Texas coast is substantially greater than for previous periods. It has been suggested that the dramatic increase in the number of sites can be explained by the combination of sea level stabilization, increase in river sediments, and the gradual formation of Matagorda Island would have acted to reduce salinity of the estuary bay system, thereby increasing the productivity of oysters and other estuarine resources. Concomitantly, evidence of Late Archaic subsistence is dominated by fish species whose yearly cycle is tied to estuary bay systems. As the central Texas coast estuary bay systems began to increase their biotic productivity throughout the Late Archaic, other areas such as river valleys possibly began to offer more opportunities for prehistoric activities. The increase in both the number of sites and use of estuarine resources is a trend that continues into the Late Prehistoric period.

In addition to the increased reliance upon estuarine resources, the archaeology of the Late Archaic reveals a diverse shell tool industry and evidence of basketry. Although perforated oyster shell and edge-flaked clamshell scrapers are known from the Early Archaic and continue to be found in later periods, the use of conch shell for tools appears to begin only in the Late Archaic. Additionally, bone artifacts (e.g., awls, socketed points) increase dramatically in the archaeological record of the Late Archaic.

The end of the Late Archaic period on the central Texas coast, as with the remainder of the state, is signaled by the widespread adoption of the bow and arrow and ceramics. Based on changes in artifact types and suspected shifts in subsistence practices, the Late Prehistoric period (ca. A.D. 1000–1700) for the central Texas coast is divided into Initial Late Prehistoric (ca. A.D. 1000–1250/1300) and Final Late Prehistoric (ca. A.D. 1250/1300–1700) phases. The Initial Late Prehistoric phase along the central Texas coast is characterized by Scallorn and Fresno arrow points along with plain, sandy paste ceramics similar to Goose Creek of the upper Texas coast. By the Final Late Prehistoric phase, Perdiz arrow points predominate along with a prismatic blade technology, thin bifacial knives, and Rockport sandy paste ceramics.

Fishing continued to be a major focus of subsistence in the Late Prehistoric period and was possibly of even greater importance than in the Late Archaic. At several sites along the central Texas coast, Late Prehistoric fish-rich middens are stratigraphically above Late Archaic shell middens, suggesting a possible shift in resource selection. Additionally, by A.D. 1250/1300, bison became a significant resource for the region as numerous upland hunting camps have been dated to this period. Collectively, subsistence data along with site size information suggest large aggregations of groups occurred during the fall and winter months along the coast, followed by a late spring and summer dispersal of smaller groups into upland river margin settings. Many of the smaller upland sites are indicative of hunting camps and have yielded concentrations of deer and bison bone. Archival sources suggest similar seasonality patterns existed within the early historic period Karankawa along the central Texas coast.

Historic

The first Europeans explorers reached the central Texas coast area during the early sixteenth century. At the time, the Karankawa Indians were the inhabitants of what is now Matagorda County. Evidence for interaction between indigenous cultures and Europeans during the start of the Historic period is limited to mostly indigenous archaeological sites with European artifacts present. Although widely dispersed, such sites demonstrate indigenous interaction with colonial Spanish interests. These sites are few along the central Texas coast (Peter and Prior 2008). By the time of the Civil War, the Karankawa ceased to exist (Preserve America 2009).

The establishment of Spanish settlements, with development of agriculture, irrigation, land ownership systems, and raising livestock, started in earnest in the 1700s. In 1812, Mexico won its independence from Spain, and the newly formed Mexican government maintained control of the central Texas coast area. In 1828, 60 settlers established the town of Matagorda, one of Steven F. Austin's original three colonies and the second busiest port in Texas throughout much of the 1800s. In 1836, the Texas Revolution began. After the war and establishment of the Republic of Texas, many of the Hispanic families along the coastal areas who had supported the Texans in their bid for independence were ostracized and forced to flee, and

Anglo-Americans eventually re-settled the area (Peter and Prior 2008). The Republic of Texas sought to encourage a high level of immigration by offering free land to settlers and immigration agents. Matagorda County was organized in 1837 under the Texas Republic. In 1845, Texas joined the United States. During the Civil War, Matagorda was at the center of rich farmlands and the port was used to ship cotton out and import supplies for the Confederacy (Preserve America 2009). Ranching also thrived in the 19th century. Throughout the nineteenth and twentieth centuries, agriculture has served as the principal economic activity in the region surrounding the STP Units 1 & 2 site.

2.14.2 Initial Construction and Operation

Cultural resource investigations of approximately 12,350 acres were conducted in 1973 by the Texas Archaeological Society for the proposed construction of STP Units 1 & 2. The investigations included a pedestrian surface survey with limited subsurface testing and an historic records search. Those investigations determined that the study area did not include any resources there were listed on, or eligible for listing on, the National Register of Historic Places (NRHP). It also concluded that no resources of local, regional, or state significance were in the study area (HL&P 1975). A possible grave site was noted in the southeast portion of the study area; however, because it was located outside the area proposed for disturbance, no further investigation was conducted.

The findings of the survey were included in the analysis conducted for the Final Environmental Statement (FES) for construction of STP Units 1 & 2. The FES found that, based on the findings of the study, there were no archaeological resources in the site area (NRC 1975). The Advisory Council on Historic Preservation and the Texas Historical Commission (THC) both commented on the Draft FES saying that a field investigation of the transmission line corridors would be needed (NRC 1975). The FES response to comments indicates that a field investigation of the transmission lines would occur and the results provided to the THC (NRC 1975). The FES for operation of STP Units 1 & 2 reports that consultation with the THC on the operation of the STP site and transmission lines was conducted, and the THC concluded that no effect upon any properties listed on or eligible for listing on the NRHP would occur (NRC 1986).

2.14.3 Current Status

There are five types of designations within the County of Matagorda to recognize and protect significant historic and prehistoric properties. National Historic Landmarks and properties listed on the NRHP are two types designated by the National Park Service. The THC offers three types of designations. These are: Recorded Texas Historic Landmark, State Archaeological Landmark, and Historic Texas Cemetery. The County of Matagorda has a Historical Commission, but they do not maintain a listing of important cultural properties.

There are no recorded historic or archaeological resources on the STP Units 1 & 2 site.

A search of records maintained by the National Park Service, the THC, and the Texas Archaeological Research Laboratory was conducted to identify designated cultural properties and recorded archaeological resources within six miles of STP Units 1 & 2. There are no National Historic Landmarks and no properties listed on the NRHP located within six miles of STP Units 1 & 2 (NPS 2009a and NPS 2009b). There are no Historic Texas Cemeteries and only one Recorded Texas Historical Landmark within six miles (THC 2009a). The Landmark is the St. Francis Catholic Church, a late Victoria church dating to 1896, which is located near

Wadsworth approximately six miles to the east of STP Units 1 & 2 (THC 2009b). There are three previously recorded archaeological sites located within six miles of STP Units 1 & 2, none of which are State Archaeological Landmarks (THC 2009c). One site is the wreck of a small boat, and one site is a historic farmstead with structural foundation remains and a widespread scatter of 20th century machine parts and structural debris. The site form for the third site is missing from the records. The three archaeological sites are located to the northeast of STP Units 1 & 2, between 3.85 and 4.40 miles away.

2.15 OTHER PROJECTS AND ACTIVITIES

This section briefly describes federal and other activities in the area that could have cumulative impacts with the proposed action, which is to operate STP Units 1 and 2 for an additional 20 years.

Industries in the STP Vicinity

The “Envirofacts Warehouse” online database provided by the U.S. Environmental Protection Agency (USEPA) lists a total of 120 EPA-regulated facilities in Matagorda County. The list included 24 industries that produce and release air pollutants, 4 facilities that reported toxic releases, 62 facilities that reported hazardous waste activities, and 30 facilities that are permitted to discharge to waters of the United States (USEPA 2009). There are 2 Superfund sites in Matagorda County, but none are located within a six-mile radius of the STP Units 1 and 2 (USEPA 2009).

As indicated on Figure 2.1-2, there are few urban areas within the 6-mile radius of STP Units 1 and 2. There are two offsite industrial facilities located within 6 miles of the STP site. The OXEA Corporation facility (previously owned by the Celanese Ltd., Inc) (Celanese 2007) is the largest facility located in the region and is approximately 5 miles northeast of STP. The second offsite industrial facility within the vicinity is a public wharf located at the Port of Bay City located approximately 4.8 miles north-northeast of STP. The wharf is used for temporary storage and transport (by barge and tanker) of petroleum crude oil and condensate. The terminal is used by Gulfstream Terminal and Marketing, LLC and by GulfMark Energy, Inc. as a facility for unloading petroleum products such as gasoline and diesel fuel from barges traveling on the Colorado River (STPNOC 2008).

One additional offsite industrial facility is located just outside of the 6-mile vicinity radius. The Equistar Chemicals, LP owns and operates a high-density polyethylene plastic resin manufacturing plant, located approximately 7 miles east of the STP site (STPNOC 2008).

Federal and Energy Facilities in the Vicinity of STP

There are no known federal facilities located within six-miles of STP.

Within 6 miles of the site there are at least 6 natural gas pipelines, including a 24-inch transmission pipeline located about 2 miles northwest of the site, and a 30-inch transmission pipeline 4.5 miles northwest of the site. There is also a natural gas field (the Collegeport field) with a large number of wells of production wells located within 6 miles southwest of the site (RRCT 2009).

Independent Spent Fuel Storage Installation at STP

STP currently has a spent fuel pool for storage of radioactive, spent nuclear fuel located at the plant. Implementation of a Dry Fuel Storage system is proposed for the Station since the pool is not designed to have adequate storage capacity to take the Station past 2025. Currently, there are no applications pending for the Dry Fuel Storage system.

The spent fuel storage pool is operated in accordance with 10 CFR 72, Subpart K, “General License for Storage of Spent Fuel at Power Reactors.”

Combined License Application for Additional Reactors at STP

In September 2007, STPNOC applied to the NRC for a combined license (COL) consistent with the requirements of 10 CFR 52 to support construction and operation of two additional reactors at STP.

The site was originally planned for four reactors. STPNOC submitted comprehensive information on the site and surrounding area to NRC in its application for a combined license (STPNOC 2008). NRC reviewed the COL application and prepared a Draft Environmental Impact Statement (DEIS), which analyzed the impacts on the surrounding communities and natural resources to determine if the STP site is suitable to support additional nuclear power generation (NRC 2010). In the DEIS, NRC also evaluated the cumulative impacts of the four units on the surrounding environment. NRC's cumulative impact analysis considered the possible life extension of Units 1 & 2 by 20 years.

Other Activities

White Stallion Energy Center, LLC is proposing to build a 1320-megawatt, base-load, solid fuel electric generating plant approximately 4 miles north-northeast of STP (White Stallion 2009). White Stallion submitted a water-supply contract application to the Lower Colorado River Authority (LCRA) on October 13, 2008, for diversion of 22,000 acre feet of water from the lower Colorado River (LCRA 2009). The development phase of the plant is expected to be completed by the end of 2009, and a four-to five-year construction period will commence in early 2010 (White Stallion 2009).

NGS Energy is developing the Tres Palacios Gas Storage facility utilizing existing underground salt caverns on the Markham Dome located approximately 10.5 miles north of STP in Markham, Texas. The development of the first of three salt caverns was completed in October 2008 with a storage capacity of 12 billion cubic feet (Bcf). The two additional salt caverns are expected to be developed in the next few years for a total gas capacity of 36.62 Bcf for the facility (NGS 2009; McConnell 2009).

Gulfstream Terminals and Marketing is proposing to build a bulk diesel and crude oil terminal at the Port of Bay City (Bludau 2009). According to records on file at Texas Commission on Environmental Quality (TCEQ), Gulfstream submitted an air quality permit application to TCEQ in October 2008 (TCEQ 2009). Gulfstream plans to begin construction on the facility in 2010.

Swedish Gas Centre (SGC) plans to build a synthetic gas production facility at the Port of Bay City. The facility will produce synthetic gas from industrial and other waste products and construction is also planned for 2010 (Bludau 2009).

Matagorda County also has multiple gas lines and ongoing development, exploration and production of oil and gas resources.

2.16 TABLES AND FIGURES

Table 2.2-1. Relative Abundance of Life Stages of Important Estuarine Organisms in Matagorda Bay

		Relative Abundance in Salinity Zones		
Species	**Life Stage**	**Tidal Fresh (<0.5 ppt)**	**Mixing (0.5–25 ppt)**	**Seawater (>25 ppt)**
American Oyster	Adult	Rare	Common	Rare
Crassostrea virginica	Spawning adults		Common	
	Juveniles	Rare	Common	Rare
	Larvae	Rare	Common	Rare
	Eggs		Common	
Brown shrimp	Adult		Common	Highly Abundant
Farfantepenaeus aztecus	Spawning adults			
	Juveniles	Common	Highly Abundant	Common
	Larvae	Common	Highly Abundant	Highly Abundant
	Eggs			
White shrimp	Adult	Rare	Abundant	Common
Penaeus setiferus	Spawning adults			
	Juveniles	Highly Abundant	Abundant	Common
	Larvae	Highly Abundant	Highly Abundant	Highly Abundant
	Eggs			
Blue crab	Adult	Common	Abundant	Common
Callinectes sapidus	Spawning adults	Common	Rare	
	Juveniles	Common	Abundant	Common
	Larvae	Highly Abundant	Abundant	Common
	Eggs		Rare	Common
Gulf menhaden	Adult		Abundant	Highly Abundant
Brevoortia patronus	Spawning adults			
	Juveniles	Highly Abundant	Highly Abundant	Highly Abundant
	Larvae			
	Eggs			

Table 2.2-1. Relative Abundance of Life Stages of Important Estuarine Organisms in Matagorda Bay (continued)

		Relative Abundance in Salinity Zones		
Species	**Life Stage**	**Tidal Fresh (<0.5 ppt)**	**Mixing (0.5–25 ppt)**	**Seawater (>25 ppt)**
Bay anchovy *Anchoa mitchelli*	Adult	Abundant	Highly Abundant	Common
	Spawning adults	Common	Highly Abundant	Common
	Juveniles	Abundant	Abundant	Common
	Larvae	Abundant	Common	Common
	Eggs	Common	Common	Common
Sheepshead *Archosargus probatocephalus*	Adult	Common	Abundant	Abundant
	Spawning adults			
	Juveniles	Common	Abundant	Common
	Larvae			
	Eggs			
Sand seatrout *Cynoscion arenarius*	Adult		Common	Common
	Spawning adults			
	Juveniles	Common	Common	Common
	Larvae			
	Eggs			
Spotted seatrout *Cynoscion nebulosus*	Adult	Rare	Common	Common
	Spawning adults		Common	Common
	Juveniles	Rare	Common	Common
	Larvae		Common	Common
	Eggs		Common	Common
Atlantic croaker *Micropogonias undulatus*	Adult	Abundant	Abundant	Abundant
	Spawning adults			
	Juveniles	Abundant	Highly Abundant	Abundant
	Larvae			
	Eggs			
Black drum *Pogonias cromis*	Adult		Common	Common
	Spawning adults			Common
	Juveniles	Common	Common	Common
	Larvae			Common
	Eggs			Common

Table 2.2-1. Relative Abundance of Life Stages of Important Estuarine Organisms in Matagorda Bay (continued)

		Relative Abundance in Salinity Zones		
Species	**Life Stage**	**Tidal Fresh (<0.5 ppt)**	**Mixing (0.5–25 ppt)**	**Seawater (>25 ppt)**
Red drum *Sciaenops ocellatus*	Adult	Rare	Rare	Common
	Spawning adults			Common
	Juveniles	Common	Common	Common
	Larvae			Common
	Eggs			Common
Striped mullet *Mugil cephalus*	Adult	Common	Abundant	Abundant
	Spawning adults			Abundant
	Juveniles	Abundant	Abundant	Abundant
	Larvae			Abundant
	Eggs			Abundant
Southern flounder *Paralichthys lethostigma*	Adult	Common	Abundant	Common
	Spawning adults			
	Juveniles	Common	Common	Common
	Larvae			
	Eggs			

Source: Nelson 1992
Abundant = Numerically dominant relative to other species
Highly Abundant = Often encountered in substantial numbers relative to other species
Blank cell = Absent
Common = Frequently encountered but not in large numbers; does not imply a uniform distribution throughout the salinity zone
Rare = Present but not frequently encountered

Table 2.3-1. STP Units 1 & 2 Production Well System Details

CPGCD ID	STP Well ID	Date Installed	Well Depth (feet)	Aquifer	Design Capacity (gpm)
2004122804	Well #5	1975	700	Deep Chicot Aquifer	500
2004122806	Well #6	1977	700	Deep Chicot Aquifer	500
2005010409	Well #7	1977	700	Deep Chicot Aquifer	500
2004122802	Well #8	1991	600	Deep Chicot Aquifer	250
2004122805	NTF	1985	600	Deep Chicot Aquifer	200

Note: Well numbers 1 through 4 are not used.
CPGCD = Coastal Plains Groundwater Conservation District
NTF = Nuclear Training Facility

Table 2.3-2. STP Units 1 & 2 Groundwater Use (Gallons)

Month	2005	2006	2007	2008	2009	Average 2005–2009
January	40,797,000	37,189,345	28,904,613	29,332,900	31,723,000	33,589,372
February	37,531,591	34,819,000	36,071,054	27,898,800	29,985,000	33,261,089
March	32,713,000	35,201,420	37,997,159	31,848,000	31,824,000	33,916,716
April	31,956,336	34,964,690	37,691,511	30,537,000	33,483,000	33,726,507
May	36,310,300	37,782,730	36,019,895	37,281,800	35,199,000	36,518,745
June	37,855,740	33,220,900	34,316,021	35,634,200	37,746,000	35,754,572
July	40,315,960	33,538,680	28,817,937	31,428,000	33,310,500	33,482,215
August	38,457,620	32,946,400	30,316,851	34,385,000	31,770,600	33,575,294
September	31,230,060	36,836,000	34,062,834	32,894,000	30,786,400	33,161,859
October	36,540,206	29,407,550	40,928,189	32,965,000	25,995,300	33,167,249
November	34,429,744	38,474,080	32,270,980	30,984,000	24,135,000	32,058,761
December	24,196,105	39,554,770	31,463,847	30,833,000	22,808,400	29,771,224
Total Gallons/ Year	422,333,662	423,935,565	408,860,891	386,021,700	368,766,200	401,983,604
Total Gallon/ Minute	804	807	777	734	702	765
Total Ac-Ft/Year	1296	1301	1253	1185	1135	1234

Note:
Years 2005 through 2006 groundwater use data from STPNOC 2008c.
Year 2007 groundwater use data from STPNOC 2008a.
Years 2008 and 2009 groundwater use data from STPNOC 2010a.

Table 2.5-1. Protected Species in Texas Counties Containing South Texas Project Facilities and Transmission Lines

Common Name	Scientific Name	Federal Status[a]	State Status[a]	Plant Site[b]	T-Line Counties[b]
Birds					
White-tailed hawk	*Buteo albicaudatus*	-	T	Y	Y
Zone-tailed hawk	*Buteo albonotatus*	-	T	-	Y
Piping plover	*Charadrius melodus*	LT	T	Y	Y
Golden-cheeked warbler	*Dendroica chrysoparia*	LE	E	-	Y
Reddish egret	*Egretta rufescens*	-	T	Y	Y
Peregrine falcon	*Falco peregrinus anatum*	DL	T	Y	Y
Arctic peregrine falcon	*Falco peregrinus tundrius*	DL	T	Y	Y
Whooping crane	*Grus americana*	LE	E	Y	Y
Bald eagle	*Haliaeetus leucocephalus*	DL	T	Y	Y
Wood stork	*Mycteria americana*	-	T	Y	Y
Eskimo curlew	*Numenius borealis*	LE	E	Y	Y
Brown pelican	*Pelecanus occidentalis*	LT	E	Y	Y
White-faced ibis	*Plegadis chihi*	-	T	Y	Y
Interior least tern	*Sterna antillarum athalassos*	LE	E	-	Y
Sooty tern	*Sterna fuscata*	-	T	Y	Y
Attwater's prairie chicken	*Tympanuchus cupido attwateri*	LE	E	-	Y
Black-capped vireo	*Vireo atricapilla*	LE	E	-	Y
Mammals					
Gray wolf	*Canis lupus*	LE	E	-	Y
Red wolf	*Canis rufus*	LE	E	Y-	Y
Gulf coast jaguarundi	*Herpailurus yaguarondi cacominth*	LE	E	-	Y
Ocelot	*Leopardus pardalis*	LE	E	Y	Y
White-nosed coati	*Nasua narica*	-	T	-	Y
Manatee	*Trichechus manatus*	LE	E	Y	Y
Black bear	*Ursus americanus*	SAT	T	-	Y
Louisiana black bear	*Ursus americanus luteolus*	T	T	Y	Y
Reptiles					
American alligator	*Alligator mississippiensis*	SAT	-	Y	Y

Table 2.5-1 Protected Species in Texas Counties Containing South Texas Project Facilities and Transmission Lines (continued)

Common Name	Scientific Name	Federal Status[a]	State Status[a]	Plant Site[b]	T-Line Counties[b]
Reptiles (continued)					
Loggerhead sea turtle	*Caretta caretta*	LT	T	Y	Y
Texas scarlet snake	*Cemophora coccinea lineri*	-	T	Y	Y
Green sea turtle	*Chelonia mydas*	E	T	Y	Y
Timber/canebrake rattlesnake	*Crotalus horridus*	-	T	Y	Y
Leatherback sea turtle	*Dermochelys coriacea*	E	E	Y	Y
Indigo snake	*Drymarchon corais*	-	T	-	Y
Hawksbill sea turtle	*Eretmochelys imbricata*	E	E	Y	Y
Texas tortoise	*Gopherus berlandieri*	-	T	Y	Y
Cagle's map turtle	*Graptemys caglei*	-	T	-	Y
Kemp's ridley sea turtle	*Lepidochelys kempii*	E	E	Y	Y
Smooth green snake	*Liochlorophis vernalis*	-	T	Y	-
Texas horned lizard	*Phrynosoma cornutum*	-	T	Y	Y
Alligator snapping turtle	*Macrochelys temminckii*	-	T	-	Y
Amphibians					
Houston toad	*Bufo houstonensis*	LE	E	-	Y
Cascade Caverns salamander	*Eurycea latitans complex*	-	T	-	Y
Comal blind salamander	*Eurycea tridentifera*	-	T	-	Y
Sheep frog	*Hypopachus variolosus*	-	T	-	Y
Black-spotted newt	*Notophthalmus meridionalis*	-	T	-	Y
Fish					
Blue sucker	*Cycleptus elongatus*	-	T	-	Y
Fountain darter	*Etheostoma fonticola*	LE	E	-	Y
Sharpnose shiner	*Notropis oxyrhynchus*	C	-	-	Y
Widemouth blindcat	*Satan eurystomus*	-	T	-	Y
Toothless blindcat	*Trogloglanis pattersoni*	-	T	-	Y

Table 2.5-1. Protected Species in Texas Counties Containing South Texas Project Facilities and Transmission Lines (continued)

Common Name	Scientific Name	Federal Status[a]	State Status[a]	Plant Site[b]	T-Line Counties[b]
Crustaceans					
Peck's Cave amphipod	*Stygobromus pecki*	LE	E	-	Y
Insects					
Helotes mold beetle	*Batrisodes venyivi*	LE	-	-	Y
Comal Springs riffle beetle	*Heterelmis comalensis*	LE	-	-	Y
A ground beetle	*Rhadine exilis*	LE	-	-	Y
A ground beetle	*Rhadine infernalis*	LE	-	-	Y
Comal Springs dryopid beetle	*Stygoparnus comalensis*	LE	-	-	Y
Arachnids					
Robber Baron Cave meshweaver	*Circurina baronia*	LE	-	-	Y
Madla Cave meshweaver	*Cicurina madla*	LE	-	-	Y
Braken Bat Cave meshweaver	*Cicurina venii*	LE	-	-	Y
Government Canyon Bat Cave meshweaver	*Cicurina vespera*	LE	-	-	Y
Government Canyon Bat Cave spider	*Neoleptoneta microps*	LE	-	-	Y
Cokendolpher Cave harvestman	*Texella cokendolpheri*	LE	-	-	Y
Plants					
Navasota ladies'-tresses	*Spiranthes parksii*	LE	E	-	Y

Sources of county occurrences: TPWD 2008 & USFWS 2008 .

[a] LE/E = Endangered; LT/T = Threatened; C = Candidate; - = Not listed; DL = delisted tax on, recovered, being monitored for first five years post delisting; SAE/T = listed due to similarity to endangered/threatened species.

[b] Listed in the county containing the plant site (Matagorda County) and/or the counties containing the existing transmission lines (Y=Yes, - = no reported occurrence) Bexar, Brazoria, Colorado, Comal, DeWitt, Fayette, Gonzales, Guadalupe, Jackson, Karnes, Lavaca, Victoria, Wharton and Wilson Counties.

Table 2.6-1. Population Growth in Matagorda and Brazoria Counties and the State of Texas, 1970 to 2040

	Matagorda		Brazoria		Texas	
Year	Population	Annual Percent Growth	Population	Annual Percent Growth	Population	Annual Percent Growth
1970[a]	27,913	N/A	108,312	N/A	11,196,730	N/A
1980[a]	37,828	3.1%	169,587	4.6%	14,229,191	2.4%
1990[a]	36,928	-0.2%	191,707	1.2%	16,986,510	1.8%
2000[b]	37,957	0.3%	241,767	2.3%	20,851,820	2.1%
2010[b]	41,406	0.9%	287,643	1.8%	24,330,612	1.6%
2020[b]	44,715	0.8%	335,925	1.6%	28,005,788	1.4%
2030[b]	47,062	0.5%	383,598	1.3%	31,830,589	1.3%
2040[b]	48,664	0.3%	429,766	1.1%	35,761,201	1.2%

Sources:
[a] USCB 1995
[b] Texas State Data Center 2006

Table 2.6-2. South Texas Project Employees by County

County	Number of STP Employees in Residence[a,b]	Percentage of Total STP Employees	2000 Population[c]	Percentage of County Population
Matagorda County	851	61.8	37,957	2.2
Brazoria County	298	21.6	241,767	0.1
Wharton County	62	4.5	41,188	0.2
Fort Bend County	54	3.9	354,452	0.02
Other Texas Counties	96	7.0	N/A	N/A
Other States	17	1.2	N/A	N/A
Total	1,378	100.00		

[a] STPNOC 2008
[b] STPNOC 2009
[c] USCB 2000d

Table 2.6-3. Block Groups within 50 Miles of South Texas Project with Significant Minority or Low-Income Populations

County	Number of Block Groups	Black or African - American	American Indian or Alaskan Native	Asian	Native Hawaiian or Other Pacific Islander	Some Other Race	Multi-Racial	Aggregate	Hispanic	Low-Income Households
Brazoria	104	7	0	0	0	1	0	8	12	1
Calhoun	17	0	0	0	0	0	0	0	6	0
Colorado	3	0	0	0	0	0	0	0	0	0
Fort Bend	14	1	0	0	0	0	0	1	1	0
Jackson	11	1	0	0	0	0	0	1	0	0
Lavaca	2	0	0	0	0	0	0	0	0	0
Matagorda[a]	36	3	0	1	0	4	0	4	5	2
Victoria	6	0	0	0	0	0	0	0	1	0
Wharton	38	7	0	0	0	1	0	8	5	3
TOTALS:	231	19	0	1	0	6	0	22	30	6

Source: TtNUS 2009
[a] Shading indicates that the county is completely contained within the 50-mile radius.

Table 2.10-1. STP Owner Payments, Matagorda County Property Tax, 2003-2008

Year[1]	Taxing District	Rate per $100 of property value	Est. Levy	Other Fees	Total
2003	Matagorda County[2]	0.31837	$2,883,623	$3,216,377	$6,100,000
	Matagorda County Hospital[2]	0.16140	1,461,132	1,000,000	2,461,132
	Navigation District #1	0.03981	360,394	0	360,394
	Drainage District #3	0.02760	249,859	0	249,859
	Palacios Seawall	0.04540	411,000	0	411,000
	Coastal Plains GW District	0.00500	45,264	0	45,264
	Total 2003		$5,411,272	$4,216,377	$9,627,648
2004	Matagorda County[2]	0.31837	$2,315,358	$3,784,642	$6,100,000
	Matagorda County Hospital[2]	0.20999	1,526,807	1,000,000	2,526,807
	Navigation District #1	0.03981	289,453	70,957	360,410
	Drainage District #3	0.03220	234,121	15,748	249,869
	Palacios Seawall	0.04540	330,097	80,921	411,018
	Coastal Plains GW District	0.00500	36,354	8,912	45,266
	Total 2004		$4,732,190	$4,961,180	$9,693,369
2005	Matagorda County[2]	0.30852	$1,951,575	$4,148,425	$6,100,000
	Matagorda County Hospital[2]	0.21240	1,343,558	1,000,000	2,343,558
	Navigation District #1	0.03981	251,822	0	251,822
	Drainage District #3	0.03220	203,684	0	203,684
	Palacios Seawall	0.03540	223,926	0	223,926
	Coastal Plains GW District	0.00500	31,628	0	31,628
	Total 2005		$4,006,193	$5,148,425	$9,154,617
2006	Matagorda County[2]	0.26829	$2,442,652	$3,657,348	$6,100,000
	Matagorda County Hospital[2]	0.17214	1,567,253	1,000,000	2,567,253
	Navigation District #1	0.03758	342,148	0	342,148
	Drainage District #3	0.02200	200,299	0	200,299
	Palacios Seawall	0.02528	230,162	0	230,162
	Coastal Plains GW District	0.00433	39,422	0	39,422
	Total 2006		$4,821,936	$4,657,348	$9,479,283

Table 2.10-1. STP Owner Payments, Matagorda County Property Tax, 2003-2008 (continued)

Year[1]	Taxing District	Rate per $100 of property value	Est. Levy	Other Fees	Total
2007	Matagorda County[2]	0.27593	$2,778,976	$3,321,024	$6,100,000
	Matagorda County Hospital[2]	0.17724	1,785,039	814,961	2,600,000
	Navigation District #1	0.03771	379,789	0	379,789
	Drainage District #3	0.01900	191,355	0	191,355
	Palacios Seawall	0.02000	201,426	0	201,426
	Coastal Plains GW District	0.00447	45,019	0	45,019
	Total 2007		$5,381,604	$4,135,985	$9,517,588
2008	Matagorda County[2]	0.27518	$2,956,446	$3,143,554	$6,100,000
	Matagorda County Hospital[2]	0.17864	1,919,251	680,749	2,600,000
	Navigation District #1	0.03793	407,508	0	407,508
	Drainage District #3	0.01900	204,130	0	204,130
	Palacios Seawall	0.01909	205,097	0	205,097
	Coastal Plains GW District	0.00451	48,454	0	$48,454
	Total 2008		$5,740,886	$3,824,303	$9,565,188
Six-Year Total			$30,094,080	$26,943,618	$57,037,692

Source: MCTO 2009; TtNUS 2009.

[1] Year levy and rate are for the following budget year. STP owners pay the standard millage rate for the special districts.

[2] Payments to Matagorda County and the Matagorda County Hospital District are based on an agreement between those entities and STPNOC, which sets a fixed amount to be paid each year (see Section 2.10) (MCJ 2006: MCJ 2008).

Note: Totals may not add due to rounding.

Table 2.10-2. Comparison of STP Owner Payments with Taxing District Property Tax Levies, 2003-2008

			Total STP	
Year[1]	Taxing District	Property Tax Levy ($)[2]	Payments ($)[3]	% of Property Tax Levy
2003	Matagorda County[4]	$ 8,214,934	$ 6,100,000	74.3%
	Matagorda County Hospital[4]	4,126,692	2,461,132	59.6%
	Navigation District #1	459,261	360,394	78.5%
	Drainage District #3	288,179	249,859	86.7%
	Palacios Seawall	499,121	411,000	82.3%
	Coastal Plains Groundwater	137,930	45,264	32.8%
	Total	$ 13,726,117	$ 9,627,649	70.1%
2004	Matagorda County[4]	$ 8,122,946	$ 6,100,000	75.1%
	Matagorda County Hospital[4]	5,254,940	2,526,807	48.1%
	Navigation District #1	413,867	360,410	87.1%
	Drainage District #3	287,909	249,869	86.8%
	Palacios Seawall	433,674	411,018	94.8%
	Coastal Plains Groundwater	136,040	45,266	33.3%
	Total	$ 14,649,376	$ 9,693,370	66.2%
2005	Matagorda County[4]	$ 8,191,213	$ 6,100,000	74.5%
	Matagorda County Hospital[4]	5,613,566	2,343,558	41.7%
	Navigation District #1	370,191	251,822	68.0%
	Drainage District #3	254,311	203,684	80.1%
	Palacios Seawall	329,155	223,926	68.0%
	Coastal Plains Groundwater	141,239	31,628	22.4%
	Total	$ 14,899,675	$ 9,154,618	61.4%
2006	Matagorda County[4]	$ 9,038,864	$ 6,100,000	67.5%
	Matagorda County Hospital[4]	5,753,331	2,567,253	44.6%
	Navigation District #1	486,645	342,148	70.3%
	Drainage District #3	242,142	200,299	82.7%

Table 2.10-2. Comparison of STP Owner Payments with Taxing District Property Tax Levies, 2003-2008 (continued)

			Total STP	
Year[1]	Taxing District	Property Tax Levy ($)[2]	Payments ($)[3]	% of Property Tax Levy
2006 Con't.	Palacios Seawall	327,813	230,162	70.2%
	Coastal Plains Groundwater	153,850	39,422	25.6%
	Total	$ 16,002,645	$ 9,479,284	59.2%
2007	Matagorda County[4]	$ 9,785,561	$ 6,100,000	62.3%
	Matagorda County Hospital[4]	6,236,490	2,600,000	41.7%
	Navigation District #1	519,472	377,347	72.6%
	Drainage District #3	229,254	190,125	82.9%
	Palacios Seawall	276,122	200,131	72.5%
	Coastal Plains Groundwater	166,556	45,019	27.0%
	Total	$ 17,213,455	$ 9,512,622	55.3%
2008	Matagorda County[4]	$ 10,968,961	$ 6,100,000	55.6%
	Matagorda County Hospital[4]	7,035,468	2,600,000	37.0%
	Navigation District #1	547,517	405,019	74.0%
	Drainage District #3	246,398	202,883	82.3%
	Palacios Seawall	276,565	203,844	73.7%
	Coastal Plains Groundwater	187,828	48,454	25.8%
	Total	$ 19,262,738	$ 9,560,200	49.6%
	6-year Total	$ 95,754,006	$ 57,027,743	59.6%

Sources: MCTO 2009; NRG 2007; TC 2004; TC 2005; TC 2006; TC 2008; TC 2009; TtNUS 2009.

[1] Year levy and rate are for the following budget year. STP Units 1 & 2 owners pay the standard millage rate for the special districts.

[2] Total levies for 2003-2007 are from the Texas Comptroller of Public Accounts, Annual Property Tax Reports for Tax Years 2003, 2004, 2005, and 2006; and 2007 Property Tax Rates and Taxes (TC 2004; TC 2005; TC 2006; TC 2008; TC 2009). Total levies for 2008 are from the Matagorda County Tax Office (MCTO 2009).

[3] For 2003-2006, tax payments are based on estimates from the Matagorda County Tax Office (MCTO 2009). For 2007 and 2008, estimated payments are based on actual NRG property tax statements (NRG 2007 and NRG 2008).

[4] Payments to Matagorda County and the Matagorda County Hospital District are based on an agreement between those entities and STPNOC, which sets a fixed amount to be paid each year (see Section 2.10) (MCJ 2006; MCJ 2008).

Note: Totals may not add due to rounding.

Table 2.10-3. Comparison of STP Units 1 & 2 Owner Payments with Matagorda County's Total Tax Revenues, 2003-2007

Year	Taxing District	Total Tax Revenues	Total STP Property Tax Payment[1]	Percent of Total Tax Revenues
2003	Matagorda County	16,277,484	6,100,000	37.5%
2004	Matagorda County	16,096,191	6,100,000	37.9%
2005	Matagorda County	16,511,892	6,100,000	36.9%
2006	Matagorda County	17,147,614	6,100,000	35.6%
2007	Matagorda County	18,547,870	6,100,000	32.9%

Sources: MCA 2008; TtNUS 2009.
[1] Payment is for County only and does not include payments to other taxing entities within the county.

Table 2.10-4. STP Units 1 & 2 Owner Payments to Other Taxing Districts in Matagorda County, 2007-2008[1]

	2007			2008		
Special District	STP Owner Payments	District's Est. Total Levy, 2007	STP as % of Total	STP Owner Payments	District's Est. Total Levy, 2008	STP as % of Total
Port of Bay City	$3,097	$723,680	0.43%	$5,080	$833,907	0.61%
Conservation & Reclamation District	$468	$112,458	0.42%	$774	$130,055	0.60%
Matagorda ISD	$74,943	$2,525,549	2.97%	$75,038	$2,677,920	2.80%
Drainage District #1	$6,419	$1,607,005	0.40%	$6,179	$1,681,062	0.37%
Drainage District #2	$2,000	$342,514	0.58%	$6,278	$419,134	1.50%
Bay City ISD	$0	$12,840,989	0.00%	$1,942	$14,265,846	0.01%
Tidehaven ISD	$22,837	$5,026,792	0.45%	$79,465	$6,541,043	1.21%
City of Bay City	$0	$2,746,295	0.00%	$747	$3,050,691	0.02%
Total	$111,771	$25,925,282	0.43%	$175,502	$29,599,657	0.59%

Sources: MCTO 2009; NRG 2007 and NRG 2008; TtNUS 2009.
[1] "Other" = Taxing districts other than: Matagorda County; Matagorda County Hospital; Navigation District #1; Palacios Seawall District; Coastal Plains Groundwater District; and Drainage District #3.

Table 2.10-5. Palacios Independent School District Property Tax Information, 2003–2008

Year	Total District Revenue ($)	Excess Percentage (goes to State)	Revenue Remaining in District ($)	STP Total Pmts to ISD ($)	STP Portion Remaining in District ($)	STP as % of Revenues Remaining in District	STP Portion of Revenues to State ($)
2003	14,916,215	42.13%	8,632,710	12,400,875	7,176,966	83.14%	5,223,909
2004	13,870,667	35.62%	8,930,235	10,546,373	6,789,983	76.03%	3,756,390
2005	12,881,012	29.56%	9,073,797	9,192,321	6,475,365	71.36%	2,716,956
2006	16,547,854	48.03%	8,599,284	12,068,104	6,271,330	72.93%	5,796,774
2007	13,366,796	45.19%	7,326,341	11,307,412	6,197,593	84.59%	5,109,820
2008	13,797,845	46.33%	7,405,303	11,318,758	6,074,778	82.03%	5,243,981
Total(2003-2008)	85,380,389	41.48%	49,967,671	66,833,844	38,986,014	78.02%	27,847,830

Sources: Ressler 2009; TtNUS 2009.
Note: The total excess revenues sent to state between 2003 and 2008 totaled $35,412,718.

Table 2.11-1. Matagorda County Land Use, 2000

Land Use	Square Miles	Percent of Total
Agricultural Land	660.58	57.66%
Barren Land	18.52	1.62%
Forest Land	155.84	13.60%
Rangeland	150.80	13.16%
Urban or Built-up Land	25.50	2.23%
Water	37.15	3.24%
Wetland	97.16	8.48%
Total	1145.55	100.00%

Source: NOAA 2000

Table 2.12-1. Major Public Water Suppliers[a]

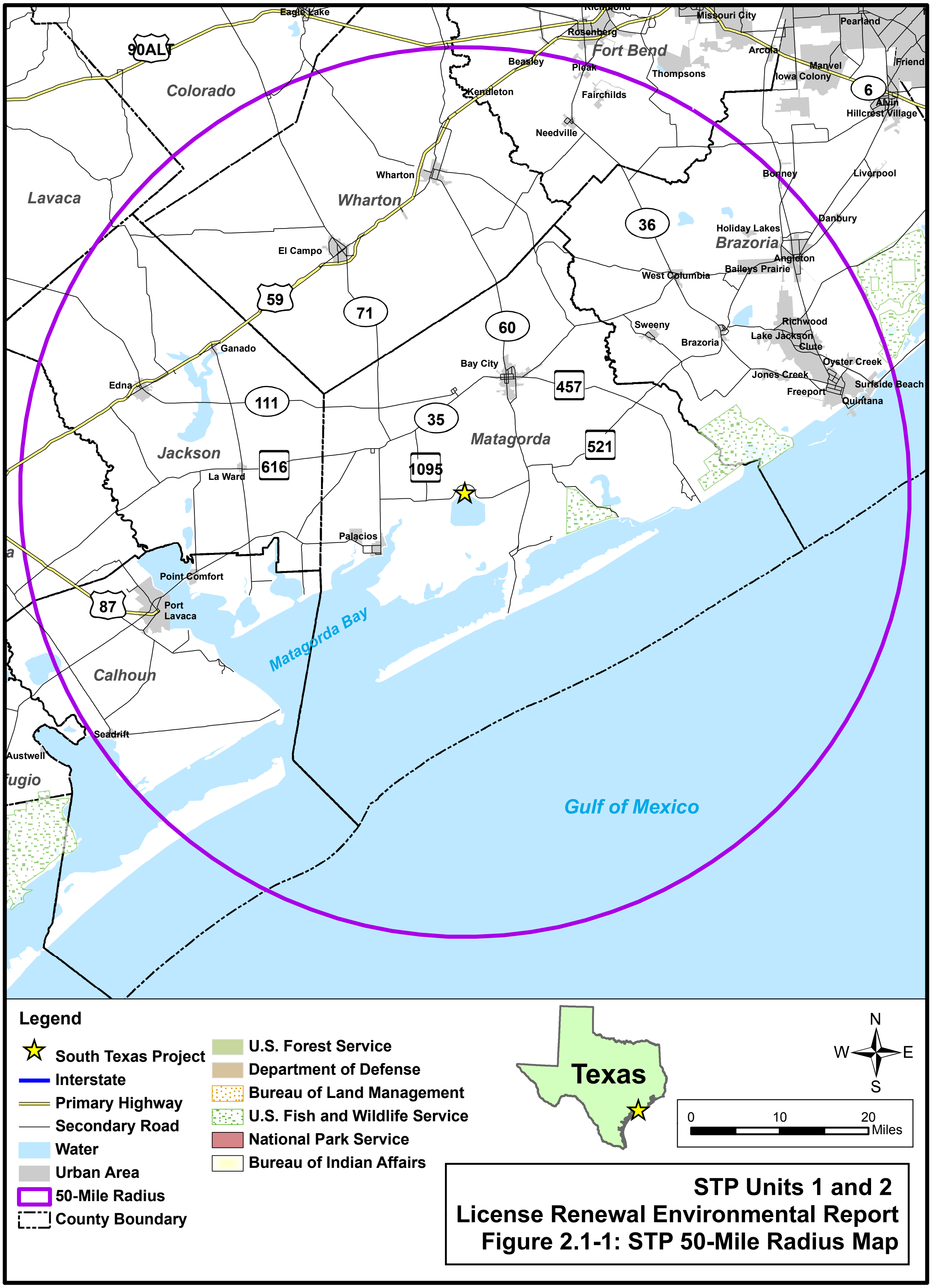
System Name	Population Served	Primary Water Source	Total Producti on (MGD)	Max Purchased Capacity (MGD)	Average Daily Consumption (MGD)
Matagorda County					
City of Bay City	19,263	Groundwater	8.856	4.403	2.409
Brazoria County					
City of Alvin	19,152	Groundwater	8.739	0.00	2.185
City of Angleton	19,167	Purchased Surface Water	5.470	2.016	2.052
City of Clute	10,737	Purchased Surface Water	2.080	0.000	0.361
City of Freeport	12,708	Purchased Surface Water	0.000	2.000	1.400
City of Lake Jackson	25,890	Purchased Surface Water	6.696	2.000	3.100
City of Pearland	56,877	Purchased Surface Water	15.264	0.000	11.000

Sources: USEPA 2009; TCEQ Undated
[a] Systems serving more than 10,000 people.

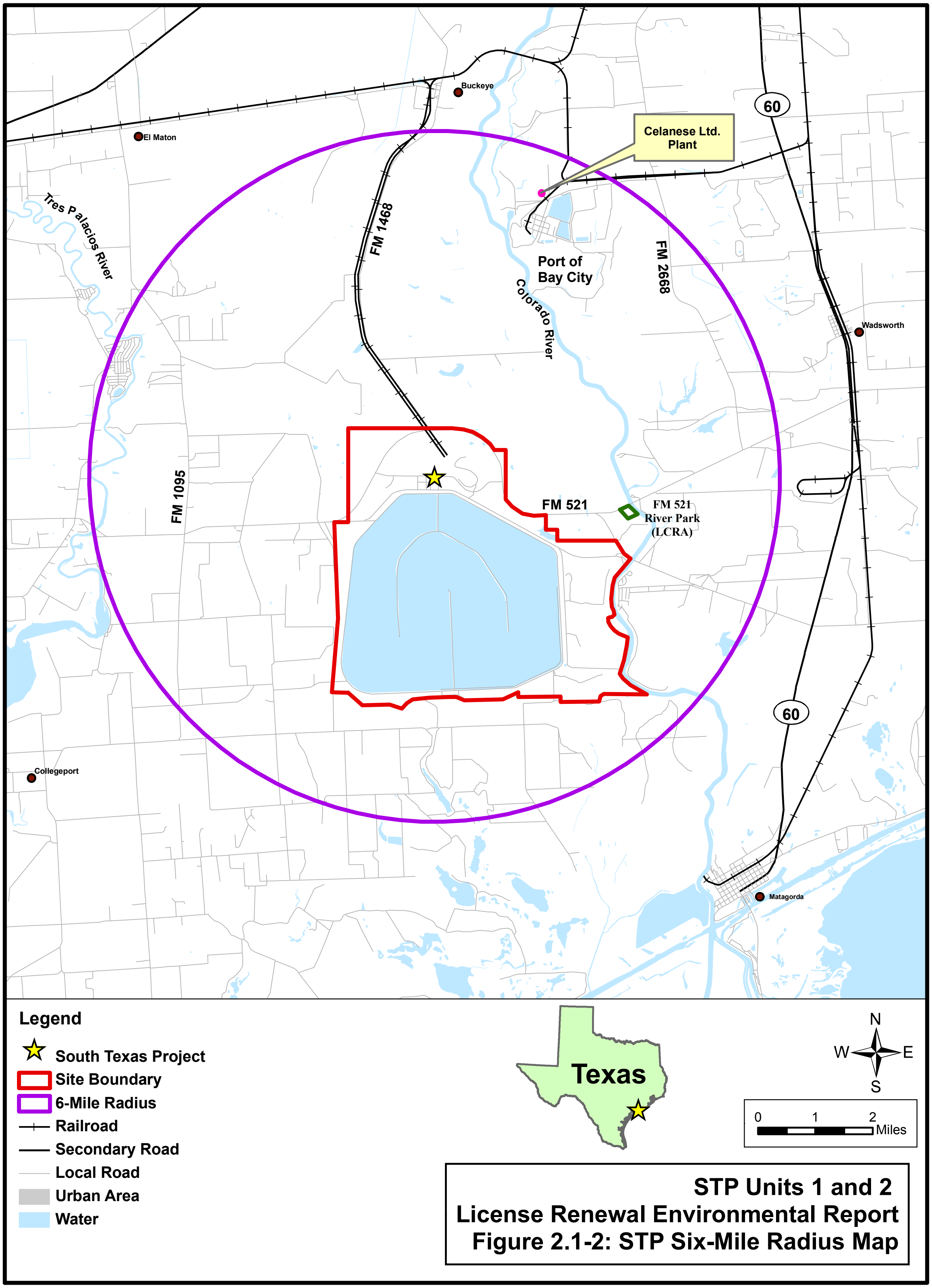
Table 2.12-2. Statistics for Most Likely Routes to the STP Site

	Roadway and Location	Functional Classification [a]	Description	2006 Annual Average Daily Traffic [a, b]	Planning Threshold Capacity (vehicles per day) [c, d]
1	TX-60 south to FM 521 west	Rural major collector	2-lane, undivided	1,600	2,300
2	FM 2078 west to FM 2668 south	Rural minor collector	2-lane, undivided	400	2,300
3	FM 2668 south to FM 521 west	Rural major collector	2-lane, undivided	500	2,300
4	TX-35 south of FM 521t	Rural minor arterial	2-lane, undivided	3,000	4,200
5	FM 1468 south to FM 521 east	Rural minor collector	2-lane, undivided	600	2,300
6	FM 1095 south to FM 521 east	Rural major collector	2-lane, undivided	500	2,300
7	FM 2853 south to FM 521 east	Rural minor collector	2-lane, undivided	600	2,300
8	FM 521 west	Rural major collector	2-lane, undivided	2,600	2,300
9	FM 521 east	Rural major collector	2-lane, undivided	1,500	2,300

[a] Source: TXDOT 1993
[b] Source: TXDOT 2007
[c] The traffic counts are for a 24-hour time period and location of the count is identified on Fig. 2.12-1
[d] Source: TXDOT 2001
[e] The capacity is typically based on Level of Service (LOS) C (stable flow). LOS F is exceeding capacity



STP Units 1 and 2
License Renewal Environmental Report
Figure 2.1-1: STP 50-Mile Radius Map



STP Units 1 and 2
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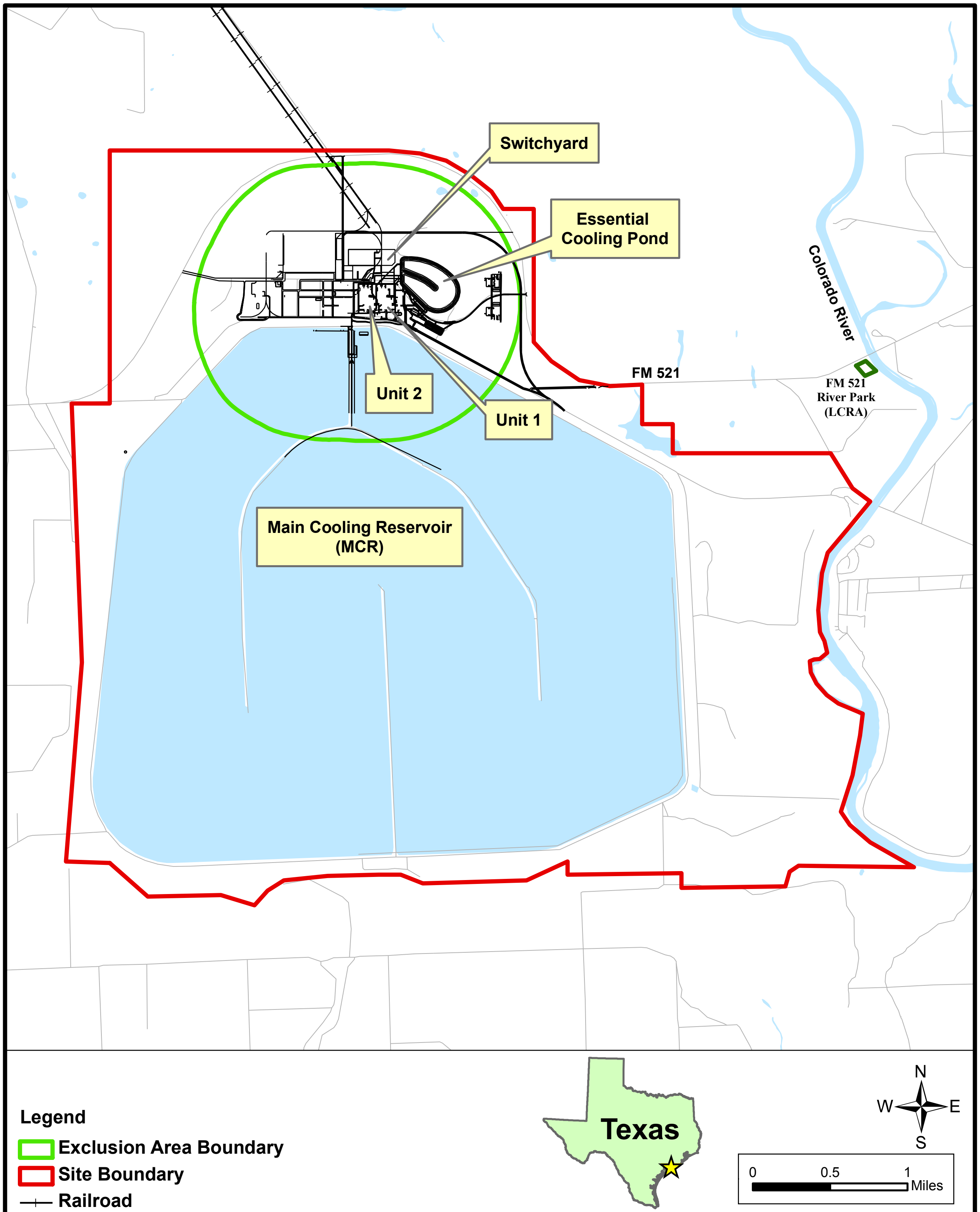
Figure 2.1-2: STP Six-Mile Radius Map



STP Units 1 and 2
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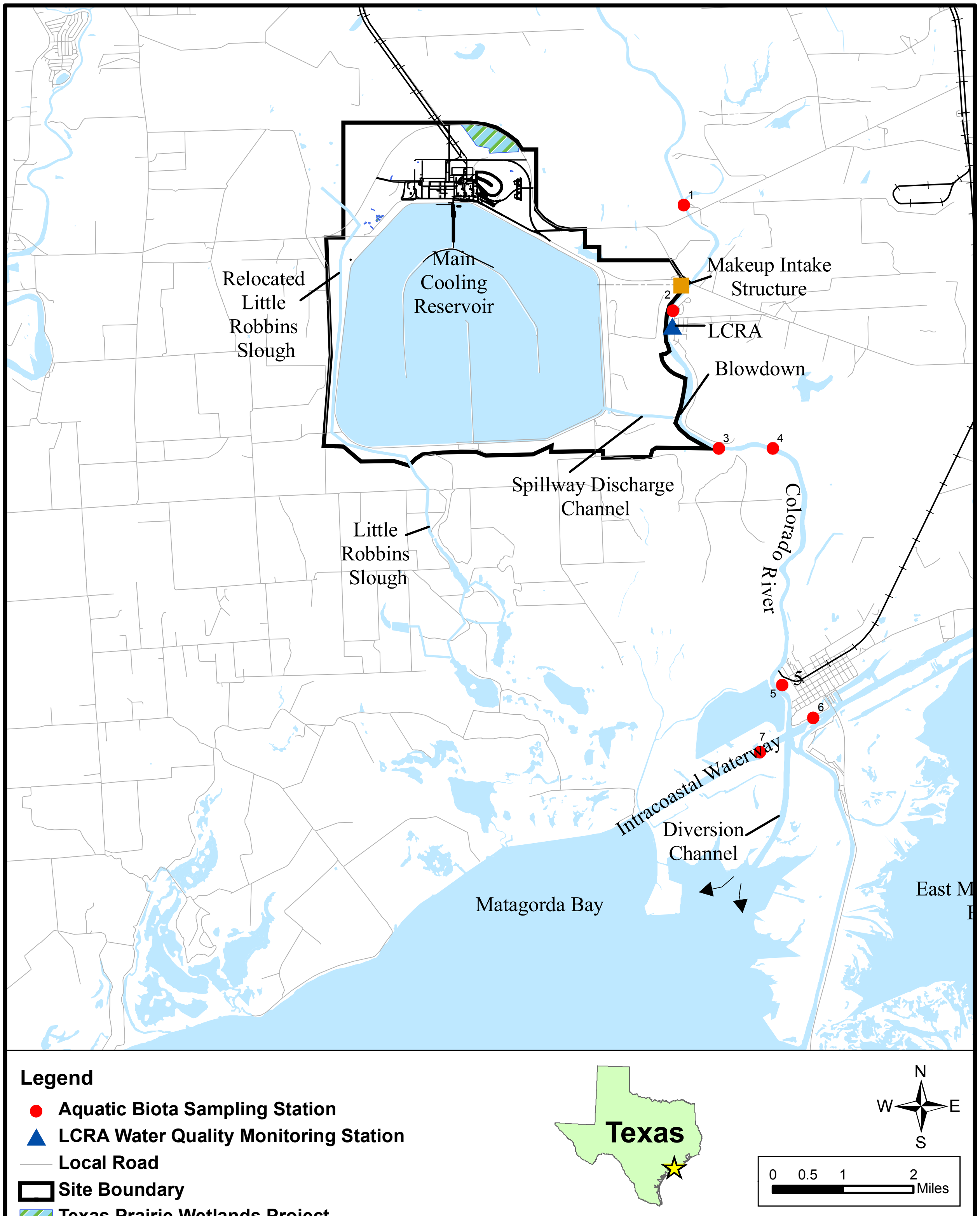
Figure 2.1-3: STP Site Boundary



STP Units 1 and 2
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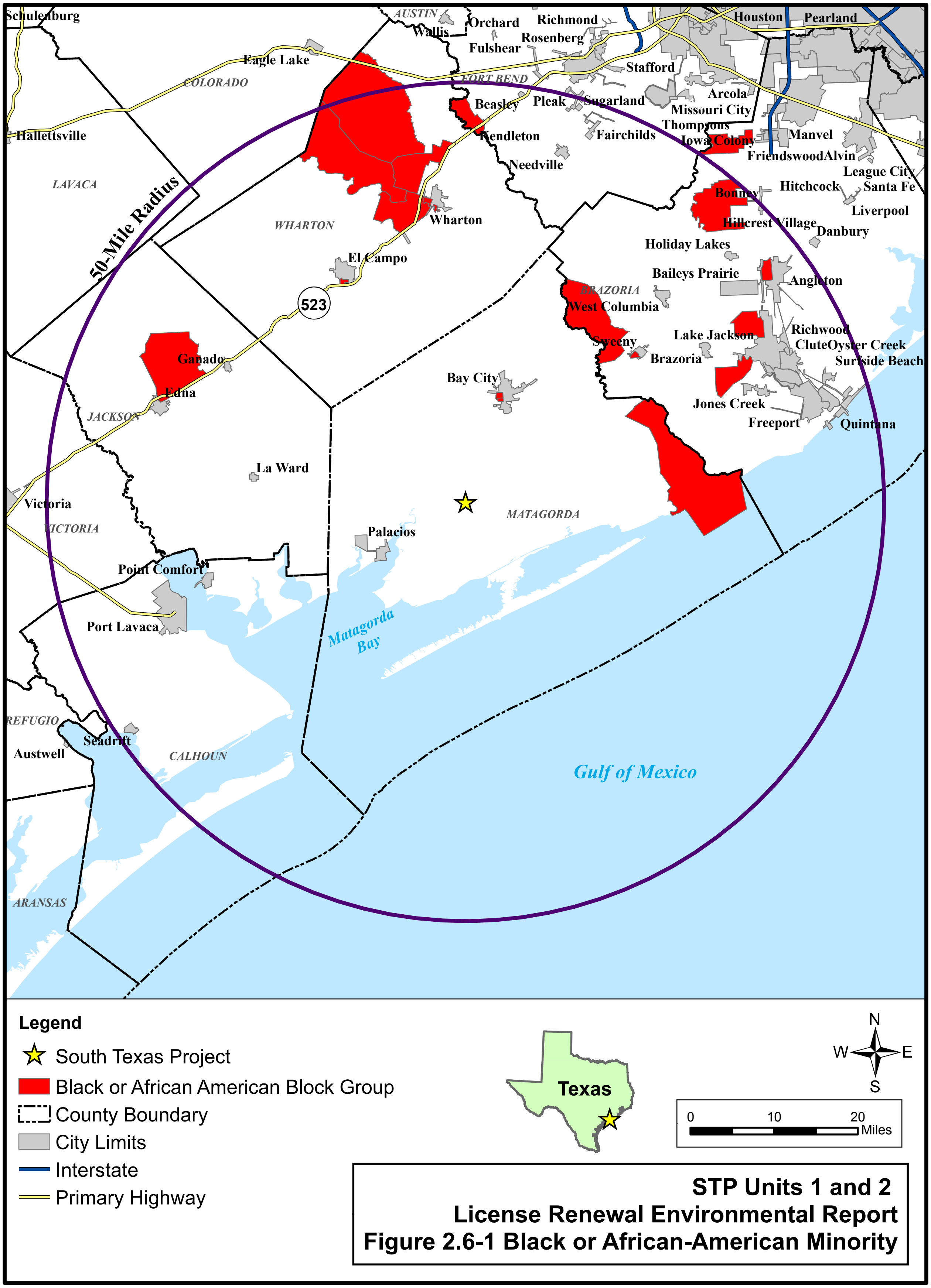
Figure 2.2-1 Major Water Bodies in STP Vicinity



STP Units 1 and 2
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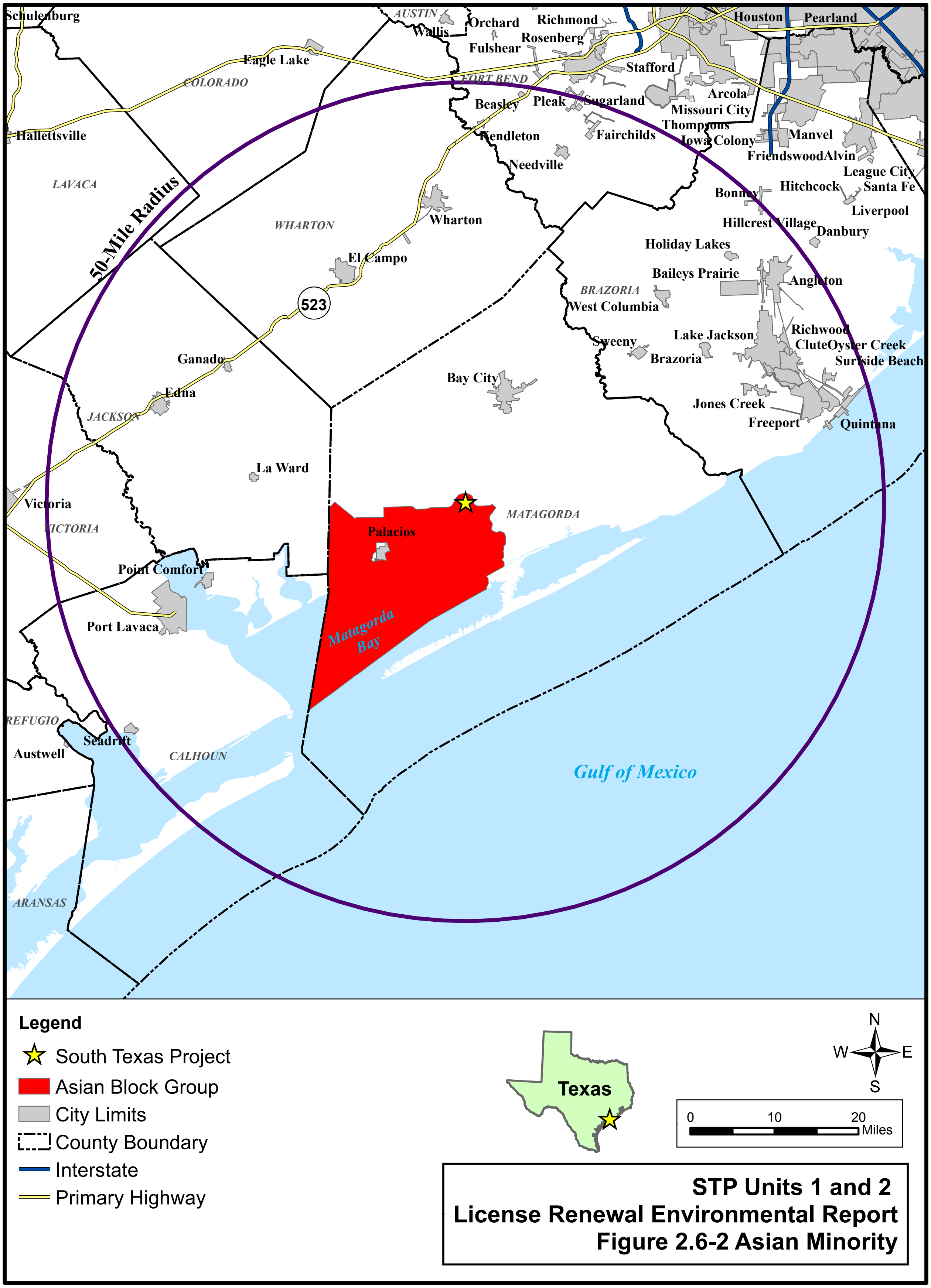
Figure 2.6-1 Black or African-American Minority



STP Units 1 and 2
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Figure 2.6-2 Asian Minority

STP Units 1 and 2
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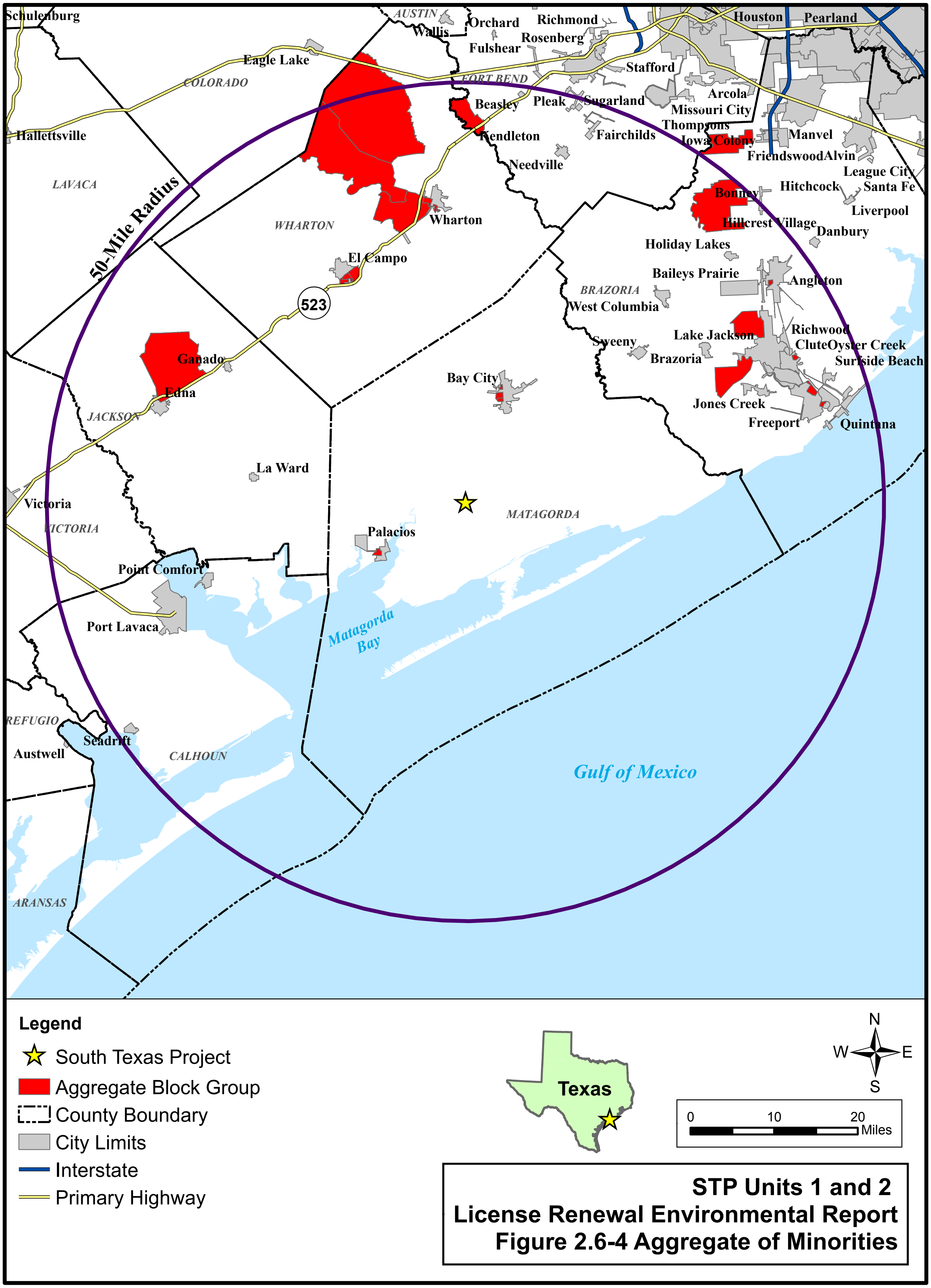
Figure 2.6-3 Other Minority



STP Units 1 and 2
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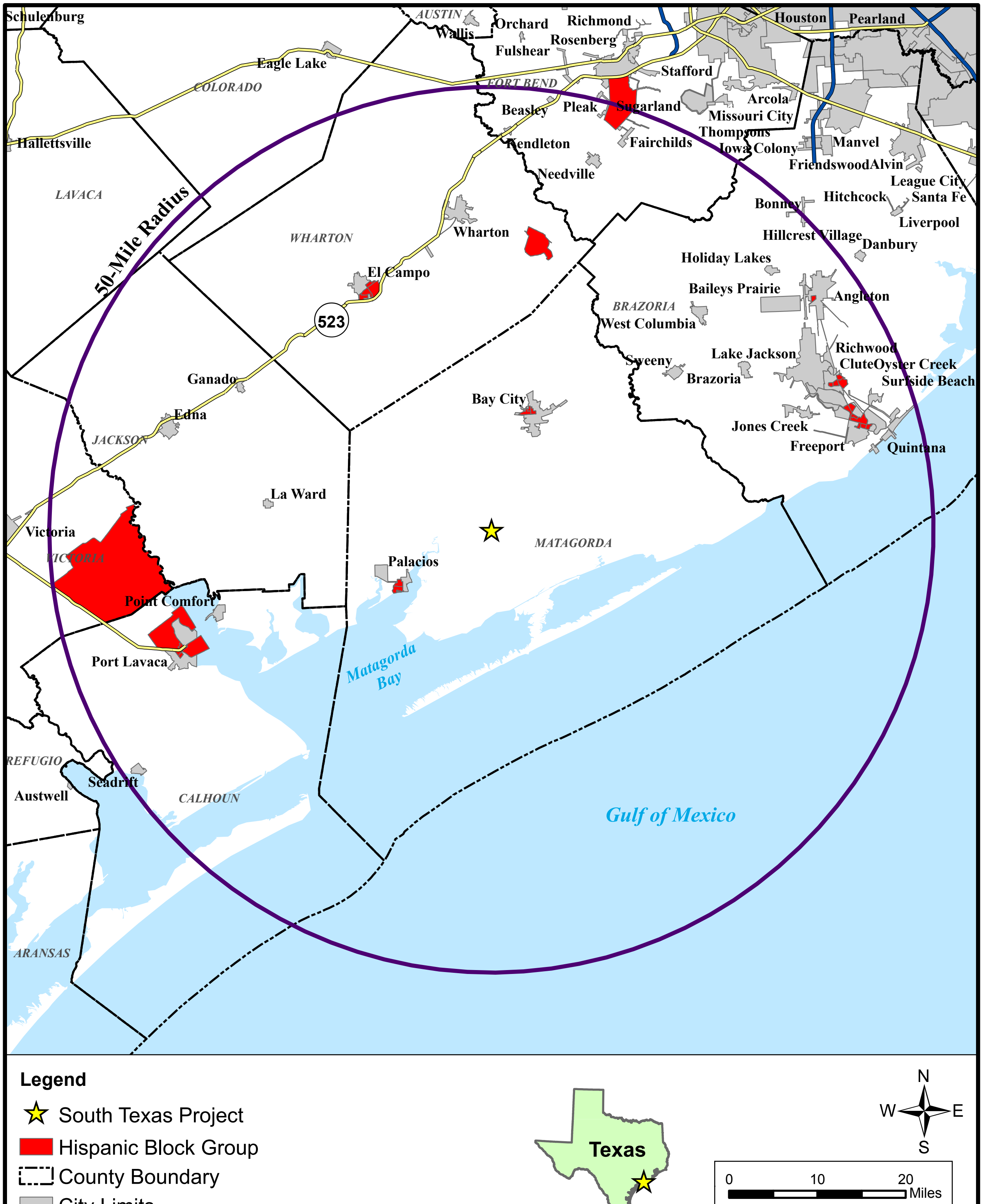
Figure 2.6-4 Aggregate of Minorities



STP Units 1 and 2
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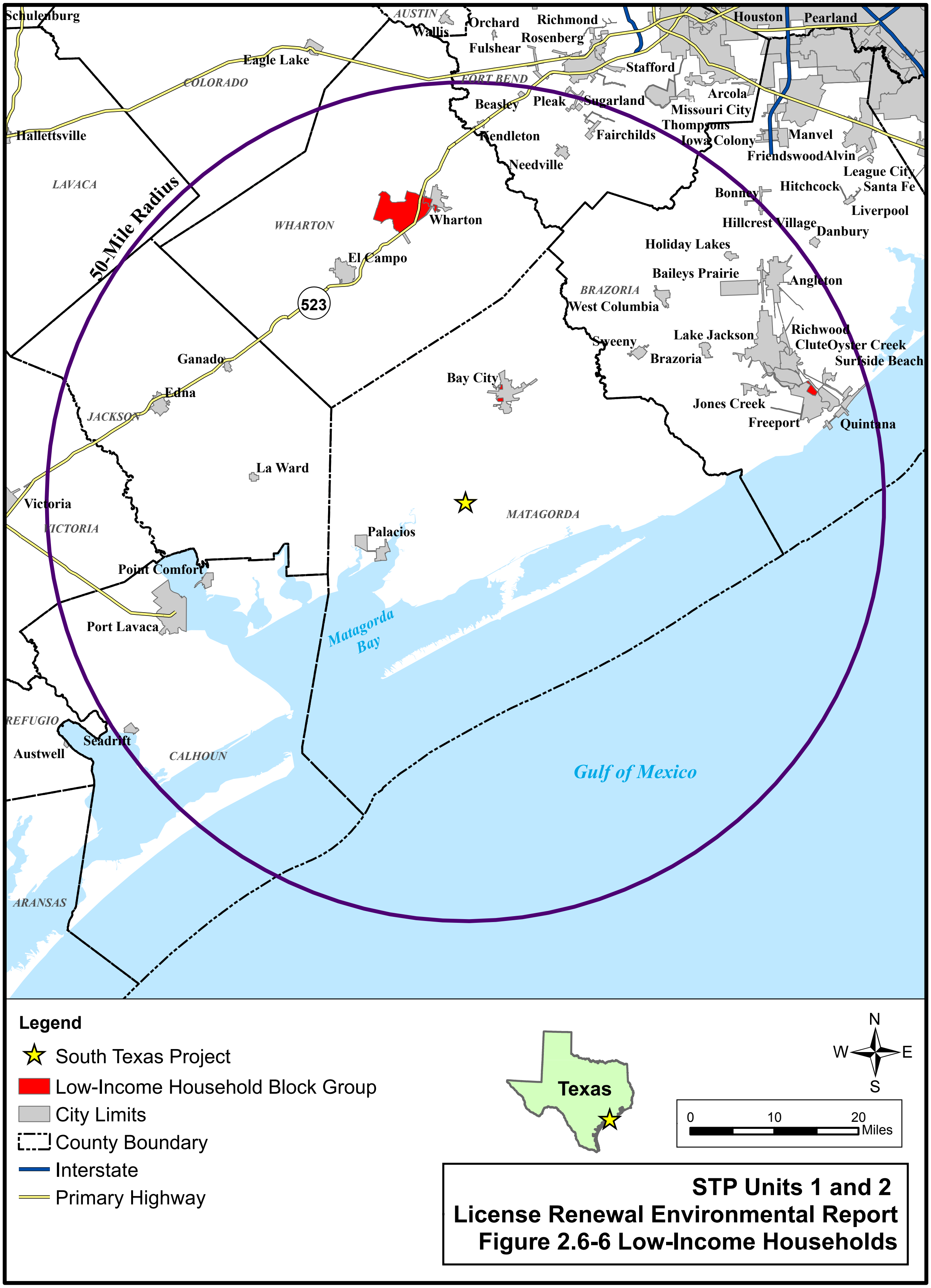
Figure 2.6-5 Hispanic Population



STP Units 1 and 2
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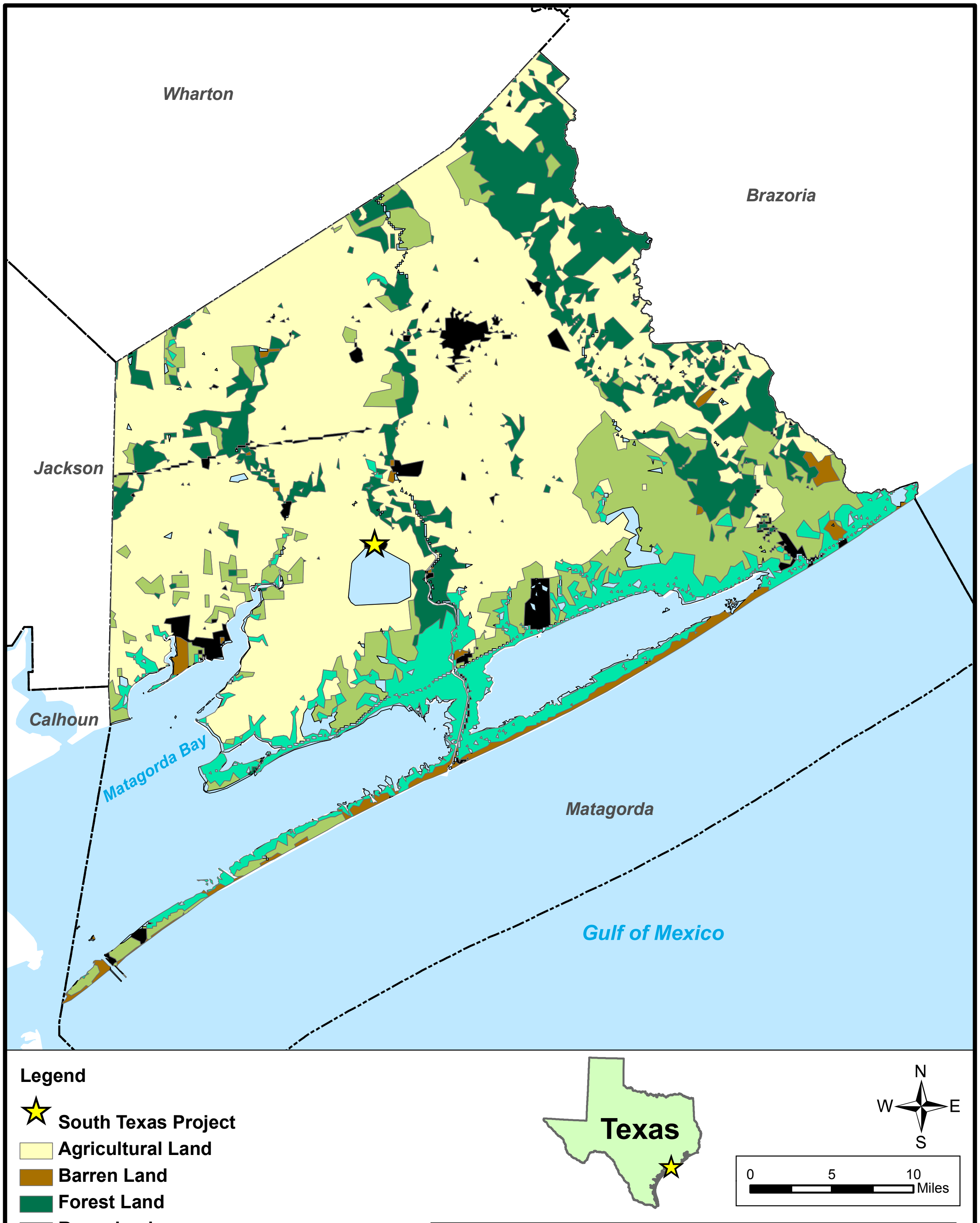
Figure 2.6-6 Low-Income Households



STP Units 1 and 2
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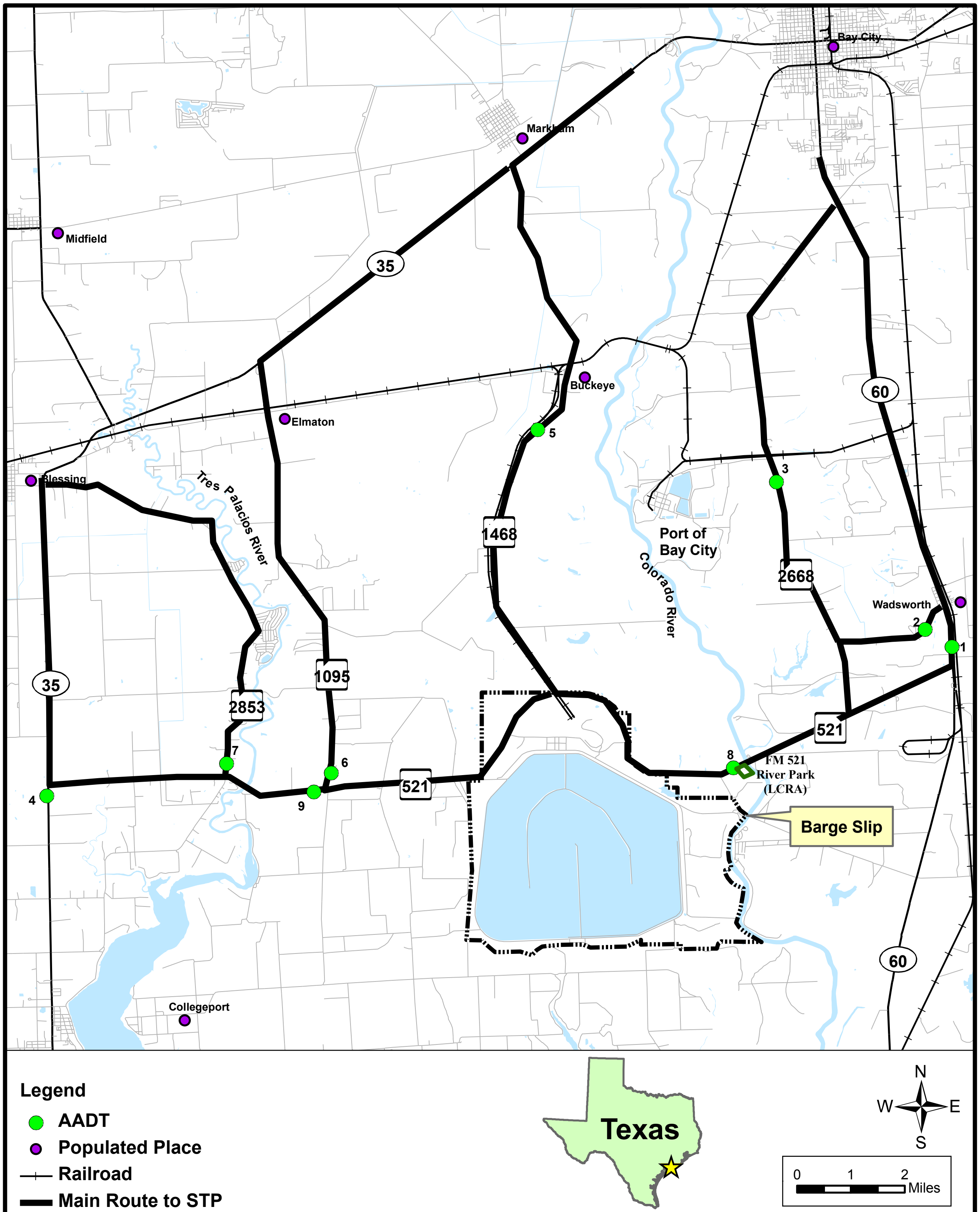
Figure 2.11-1: Matagorda County Land Use



STP Units 1 and 2
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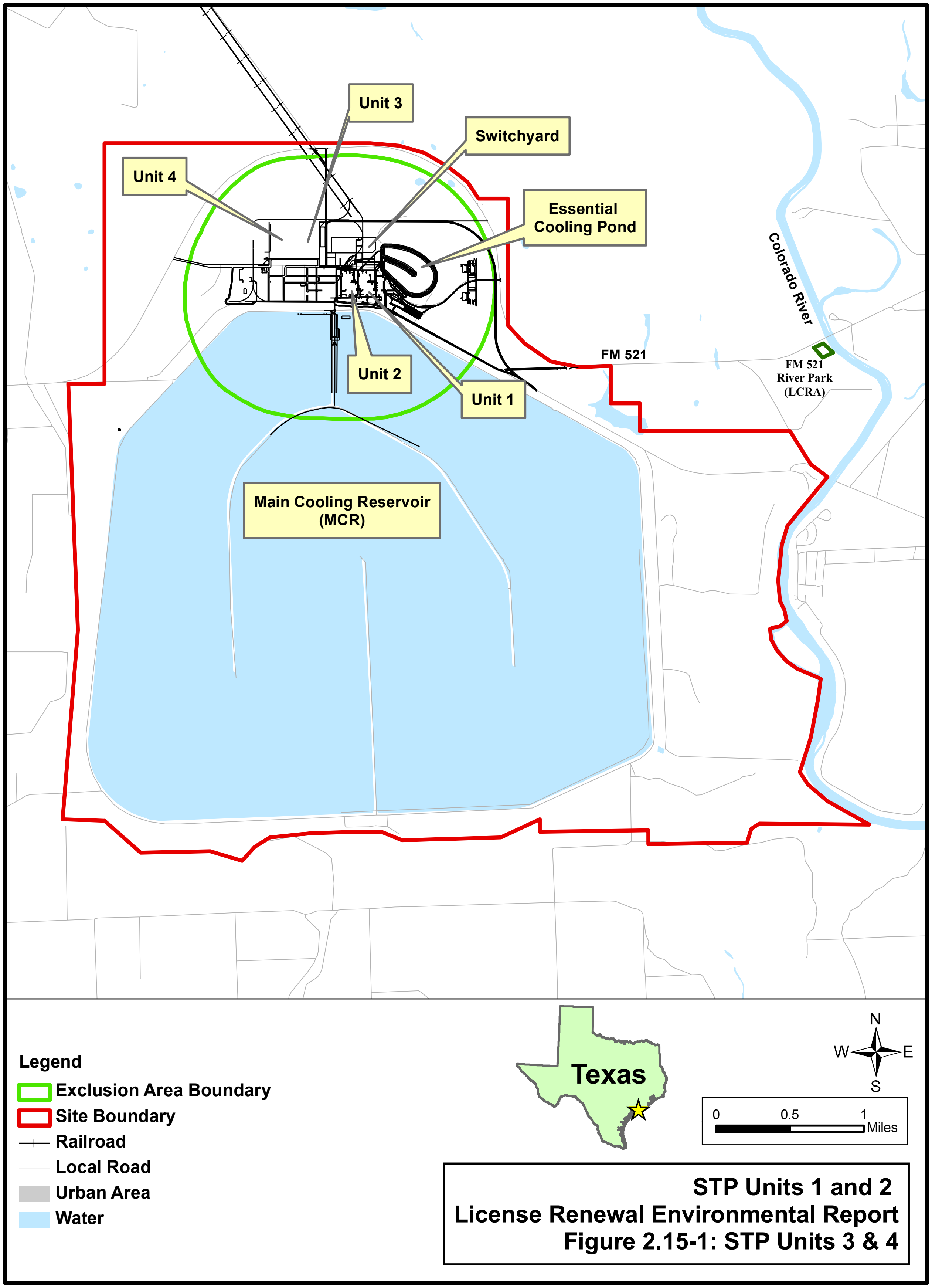
Figure 2.12-1: Main Transportation Routes to STP



**STP Units 1 and 2
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Figure 2.15-1: STP Units 3 & 4**

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3.0 CHAPTER 3 - PROPOSED ACTION

NRC

"The report must contain a description of the proposed action...." 10 CFR 51.53(c)(2)

STPNOC proposes that NRC renew the operating licenses for STP for an additional 20 years beyond the current licenses' expiration dates of August 20, 2027 for Unit 1 and December 15, 2028 for Unit 2. Renewal of the operating licenses would give the owners of STP and the Electric Reliability Council of Texas the option of relying on STP to meet future baseload electricity needs. Section 3.1 discusses the major features of the plant and the operation and maintenance practices directly related to the license renewal period. Sections 3.2 through 3.4 address potential changes that could occur as a result of license renewal.

3.1 GENERAL PLANT INFORMATION

STP is a two-unit nuclear-powered steam electric generating facility that began commercial operation in August 1988 (Unit 1) and June 1989 (Unit 2). The nuclear reactor for each unit is a Westinghouse pressurized water reactor (PWR) producing a reactor core rated thermal power of 3,853 megawatts (MWt). The nominal net electrical capacity is 1,250 megawatts-electric (MWe). Figure 3.1-1 depicts the site layout.

The following subsections provide information on the reactor and containment systems, the cooling and auxiliary water systems, and the electrical transmission system. Additional information about STP is available in the final environmental statement for operation of the plant (FES-OP; NRC 1986), the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) (NRC 1996), and the STP Updated Final Safety Analysis Report (STPNOC 2008a).

3.1.1 Reactor and Containment Systems

The nuclear steam supply system at STP is a four-loop Westinghouse PWR. The reactor core heats water to approximately 620 degrees Fahrenheit (°F). Because the pressure is approximately 2,250 pounds per square inch (psi), the water does not boil. The heated water is pumped to four U-tube heat exchangers known as steam generators where the heat boils the water on the shell-side into steam. After drying, the steam is routed to the turbines. The steam yields its energy to turn the turbines, which are connected to the electrical generator. The nuclear fuel is low-enriched uranium dioxide with enrichments less than 5 percent by weight uranium-235 and fuel burnup levels with a batch average of approximately 45,000 megawatt-days (MW-d) per metric ton uranium at discharge. Maximum burnup would not exceed 60,000 MW-d per metric ton uranium. STP operates on an 18-month refueling cycle.

The reactor, steam generators, and related systems are enclosed in a containment building that is designed to prevent leakage of radioactivity to the environment in the improbable event of a rupture of the reactor coolant piping. The containment building is a post-tensioned, reinforced concrete cylinder with a slab base and a hemispherical dome. A welded steel liner is attached to the inside face of the concrete shell to insure a high degree of leak tightness. In addition, the 4-foot-thick concrete walls serve as a radiation shield for both normal and accident conditions.

The containment building is ventilated to maintain pressure and temperatures within acceptable limits. Exhaust from the ventilation system is monitored for radioactivity before being released to the environment through the plant vent. High efficiency particulate air filters are available to filter the air before releasing it. The containment can be isolated if needed.

3.1.2 Water Systems

The water systems most pertinent to license renewal are those that directly interface with the environment. The Circulating Water System, the Freshwater and Service Water systems, the Potable and Sanitary Water systems, and the Auxiliary Cooling Water and Essential Cooling Water systems all have environmental interfaces. There are two influent water sources to STP: the Colorado River and groundwater. The plant uses more than 100 gallons per minute (gpm) of groundwater. STP does not routinely discharge any waste water directly to any natural water body; however, the Main Cooling Reservoir (MCR) has the capacity to discharge to the Colorado River. The site's existing Texas Pollutant State Elimination System (TPDES) permit states that the MCR can discharge to the Colorado River if appropriate conditions are met.

Circulating Water System

The Circulating Water System for each unit consists of a main condenser, the MCR, circulating water pumps, a chemical injection system and makeup and blowdown systems. Each unit's Circulating Water System removes the waste heat of normal operations and rejects it to the atmosphere via the MCR.

Four circulating water pumps take suction from the intake structure on the MCR and pass it to a common distribution header for the condensers for both units. In the condenser, waste heat is absorbed by the circulating water, which is discharged to the MCR through a discharge structure. Each unit circulates 906,957 gpm for circulating water flow (STPNOC 2008a).

The 7,000-acre MCR, shown in Figures 2.1-3 and 3.1-1, is completely enclosed by approximately 12.4 miles of embankment consisting of clay fill that is constructed above natural ground. The approximate elevation of the embankment base varies from elevation 15 feet mean seal level (MSL) to 29 feet MSL, and the elevation of the top of the embankment varies between 65.75 and 67.0 feet MSL. The MCR contains approximately 202,600 acre-feet of water when at the normal maximum operating level of elevation 49 feet MSL; however, there is currently a procedural limit of 47 feet for two-unit operation. Storage in the reservoir is also required to account for the intermittent operation of makeup from the Colorado River due to permit restrictions.

Makeup water for the MCR is diverted from the Colorado River using the makeup water system, which includes a shoreline Reservoir Makeup Pumping Facility (RMPF) with the intake sized for four units, two buried 108-inch-diameter makeup water pipelines. The RMPF currently has the screening and pumping capacity installed for 600 cubic feet per second (cfs). A seldom used discharge outfall back to the Colorado River is also available.

Freshwater and Service Water Systems

Three onsite groundwater wells feed a common header. The water is chlorinated with sodium hypochlorite, filtered and stored in the freshwater settling basin before it is pumped to the Service Water Storage Tank and the Fire Water Storage Tanks. The Service Water Storage Tank provides clean, filtered water for various uses in the Protected Area, including the makeup demineralizer system. The Fire Water Storage Tanks provide water for fire protection. A fourth groundwater well is used to supply the Nuclear Support Center chill water for the building cooling tower. The water is chlorinated and stored in the Well 8 groundwater storage tank. A fifth groundwater well supplies fire protection water to the Nuclear Training Facility.

Potable and Sanitary Water Systems

Potable water is from groundwater wells. A sodium hypochlorite system maintains sufficient chlorine concentration for safe human consumption. Waste water from the sanitary system is routed to the sewage treatment system. Treated water is discharged back to the MCR. Sludge is collected and disposed offsite by a licensed contractor.

Auxiliary Cooling Water and Essential Cooling Water Systems

The Auxiliary Cooling Water System takes suction on a separate bay in the MCR intake structure and supplies cooling water for nonsafety-related systems. The heated water returns to the MCR. The Essential Cooling Water System takes suction from the Essential Cooling Pond (the ultimate heat sink) and provides cooling for safety-related systems, returning the heated water to the pond. The design flowrate of the two systems are 23,600 gpm and 19,280 gpm, respectively. The Essential Cooling Pond is approximately 46 acres. The primary makeup to the Essential Cooling Pond is from any one of three groundwater wells connected to a common header. If necessary, the pond can be blown down to the MCR to maintain water chemistry.

3.1.3 Transmission Facilities

The Final Environmental Statement for the construction permit (FES-CP) (NRC 1975) and the FES-OP identified six new 345-kilovolt (kV) transmission lines that were to be constructed to connect STP to the electric grid. In addition, two pre-existing transmission lines were to be looped into the plant. A double-circuit line would run northwest to the Velasco substation. A single circuit line would run west then north to the Blessing substation. A double-circuit line would run northwest to the Hill Country substation. A single-circuit line would run north to Holman. The short loops into STP would connect the plant to substations at the W. A. Parrish substation and the Lon Hill Substation.

Subsequent to the publication of the FES, several changes were made to the transmission system.

- A new substation was constructed at Hillje and the Holman line was looped into the Hillje Substation, before proceeding on to Holman.
- A new transmission line was added on existing towers from STP to the new Hillje substation to increase the reliability of the overall transmission system.
- Although two new transmission lines were constructed from the new Hillje substation to the W.A. Parrish substation, they were not constructed to carry STP-generated power but to provide contingencies in the overall transmission system.
- The double-circuit line planned for Hill Country was split short of the Hill Country substation with one of the two lines redirected to the Skyline substation.
- A new substation was constructed at Elm Creek. The Hill Country and Skyline lines were looped into Elm Creek before proceeding on to the Hill Country and Skyline substations.

- A new substation was constructed at White Point. The Lon Hill line was looped into the White Point substation before proceeding on to Lon Hill.

As a result of these system changes, the transmission lines of interest for this report are different than those described in the two FESs. Figure 3.1-2 is a map of the transmission system of interest. The following 345-kV transmission lines are considered in scope for the license renewal analysis:

- Velasco – This double-circuit line on double-circuit towers runs east from STP to the Velasco substation south of Houston in Brazoria County. The 100-feet wide corridor is 45 miles long. Most of the corridor falls within the Coastal Management Zone along the Gulf of Mexico. The line is owned and operated by CenterPoint Energy.

- Blessing – This single-circuit line heads west from STP for approximately eight miles then takes a turn to the north for another approximately seven miles, and terminates at the Blessing Substation in Matagorda County. The corridor to Blessing is 100 feet wide. The line is owned and operated by American Electric Power Texas Central Company.

- Hillje – The Hillje substation is in the southwestern corner of Wharton County, just across the border from Matagorda County. The corridor is 400 feet wide and 20 miles long and contains six 345-kV transmission lines from STP. Hill Country, Skyline, and Holman lines all run the entire 20 miles with only Holman actually tied into Hillje substation. Two of the six lines were constructed to connect STP to the pre-existing W.A. Parish and Lon Hill (White Point) lines. A recently added sixth line runs between STP and Hillje. In addition, a 138-kV line that brings emergency power in to STP is adjacent to the corridor for the first 6 miles.

  Therefore, STPNOC is only analyzing three lines as the Hillje line, described below. The three remaining lines; the Hollman line and the two Elm Creek lines (Hill Country and Skyline) are analyzed as separate entities as identified below.

  - W. A. Parrish loop – The pre-existing W. A. Parrish-to-Lon Hill line was looped into the STP substation. This 20-mile loop connects STP to the W. A. Parrish line and is subject to analysis as it was constructed originally to connect the plant to the grid. The loop resides in the Hillje corridor. The loop is owned and operated by CenterPoint Energy.

  - Hillje line – A recently added sixth line runs the 20-mile distance between STP and Hillje and increases the reliability of the overall transmission system.

  - Lon Hill loop – The pre-existing W. A. Parrish-to-Lon Hill line was looped into the STP substation. This 20-mile loop connects STP to the Lon Hill line and is subject to analysis as it was constructed originally to connect the plant to the grid. The loop resides in the Hillje corridor. The loop is owned and operated by CenterPoint Energy.

- Holman – This single circuit line exits STP and proceeds first to the Hillje substation on a double-circuit tower shared with the Lon Hill (White Point) loop. From Hillje, the line continues to Holman for an additional 75 miles in a 100-foot corridor. From STP to Hillje, the line is owned and operated by CenterPoint Energy. From Hillje to Holman the line is owned and operated by the City of Austin.

- Hill Country – The Hill Country and Skyline lines exit STP and run on separate double-circuit towers, sharing towers with W.A. Parish and STP-Hillje loops respectively, for 20 miles in the Hillje corridor. At that point, these lines diverge from their counterparts and continue for

119 miles on double-circuit towers in a 100-foot corridor to the Elm Creek substation. From Elm Creek, the Hill Country line continues for an additional 41 miles in a 100-foot corridor to the Hill Country substation. This line is owned and operated by CPS Energy.

- Skyline – The Hill Country and Skyline lines exit STP and run on separate double-circuit towers, sharing towers with W.A. Parish and STP-Hillje loops respectively, for 20 miles in the Hillje corridor. At that point, these lines diverge from their counterparts and continue for 119 miles on double-circuit towers in a 100-foot corridor to the Elm Creek substation. From Elm Creek, the Skyline line continues for an additional 29 miles in a 100-foot corridor to the Skyline substation. This line is owned and operated by CPS Energy.

- White Point loop – The Lon Hill line was looped into the White Point substation. This 10-mile loop resides in a 100-foot-wide corridor. The loops are owned and operated by American Electric Power Texas Central Company.

In total, the corridors carrying circuits from STP extend a distance of approximately 336 miles and occupy approximately 4,775 acres of land. The corridors pass through land that is primarily agricultural and rangeland, with some forest land and lesser land-use categories. The areas are mostly remote, with low population densities. The lines cross numerous county, state, and U.S. highways. Corridors that pass through farmlands generally continue to be used as farmland. The transmission service providers that operate these lines plan to maintain these transmission lines, which are integral to the larger transmission system, indefinitely. The intention is for these transmission lines to remain a permanent part of the transmission system even after STP is decommissioned.

The transmission lines were designed and constructed in accordance with the National Electrical Safety Code (for example, IEEE 2006) and other industry guidance that was current when the lines were built. Ongoing surveillance and maintenance of these transmission facilities ensure continued conformance to design standards. These maintenance practices are described in Section 4.13.

3.2 REFURBISHMENT ACTIVITIES

NRC

> "The report must contain a description of … the applicant's plans to modify the facility or its administrative control procedures...This report must describe in detail the modifications directly affecting the environment or affecting plant effluents that affect the environment…." 10 CFR 51.53(c)(2)
>
> "…The incremental aging management activities carried out to allow operation of a nuclear power plant beyond the original 40-year license term will be from one of two broad categories…(2) major refurbishment or replacement actions, which usually occur fairly infrequently and possibly only once in the life of the plant for any given item...." (NRC 1996)

STPNOC has addressed potential refurbishment activities in this environmental report in accordance with NRC regulations and complementary information in the NRC Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) for license renewal (NRC 1996). NRC requirements for the renewal of operating licenses for nuclear power plants include the preparation of an integrated plant assessment (IPA) (10 CFR 54.21). The IPA must identify and list systems, structures, and components subject to an aging management review. Items that are subject to aging and might require refurbishment include, for example, the reactor vessel, piping, supports, and pump casings (see 10 CFR 54.21 for details), as well as those items that are not subject to periodic replacement.

In turn, NRC regulations for implementing the National Environmental Policy Act require license-renewal phase environmental reports to describe in detail and assess the environmental impacts of any refurbishment activities such as planned major modifications to systems, structures, and components or plant effluents [10 CFR 51.53(c)(2)]. Resource categories to be evaluated for impacts of refurbishment include terrestrial resources, threatened and endangered species, air quality, housing, public utilities and water supply, education, land use, transportation, and historic and archaeological resources.

The STP IPA conducted by STPNOC under 10 CFR 54 (included as part of this license renewal application) has not identified the need to undertake any major refurbishment or replacement actions to maintain the functionality of systems, structures, and components during the STP license renewal period. STPNOC has replaced its steam generators and reactor heads for Units 1 & 2. Because these replacements are 18 years prior to original license expiration, they are not related to license renewal. These plant modifications have been done to meet the current license life. Accordingly, STPNOC has determined that license renewal regulations in 10 CFR 51.53(c)(3)(ii) do not require STPNOC to assess the impact of refurbishment on plant and animal habitats, estimated vehicle exhaust emissions, housing availability, land use, public schools, or highway traffic on local highways. (See 10 CFR 51.53(c)(3)(ii)(E), (F), (I), (J), respectively.)

3.3 PROGRAMS AND ACTIVITIES FOR MANAGING THE EFFECTS OF AGING

NRC

"The report must contain a description of … the applicant's plans to modify the facility or its administrative control procedures...This report must describe in detail the modifications directly affecting the environment or affecting plant effluents that affect the environment…." 10 CFR 51.53(c)(2)

"…The incremental aging management activities carried out to allow operation of a nuclear power plant beyond the original 40-year license term will be from one of two broad categories: (1) SMITTR actions, most of which are repeated at regular intervals, and (2) major refurbishment or replacement actions, which usually occur fairly infrequently and possibly only once in the life of the plant for any given item." NRC 1996, Section 2.6.3.1, pg. 2-41. ("SMITTR" is defined in NRC 1996 as surveillance, monitoring, inspections, testing, trending, and recordkeeping.)

The IPA required by 10 CFR 54.21 identifies the programs and inspections for managing aging effects at STP Units 1 & 2. These programs are described in the License Renewal Application, South Texas Project Units 1 & 2 to which this Environmental Report is appended.

3.4 EMPLOYMENT

Current Workforce

STPNOC employs approximately 1,378 permanent and long-term contractor personnel at STP, a two-unit facility. Approximately 83 percent of the employees live in Matagorda and Brazoria counties in Texas (see Section 2.6). The remaining employees are distributed across 18 other counties, with numbers ranging from 1 to 56 employees per county (STPNOC 2008b; STPNOC 2009).

STP Units 1 & 2 are on 18-month refueling cycles. During refueling outages in the license renewal term, STPNOC estimates that site employment will increase above the permanent workforce by as many as 1,350 workers for approximately one to two months of temporary duty.

License Renewal Increment

Performing the license renewal activities described in Sections 3.2 and 3.3 could necessitate increasing the STP staff workload by some increment. The size of this increment would be a function of the schedule within which STPNOC must accomplish the work and the amount of work involved. Because STPNOC has determined that no refurbishment is needed (Section 3.2), the analysis of license renewal employment increment focuses on programs and activities for managing the effects of aging (Section 3.3).

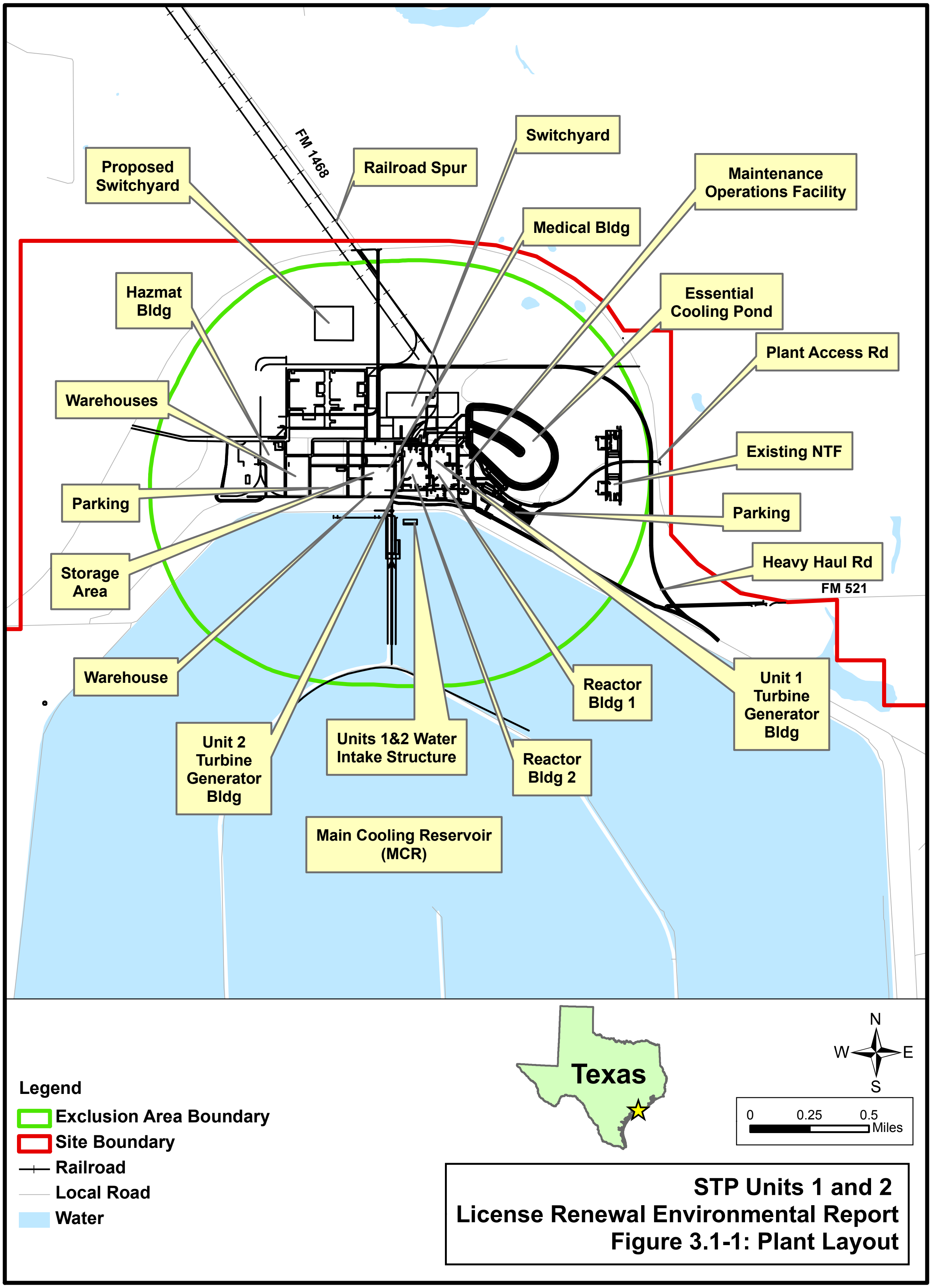
The GEIS (NRC 1996) assumes that NRC would renew a nuclear power plant license for a 20-year period, plus the duration remaining on the current license, and that NRC would issue the renewed license approximately 10 years prior to license expiration. In other words, the renewed license would be in effect for approximately 30 years. The GEIS further assumes that the utility would initiate surveillance, monitoring, inspections, testing, trending, and recordkeeping (SMITTR) activities at the time of issuance of the new license and would conduct license-renewal SMITTR activities throughout the remaining 30-year life of the plant, sometimes during full-power operation (NRC 1996), but mostly during normal refueling and the 5- and 10-year in-service inspection and refueling outages (NRC 1996).

STPNOC has determined that the GEIS scheduling assumptions are reasonably representative of STP incremental license-renewal workload scheduling. Many STP license renewal SMITTR activities would have to be performed during outages. Although some STP license-renewal SMITTR activities would be one-time efforts, others would be recurring periodic activities that would continue for the life of the plant.

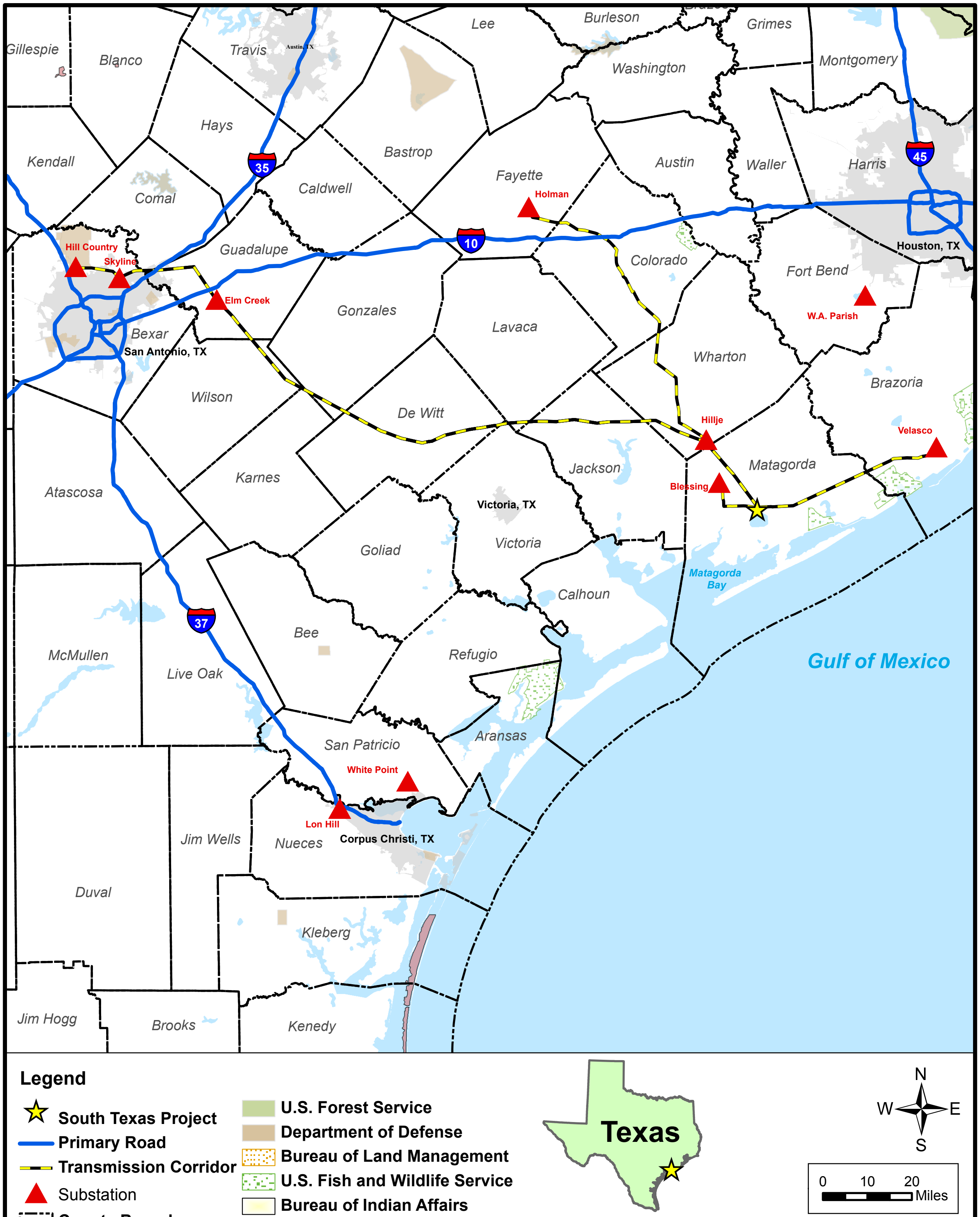
The GEIS estimates that the most additional personnel needed to perform license-renewal SMITTR activities would typically be 60 persons during the 3-month duration of a 10-year in-service inspection and refueling outage. Having established this upper value for what would be a single event in 20 years, the GEIS uses this number as the expected number of additional permanent workers needed per unit attributable to license renewal. GEIS Section C.3.1.2 uses this approach in order to "...provide a realistic upper bound to potential population-driven impacts…."

STPNOC has identified no need for significant new aging management programs or major modifications to existing programs. STPNOC anticipates that existing "surge" capabilities for routine activities, such as outages, would enable STPNOC to perform the increased SMITTR workload without increasing STP staff. Therefore, STPNOC has no plans to add outage or non-outage workers to support STP operations during the license renewal term.

3.5 FIGURES



STP Units 1 and 2
License Renewal Environmental Report
Figure 3.1-1: Plant Layout



STP Units 1 and 2
License Renewal Environmental Report
Figure 3.1-2: Transmission Corridors

3.6 CHAPTER 3 - REFERENCES

IEEE (Institute of Electrical and Electronics Engineers) 2006. National Electrical Safety Code, C2-2007, New York, New York.

NRC (U.S. Nuclear Regulatory Commission) 1975. Final Environmental Statement Related to the Proposed South Texas Project, Units 1 & 2, NUREG-75/019, Office of Nuclear Reactor Regulation, Washington, DC. March.

NRC (U.S. Nuclear Regulatory Commission) 1986. Final Environmental Statement Related to the Operation of South Texas Project, Units 1 & 2, NUREG-1171, Office of Nuclear Reactor Regulation, Washington, DC. August.

NRC (U.S. Nuclear Regulatory Commission) 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS), Volumes 1 and 2, NUREG-1437, Washington, DC. May.

STPNOC (STP Nuclear Operating Company) 2008a. South Texas Project Electrical Generating Station Updated Final Safety Analysis Report, Revision 14, South Texas Project Nuclear Operating Company, Wadsworth, Texas. April.

STPNOC (STP Nuclear Operating Company) 2008b. STPNOC Employees by County with Baseline Rollup.

STPNOC (STP Nuclear Operating Company) 2009. STPNOC Units 1 & 2 Contractor Zip Codes as of 8/17/09.

4.0 CHAPTER 4 - ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND MITIGATING ACTIONS

NRC

"The report must contain a consideration of alternatives for reducing adverse impacts…for all Category 2 license renewal issues…." 10 CFR 51.53(c)(3)(iii)

"…The environmental report shall include an analysis that considers…the environmental effects of the proposed action…and alternatives available for reducing or avoiding adverse environmental effects.…" 10 CFR 51.45(c) as adopted by 10 CFR 51.53(c)(2) and 10 CFR 51.53(c)(3)(iii)

The environmental report shall discuss "The impact of the proposed action on the environment. Impacts shall be discussed in proportion to their significance" 10 CFR 51.45(b)(1) as adopted by 10 CFR 51.53(c)(2).

"…The information submitted…should not be confined to information supporting the proposed action but should also include adverse information." 10 CFR 51.45(e) as adopted by 10 CFR 51.53(c)(2)

Chapter 4 presents an assessment of the environmental consequences and potential mitigating actions associated with the renewal of the STP Units 1 & 2 operating license. The assessment tiers from NRC's Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) (NRC 1996), which identifies and analyzes 92 environmental issues that NRC considers to be associated with nuclear power plant license renewal. In its analysis, NRC designated each of the 92 issues as Category 1, Category 2, or NA (not applicable) and required plant-specific analysis of only the Category 2 issues.

NRC designated an issue as Category 1 if, based on the result of its analysis, the following criteria were met:

- the environmental impacts associated with the issue were determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristic

- a single significance level (i.e., small, moderate, or large) was assigned to the impacts that would occur at any plant, regardless of which plant was being evaluated (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal)

- mitigation of adverse impacts associated with the issue were considered in the analysis, and it was determined that additional plant-specific mitigation measures are likely to be not sufficiently beneficial to warrant implementation.

Absent new and significant information (Chapter 5), NRC rules do not require analyses of Category 1 issues, because NRC resolved them using generic findings presented in 10 CFR 51, Appendix B, Table B-1. An applicant may reference the generic findings or GEIS analyses for Category 1 issues.

If the NRC analysis concluded that one or more of the Category 1 criteria could not be met, the issue was assigned as Category 2. NRC requires plant-specific analyses for Category 2 issues. NRC designated two issues as “NA” (Issues 60 and 92), signifying that the categorization and impact definitions do not apply to these issues. Attachment A of this report lists the 92 issues and identifies the environmental report section that addresses each issue and, where appropriate, references supporting analyses in the GEIS.

Category 1 License Renewal Issues

> **NRC**
>
> “The environmental report for the operating license renewal stage is not required to contain analyses of the environmental impacts of the license renewal issues identified as Category 1 issues in Appendix B to subpart A of this part.” 10 CFR 51.53(c)(3)(i)
>
> “…[A]bsent new and significant information, the analysis for certain impacts codified by this rulemaking need only be incorporated by reference in an applicant’s environmental report for license renewal….” 61 FR 28483

STPNOC has determined that, of the 69 Category 1 issues, 14 do not apply to STP Units 1 & 2 because they apply to design or operational features that do not exist at the facility. In addition, because STPNOC does not plan to conduct any refurbishment activities, the NRC findings for the 7 Category 1 issues that pertain only to refurbishment do not apply to this application. STPNOC has reviewed the remaining 48 NRC Category 1 findings and has identified no new and significant information that would make the NRC findings inapplicable to STP Units 1 & 2. Therefore, STPNOC adopts by reference the NRC findings for these Category 1 issues.

Category 2 License Renewal Issues

> **NRC**
>
> “The environmental report must contain analyses of the environmental impacts of the proposed action, including the impacts of refurbishment activities, if any, associated with license renewal and the impacts of operation during the renewal term, for those issues identified as Category 2 issues in Appendix B to subpart A of this part….” 10 CFR 51.53(c)(3)(ii)
>
> “The report must contain a consideration of alternatives for reducing adverse impacts, as required by § 51.45(c), for all Category 2 license renewal issues….” 10 CFR 51.53(c)(3)(iii)

NRC designated 21 issues as Category 2. Sections 4.1 through 4.20 addresses each of these issues (Section 4.17 addresses two issues), beginning with a statement of the issue. As is the case with Category 1 issues, some Category 2 issues apply to operational features that STP Units 1 & 2 do not have. In addition, some Category 2 issues apply only to refurbishment activities or to scenarios involving additional employment for managing plant aging. STPNOC does not plan any refurbishment or additional employment. If an issue does not apply to STP Units 1 & 2, the section explains the basis for inapplicability. Attachment A provides a summary of the applicability of each of the NRC’s 92 issues to STP Units 1 & 2.

For the 16 Category 2 issues that STPNOC has determined to be applicable to STP Units 1 & 2, analyses are provided. These analyses include conclusions regarding the significance of the impacts relative to the renewal of the operating license for STP Units 1 & 2 and, when applicable, discuss potential mitigative alternatives. STPNOC has identified the significance of the impacts associated with each issue as either Small, Moderate, or Large, consistent with the criteria that NRC established in 10 CFR 51, Appendix B, Table B-1, Footnote 3 as follows:

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

In accordance with National Environmental Policy Act practice, STPNOC considered ongoing and potential additional mitigation in proportion to the significance of the impact to be addressed (i.e., impacts that are small receive less mitigative consideration than impacts that are large).

"NA" License Renewal Issues

NRC determined that its categorization and impact-finding definitions did not apply to two issues (Issues 60 and 92); however, STPNOC included these issues in Attachment A. Applicants currently do not need to submit information on chronic effects from electromagnetic fields (10 CFR 51, Appendix B, Table B-1, Footnote 5). For environmental justice, NRC does not require information from applicants, but noted that it will be addressed in individual license renewal reviews (10 CFR 51, Appendix B, Table B-1, Footnote 6). STPNOC has included minority and low income demographic information in Section 2.6.2.

4.1 WATER USE CONFLICTS (PLANTS USING COOLING TOWERS OR COOLING PONDS AND WITHDRAWING MAKEUP WATER FROM A SMALL RIVER WITH LOW FLOW)

NRC

"If the applicant's plant utilizes cooling towers or cooling ponds and withdraws make-up water from a river whose annual flow rate is less than $3.15x10^{12}$ ft^3/year ($9x10^{10}m^3$/year), an assessment of the impact of the proposed action on the flow of the river and related impacts on in-stream and riparian ecological communities must be provided…" 10 CFR 51.53(c)(3)(ii)(A).

"…The issue has been a concern at nuclear power plants with cooling ponds and at plants with cooling towers. Impacts on instream and riparian communities near these plants could be of moderate significance in some situations…" 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 13

The water-use issue associated with operation of cooling ponds is the availability of adequate stream flows to provide makeup water, particularly during droughts or in the context of increasing in-stream or off-stream uses (NRC 1996). For this reason, NRC made surface water use conflicts a Category 2 issue.

As discussed in Section 3.1, STP Units 1 & 2 use a closed cycle cooling pond (MCR) that receives its makeup water from the lower Colorado River. The Lower Colorado River Basin comprises approximately 22,682 square miles of drainage area from Lake O. H. Ivie in Mills County, Texas, to Matagorda Bay (TWDB 2007). From 1948 to 2007, the mean average flow of the lower Colorado River at Bay City (USGS Gauging Station 08162500) was 2,628 cubic feet per second (cfs) (USGS 2008) or 8.29×10^{10} cubic feet per year. Therefore, the lower Colorado River meets the NRC definition of a small river.

The Lower Colorado River Basin is under the authority of the Lower Colorado River Authority (LCRA), which was created by the Texas legislature in 1934 as a conservation and reclamation district to provide reliable energy, water, and public services. The LRCA provides services to all or parts of 53 counties in central and southeastern Texas. The LCRA operates dams that form the six reservoirs that form the Highlands Lakes, which include Lake Buchanan, Inks Lake, Lake LBJ, Lake Marble Falls, Lake Travis, and Lake Austin. The Highland Lakes are located upstream of STP and have a total conservation storage capacity of 2,155,917 acre-feet and a total release capacity of 381,545 acre-feet per year (LCRA 2003).

Based on a 1989 Certificate of Adjudication, STPNOC has secured a portion of the LCRA priority water rights to use 102,000 acre-feet per year of water from the lower Colorado River. The STP site is permitted to remove water from the lower Colorado River up to a maximum rate of 1,200 cfs (540,000 gpm). However, STP is limited to diverting 55 percent of the flows of the lower Colorado River in excess of a 300-cfs base flow at the authorized diversion point on the river to protect freshwater inflows to Matagorda Bay during low flow conditions (TWC 1989).

As summarized in Table 4.1-1, between 2003 and 2007, the STP site diverted water from the lower Colorado River at an average annual rate of 35,364 acre-feet/year (48.8 cfs; 21,903 gpm), which is only 34.7 percent of the STP's permitted water use. Between 2003 and 2007, STP's water use ranged from zero percent (2003) to a maximum of 61.1 percent (2004) of the plant's permitted water use. Due to low flow conditions of the lower Colorado River, the plant did not divert water from the river in 2003. In 2004, the plant diverted 62,374 acre-feet/year of water to return the MCR up to its procedural operating level of elevation 47 feet above sea level.

STP's maximum monthly withdrawal versus the lower Colorado River maximum monthly flow data for 2003 to 2007 at the USGS Station in Bay City (Gauging Station No. 08162500) is summarized in Table 4.1-2. From 2003 through 2007, STP diverted a minimum of 1 percent of the maximum monthly lower Colorado River flow near Bay City, while the maximum monthly diversion rate in the five year period was 20 percent. There is no established 7Q10 value for the lower Colorado River near the STP site because the portion of the lower Colorado River adjacent to the STP site, Colorado River Segment 1401, has been classified by the Texas Commission on Environmental Quality as Tidal (TCEQ 2005). Therefore, 7Q10 water flow data cannot be used to determine potential impacts.

As part of the Certificate of Adjudication, STPNOC also has rights to an additional 20,000 acre-feet per year of backup water for two-unit operation, and 40,000 acre-feet per year for four-unit operation. The backup water rights are for use of stored water during periods when the water necessary to maintain the MCR at or above an elevation of 27 feet mean sea level (MSL) is not available from the Colorado River (STPNOC 2006a). If this situation were to occur, backup water would be released by the LCRA from firm stored water or any other sources of water originating upstream of the Bay City Dam.

The fundamental elements of the 2003 LCRA Water Management Plan is to ensure the availability of water for cities, industries, farmers, and environmental inflow needs (LCRA 2003). The drought of record for the Lower Colorado River Basin occurred from the late 1940s through the late 1950s and is used in the LCRA's Water Management Plan to set lake storage amounts to serve as trigger points for the LCRA's Drought Management Plan. When the amount of water stored in Lakes Buchanan and Travis falls to a combined total of 1.1 million acre-feet, the LCRA begins curtailing interruptible (non-priority) water customers. Projected priority and junior priority water rights, also known as firm water demands for stored water, are currently less than the total firm water available (LCRA 2003). Should extreme drought conditions occur, the MCR was designed for a 100-year drought event that lasts 10 years (STPNOC 2005b).

In the review of its next updated Water Management Plan, which is expected in 2011 (Kowis 2009), LCRA will consider the study results to determine if the plan needs updating (LCRA 2009). The 2011 review process will assess the inflow needs with all other water demands, water availability, and input from TCEQ as result of the passage of Senate Bill 3 by the 80th Texas Legislature in 2005.

Senate Bill 3 established a process that requires TCEQ to adopt appropriate environmental flow standards for each bay system that are adequate to support a sound ecological environment to the maximum extent reasonable considering other public interests and other relevant factors [TWC 11.1471(a)(1)]. Bay and basin advisory groups, stakeholder committees, and expert science teams will work with technical support from TPWD, TWDB, and TCEQ over the next few years to develop recommendations regarding environmental flow standards which TCEQ must consider in rulemaking. Recommendations of the expert science teams shall be developed through a collaborative process designed to achieve consensus and must be based solely on the best science available [TWC 11.02362(m)]. TCEQ rulemaking shall establish an amount of unappropriated water, if available, to be set aside to satisfy the environmental flow standards to the maximum extent reasonable when considering human water needs. While this process has been created to establish environmental flow standards and set-asides to be considered in evaluating applications for new water rights and amendments, the Texas Legislature has not chosen to apply the environmental flow standards to currently authorized uses of existing water rights, including STP.

Based on the following findings, withdrawals of surface water for the operation of STP Units 1 & 2 during low-flow periods would have a SMALL impact on the availability of fresh water downstream of site and would not warrant further mitigation:

- Between 2003 and 2007, the STP site diverted water from the lower Colorado River at an average annual rate of 35,364 acre-feet/year (48.8 cfs; 21,903 gpm), which is only 34.7 percent of the STP's permitted water use.
- From 2003 through 2007, STP diverted a minimum of one percent of the maximum monthly lower Colorado River flow near Bay City, while the maximum monthly diversion rate in the five-year period was 20 percent.
- STP diverts water from the river only after confirming that the flow at USGS Bay City Gauging Station is capable of supporting the withdrawal of surface water while in accordance with the current STPNOC Certificate of Adjudication.
- As discussed previously, MCR water quality is maintained by selective pumping during high river flow conditions (>1,200 cfs). During drought conditions, water levels and water quality in the MCR would be sacrificed.
- The design basis for the MCR is a 100-year drought event that lasts 10 years.
- The fundamental elements of the 2003 LCRA Water Management Plan is to ensure the availability of water for cities, industries, farmers, and environmental inflow needs (LCRA 2003). Projected priority and junior priority water rights, also known as firm water demands for stored water, are currently less than the total firm water available.
- TCEQ rulemaking in accordance with Senate Bill 3 shall establish an amount of unappropriated water, if available, to be set aside to satisfy the environmental flow standards to the maximum extent reasonable when considering human water needs. The Texas Legislature has not chosen to apply the environmental flow standards to currently authorized uses of existing water rights, including STP.

4.2 ENTRAINMENT OF FISH AND SHELLFISH IN EARLY LIFE STAGES

NRC

> "If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations…or equivalent State permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from…entrainment." 10 CFR 51.53(c)(3)(ii)(B)

> "…The impacts of entrainment are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. Further, ongoing efforts in the vicinity of these plants to restore fish populations may increase the numbers of fish susceptible to intake effects during the license renewal period, such that entrainment studies conducted in support of the original license may no longer be valid…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 25

NRC made impacts on fish and shellfish resources from entrainment a Category 2 issue because it could not assign a single significance level (small, moderate, or large) to the issue. The impacts of entrainment are small at many facilities, but may be moderate or large at others. Also, ongoing restoration efforts may increase the number of fish susceptible to intake effects during the license renewal period (NRC 1996). Information needing to be ascertained includes (1) type of cooling system (whether once-through or cooling pond), and (2) status of Clean Water Act (CWA) Section 316(b) determination or equivalent state documentation.

As discussed in the GEIS (NRC 1996), STP is one of nine U.S. nuclear plants with a cooling pond-based heat dissipation system. Makeup water for the cooling pond, called the Main Cooling Reservoir (MCR), is withdrawn intermittently from the Colorado River.

Section 316(b) of the CWA requires that any standard established pursuant to Sections 301 or 306 of the CWA shall require that the location, design, construction, and capacity of cooling water intake structures reflect the "Best Technology Available" for minimizing adverse environmental impacts [33 USC 1326(b)]. Entrainment through the condenser cooling system of fish and shellfish in the early life stages is one of the potential adverse environmental impacts that can be minimized by use of the best available technology.

Prior to 1998, National Pollutant Discharge Elimination System (NPDES) permits in Texas were issued by EPA Region 6. STP's original NPDES permit was issued by the EPA in December 1982. The state of Texas was delegated authority to administer the state's NPDES program in September 1998. In more recent years, the plant's NPDES (TPDES) permits have been issued by the Texas Commission on Environmental Quality (TCEQ). Because the EPA and the state of Texas have never required STPNOC to conduct a CWA Section 316(b) demonstration at its cooling water intake structure, an analysis of potential impacts of entrainment on fish and shellfish is provided here.

Main Cooling Reservoir

The MCR is a perched, off-channel, on-site industrial cooling impoundment. The MCR is on private property and exists solely for industrial cooling. It is not a publicly managed water body and has no recreational uses. The general public has never had access to the MCR nor is any planned in the foreseeable future. The MCR is considered a closed cycle recirculating system and is not considered a "water of the State" by the TCEQ. The MCR is not a "water of the U.S." as defined at 40 CFR §122.2. No studies at the plant's cooling water intake to demonstrate compliance with Section 316(b) of the Clean Water Act have been required.

When STPNOC began to explore the possibility of new generating units at the site, an assessment of cooling water intake structure (CWIS) impacts was conducted starting in 2007. STPNOC conducted surveys of the MCR's fish and invertebrate communities to evaluate entrainment and impingement at the plant's circulating water intake. These studies were intended to establish a baseline in the reservoir for the purposes of evaluating the potential impact of building and operating proposed Units 3 & 4.

An entrainment study was conducted at the STP circulating water intake over the May 2007 through April 2008 period (ENSR 2008). Entrainment samples were collected twice monthly in late spring and summer (May–September) and monthly over the October–May period. Samples were collected from behind the intake trash rack four times over a given 24-hour period: at 0430, 1030, 1630, and 2230 hours. This ensured that entrainment estimates reflected potential day–night differences in distribution of plankton in the MCR.

Entrainment sampling produced 207,696 organisms representing 9 families of fish and 12 classes of invertebrates (ENSR 2008). Most organisms entrained were macro- and micro-crustaceans—decapod (crab and shrimp) larvae, amphipods, and copepods. More than 67 percent of organisms in entrainment samples were larvae of the estuarine mud crab (also known as Harris's mud crab) *Rhithropanopeus harrisii*. This species is a common inhabitant of Gulf Coast estuaries that has become established in at least seven inland impoundments in Texas (Keith 2008). These impoundments, although putatively "freshwater," are technically brackish, with salinities in the 0.4 to 2 parts per thousand (ppt) range. Larvae/zoea of other decapods, including another mud crab genus (*Panopeus*), were also relatively common in entrainment samples. No blue crab larvae/zoeae were identified, but adult blue crabs are quite common in the MCR, and some early life stages of this species are almost certainly present. Blue crabs spawn in nearshore and offshore ocean waters with salinities greater than 20 ppt. Larvae are carried inshore with tides and currents, and develop into juveniles and adults that are able to tolerate low-salinity waters. Blue crabs are presumably pumped as late-stage larvae or juveniles with makeup water into the MCR, where they mature into adults.

Ichthyoplankton comprised less than one percent of organisms in entrainment samples. Two families, Clupeidae and Atherinidae, were predominant. Larvae and eggs were only identified to the Family level. Three clupeids (gizzard shad, threadfin shad, bay anchovy) and two atherinids (inland silverside and rough silverside) were collected during adult fish sampling, and ichthyoplankton are presumed to be from these five species. The Clupeidae and Atherinidae are both comprised primarily of small, short-lived, schooling species that are important to the extent that they serve as forage for commercially and recreationally important fish species and, in the case of the bay anchovy, for marine birds (e.g., least tern, roseate tern, black skimmer, brown pelican).

ENSR (2008) concluded that "although the reservoir functions as a cooling water system, the day-to-day withdrawal of water through the CWIS and resultant influx of heated discharge water does not appear to have a negative impact on the fish and marcroinvertebrate communities living in the MCR." Notwithstanding the fact that the MCR was designed and built to function solely as a heat dissipation facility, it supports healthy populations of decapods (most notably blue crabs), baitfish (threadfin shad, gizzard shad, bay anchovy, inland silverside, rough silverside), and sport fish (Atlantic croaker, ladyfish, blue catfish). Moreover, STPNOC health physicists collecting fish by hook and line for radiological assessments routinely catch large crevalle jack and red drum in the MCR. ENSR biologists conducting studies in 2007 and 2008 frequently observed schools of crevalle jack and red drum cruising the shallows of the reservoir, but collected only one red drum during the study. This suggests that crevalle jack and red drum may be less vulnerable than other fish species to the conventional fish sampling gear (i.e., minnow traps, gill nets, otter trawls) employed in the ENSR study.

Lower Colorado River

Houston Lighting and Power (HL&P), the original STP licensee, conducted (or provided financial support for) several studies designed to assess potential impacts of entrainment at the Reservoir Makeup Pumping Facility (RMPF). Ichthyoplankton and macrozooplankton (larval crustaceans) were collected upstream and downstream of STP in 1973 and 1974 (HL&P 1974,) and again in 1975–1976 (NUS 1976) to characterize the temporal and spatial distribution of these organisms in the lower Colorado River under low-flow (dry) and high-flow (wet) conditions. Ichthyoplankton and macrozooplankton densities (and planned pumping rates) were used to calculate estimates of entrainment at the RMPF intake.

In 1983 and 1984, after the RMPF became operational, HL&P biologists conducted additional surveys of ichthyoplankton distribution and abundance in the Colorado River in the vicinity of the RMPF along with limited studies of entrainment at the RMPF intake to determine if any species or groups were likely to be particularly susceptible to entrainment. The results of these studies are detailed in McAden et al. (1984) and McAden et al. (1985).

The original (1973 and 1974) lower Colorado fish studies, Phase I (1975–1976) ichthyoplankton studies and Phase II (1983 and 1984) ichthyoplankton studies are summarized in the Final Environmental Statement relating to the operation of South Texas Project, Units 1 & 2 (NRC 1986). Having reviewed these studies, the NRC concluded that operational entrainment losses would not constitute a significant impact to lower Colorado River fish and shellfish populations because:

- Actual entrainment losses would probably be near a median value of about 10 percent of the organisms passing the intake.
- Only organisms in the area of the intake would be at risk; the entire population of a given species in the lower Colorado River would not be affected.
- The lower Colorado River does not appear to be a unique nursery area for estuarine-marine organisms; it is only one of many such estuarine nurseries found along the Texas and Gulf coasts.
- Anchovy, menhaden, croaker, and blue crab are ubiquitous and abundant along the Texas and Gulf coasts.
- Most makeup water withdrawal would occur during periods of high river flow when concentrations of estuarine-marine organisms are low in the area of the STP intake. (NRC 1986)

Detailed information on design and operation of the RMPF was supplied to the EPA in a letter dated June 28, 1982 as part of the plant's original NPDES permit application package. Having reviewed this material, the EPA issued NPDES Permit No. TX0064947 for STP to HL&P effective on December 20, 1982. The EPA permit writers concluded that "…the intake structure is approved by (as) Best Available Technology in accordance with Section 316(b) of the CWA." (NRC 1986)

Based on (1) the EPA's acknowledgement that the RMPF intake structure represents the "Best Technology Available" for reducing adverse impacts, (2) the NRC's (1986) assessment of the impacts of entrainment at the RMPF, and (3) a recent evaluation of entrainment at the circulating water intake on the MCR, STPNOC concludes that any environmental impact from entrainment of fish and shellfish in early life stages at STP is SMALL and does not require further mitigation.

4.3 IMPINGEMENT OF FISH AND SHELLFISH

NRC

> "If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations…or equivalent State permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from…impingement…." 10 CFR 51.53(c)(3)(ii)(B)
>
> "…The impacts of impingement are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 26

NRC made impacts on fish and shellfish resources from impingement a Category 2 issue, because it could not assign a single significance level to the issue. Impingement impacts are small at many facilities, but might be moderate or large at other plants (NRC 1996). Information that needs to be ascertained includes (1) type of cooling system (whether once-through or cooling pond), and (2) current CWA 316(b) determination or equivalent state documentation.

As discussed in the GEIS (NRC 1996), STP is one of nine U.S. nuclear plants with a cooling pond-based heat dissipation system. Makeup water for the cooling pond, called the Main Cooling Reservoir (MCR), is withdrawn intermittently from the nearby Colorado River.

Section 316(b) of the CWA requires that any standard established pursuant to Sections 301 or 306 of the CWA shall require that the location, design, construction, and capacity of cooling water intake structures reflect the "Best Technology Available" for minimizing adverse environmental impacts [(33 USC 1326(b)]. Impingement of fish and shellfish on intake travelling screens is one of the potential adverse environmental impacts that can be minimized by use of the best available technology.

Prior to 1998, NPDES permits in Texas were issued by EPA Region 6. STP's original NPDES permit was issued by the EPA in December 1982. The state of Texas was delegated authority to administer the state's NPDES program in September 1998. In more recent years, the plant's NPDES permits have been issued by the TCEQ. Because the EPA and the state of Texas have never required STPNOC to conduct a CWA Section 316(b) demonstration at its cooling water intake structure, an analysis of potential impacts of entrainment on fish and shellfish is provided here.

Main Cooling Reservoir

The MCR is a perched, off-channel, on-site industrial cooling impoundment. The MCR is on private property and exists solely for industrial cooling. It is not a publicly managed water body and has no recreational uses. The general public has never had access to the MCR nor is any planned in the foreseeable future. The MCR is considered a closed cycle recirculating system and is not considered a "water of the State" by the TCEQ. The MCR is not a "water of the U.S." as defined at 40 CFR §122.2. No studies at the plant's cooling water intake to demonstrate compliance with Section 316(b) of the Clean Water Act have been required.

When STPNOC began to explore the possibility of new generating units at the site, an assessment of cooling water intake structure (CWIS) impacts was conducted starting in 2007. STPNOC conducted surveys of the MCR's fish and invertebrate communities to evaluate entrainment and impingement at the plant's circulating water intake (ENSR 2008). These studies were intended to establish a baseline in the reservoir for the purposes of evaluating the potential impact of building and operating proposed Units 3 & 4.

Impingement samples were collected twice monthly from May 2007 through September 2007 and monthly from October 2007 through April 2008. All organisms impinged on the travelling screens during consecutive 12 hour periods were collected, ensuring that diel differences in rate of impingement were evaluated. All organisms in the screenwash were identified, measured, and weighed, so the relative vulnerability of fish and shellfish species could be assessed.

A total of 3,981 organisms representing 25 finfish and 7 invertebrate species were collected in impingement samples over the 12-month period (ENSR 2008). Impingement rates during the study were highly variable, with no seasonal trends being identified. Three species dominated impingement samples: threadfin shad (42 percent of total), blue crab (24 percent), and mud crab (24 percent). Smaller numbers of Atlantic croaker (5 percent) and white shrimp (3 percent) also were collected (ENSR 2008). None of the other species collected made up even one percent of the total. Some species-specific trends were evident. The blue crab impingement rate was highest in summer, while the threadfin shad impingement rate was highest in winter and early spring.

Roughly equal numbers of finfish (1,929) and invertebrates/shellfish (2,052) were impinged during the study (ENSR 2008). The fish species most often impinged, threadfin shad, is a frail, weak-swimming species that is sensitive to sudden changes in water temperature and dissolved oxygen levels and is subject to mass die-offs in late summer and winter (Jenkins and Burkhead 1994; Mettee et al. 1996).

Threadfin shad have an extremely high reproductive potential because they are capable of spawning as one-year-olds, may spawn repeatedly over a season, and produce relatively large numbers of eggs (5,300 to 17,300 eggs per average-sized female; up to 21,000 eggs per female) for a small-bodied species (Hassan-Williams and Bonner 2007; Jenkins and Burkhead 1994). A study (computer simulation) of threadfin shad mortality at a South Carolina pumped-storage hydroelectric power plant suggested that the risk of population-level effects from power plant-induced mortality was low (maximum risk of five percent above background), even when high mortality rates were assumed (Root and Ferson 1999). The authors of the study attributed the low risk to the species' "robust reproductive potential" that allows threadfin shad populations to rebound quickly from impacts (Root and Ferson 1999).

The only commercially or recreationally important shellfish impinged in substantial numbers was the blue crab. The blue crab's life history is characterized by production of large numbers of young, rapid growth, early attainment of sexual maturity, high mortality rates, and a short life span. Species like the blue crab with high rates of natality and mortality tend to exhibit large year-to-year fluctuations in abundance because physical, chemical, and biological factors can strongly influence survival of young. In addition, blue crabs populations are known to be cyclic—five-year and longer cycles have been identified.

As discussed in the previous section, the MCR supports healthy populations of decapods (most notably blue crabs), baitfish (threadfin shad, gizzard shad, bay anchovy, inland silverside, rough silverside), and sport fish (Atlantic croaker, ladyfish, blue catfish). All indications are that these fish and shellfish are in good condition and growing normally: no diseased or emaciated/stunted fish were observed in 12 months of sampling. Although the reservoir functions as a cooling water system, the day-to-day withdrawal of water through the CWIS and resultant influx of heated discharge water does not appear to have a negative impact on the fish and macroinvertebrate communities living in the MCR (ENSR 2008).

Lower Colorado River

Impingement of macroinvertebrates and fish was monitored at the RMPF intake in the summer of 1983 during the filling of the MCR and again on a single date in September 1984 (McAden et al. 1984; McAden et al. 1985). Impingement was greatest in mid-July, when an estimated 14,976 crustaceans and fish were impinged over a 24-hour period. The September 1984 estimate was the lowest (2,880 individuals over a 24-hour period).

The most commonly impinged macroinvertebrate was the blue crab, which was collected during all impingement sampling events. In addition, representatives of six shrimp species, including four palaemonids and two penaeids, were impinged. Of these, the Ohio shrimp was the most often impinged.

A total of three fish were collected in impingement samples during the 1983 and 1984 monitoring studies (McAden et al. 1984; McAden et al. 1985). Two were estuarine fish (inland silverside and crevalle jack) and one was a freshwater fish (green sunfish). All were collected in the summer of 1983. The September 1984 impingement sampling yielded no fish.

The NRC concluded that effects of impingement on lower Colorado River fish and shellfish would be “minor,” based on the following rationale:

- Because absolute densities of organisms are low at the intake, low absolute numbers would be impinged.
- The intake design limits impingement (i.e., structure built flush to shoreline to prevent attractant flows, approach velocity < 0.5 foot per second, fish return system).
- Most pumping would occur during periods of the year (fall-winter-spring) when river flows are high, serving to limit impingement of young of the year (rather than July to September, when young are present).
- Withdrawal of upper stratum river water would limit impingement of estuarine organisms, which are more bottom-oriented due to presence of salt wedge.
- The lower Colorado River is not a unique nursery habitat for any species.
- Menhaden, croaker, anchovy, and mullet are ubiquitous and abundant (NRC 1986).

Detailed information on design and operation of the RMPF was supplied to the EPA in a letter dated June 28, 1982 as part of the plant’s original NPDES permit application package. Having reviewed this material, the EPA issued NPDES Permit No. TX0064947 for STP to Houston Lighting and Power on December 20, 1982. The EPA permit writers concluded that “…the intake structure is approved by (as) Best Available Technology in accordance with Section 316(b) of the CWA.” (NRC 1986)

Based on (1) the EPA's acknowledgement that the RMPF intake structure represents the "Best Technology Available" for reducing adverse impacts, (2) the NRC's (1986) assessment of the impacts of impingement at the RMPF, and (3) the results of a 2007–2008 impingement study at the STP circulating water intake, STPNOC concludes that any environmental impact from impingement of fish and shellfish in early life stages at STP is SMALL and does not require further mitigation.

4.4 HEAT SHOCK

NRC

> "If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act…316(a) variance in accordance with 40 CFR 125, or equivalent State permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from heat shock…" 10 CFR 51.53(c)(3)(ii)(B)

> "…Because of continuing concerns about heat shock and the possible need to modify thermal discharges in response to changing environmental conditions, the impacts may be of moderate or large significance at some plants…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 27

NRC made impacts on fish and shellfish resources resulting from heat shock a Category 2 issue, because of continuing concerns about thermal discharge effects and the possible need to modify thermal discharges in the future in response to changing environmental conditions (NRC 1996). Information to be ascertained includes: (1) type of cooling system (whether once-through or cooling pond), and (2) evidence of a CWA Section 316(a) variance or equivalent state documentation.

As discussed in the GEIS (NRC 1996), STP is one of nine U.S. nuclear plants with a cooling-pond-based heat dissipation system. Makeup water for the cooling pond, called the Main Cooling Reservoir (MCR), is withdrawn from the nearby Colorado River. Blowdown is directed to the Colorado River via an existing blowdown structure, which includes a 1.1-mile-long discharge line that extends downstream along the west bank of the river and is equipped with seven discharge ports, each with a diffuser (NRC 1986). One or more of the ports may be "valved" open, depending on river flows, to promote rapid mixing of the effluent (NRC 1986). Designed to allow the release (or blowdown) of reservoir water high in dissolved solids, the blowdown structure has been used (tested) only once, in 1997. Acceptable water quality has been maintained in the MCR by selective diversion from the Colorado River during periods of high flow.

The original NPDES permit (No. TX0064947) for STP Units 1 & 2, issued by the EPA in 1985, contained requirements on the blowdown flow rates and the number of discharge ports that must be opened (NRC 1986), but these requirements were removed from the permit when the state of Texas assumed responsibility for the NPDES program. However, STPNOC procedures direct operators to open two to seven blowdown valves, depending on blowdown rate. STPNOC procedures also prescribe a range (80 to 308 cfs) of allowable blowdown rates, depending on Colorado River flows.

It may be necessary to discharge from the MCR in the future to reduce levels of dissolved solids. The current TPDES permit (No. WQ0001908000, issued July 27, 2005) limits the average daily discharge to the Colorado River to 144 million gallons per day (gpd) via Outfall 001, the only outfall that discharges to the Colorado River. The current TPDES permit for STP Units 1 & 2 contains limits on daily average (95°F) and daily maximum (97°F) discharge temperatures, limits that are based on site-specific (or segment-specific) TCEQ water quality standards for Segment 1401, Colorado River Tidal, at Title 30, Chapter 307.10, Appendix A, pursuant to the Texas Administrative Code.

The current TPDES permit also stipulates that the discharge from Outfall 001 shall not exceed 12.5 percent of the flow of the Colorado River at the discharge point and prohibits discharges from Outfall 001 when flow in the Colorado River adjacent to the plant is less than 800 cfs. Because the blowdown flow will be no more than 12.5 percent of the Colorado River flow (and under normal circumstances will be an even smaller percentage) the effect on temperature downstream in the Colorado River will be negligible, limited to an area in the immediate vicinity of the blowdown line.

NRC staff modeled STP blowdown temperatures in the course of preparing the Final Environmental Statement related to the proposed South Texas Project Units 1 and 2 and determined that in all cases, the temperatures at the edge of the (25 percent cross-sectional area and/or 25 percent volume) mixing zone would be within the limits permitted by the Texas Water Quality Standards (NRC 1975). Based on these modeling results, NRC staff concluded that the thermal plume would be limited to the immediate area of the blowdown diffuser ports (NRC 1975), would not block up- and downstream movement of aquatic biota, and would not significantly affect the aquatic productivity of the Colorado River (NRC 1975). Subsequently, in the Final Environmental Statement related to the operation of South Texas Project Units 1 and 2, NRC staff noted that the water temperature at the edge of the 25 percent mixing zone would not exceed the ambient river temperature by more than 1.8°C (3.3°F) in fall, winter, and spring, or by 0.6°C (1.1°F) in summer (NRC 1986). The (1986) FES went on to state that the "conclusions of no significant impact to aquatic biological resources (in the 1975 construction-phase FES) remain valid."

Neither the EPA, which administered the Texas NPDES program until September 1998, nor TCEQ, which currently administers the (TPDES) program, has required STPNOC (or previous licensees) to conduct a thermal effects study or seek a 316(a) variance. No such variance is necessary because any discharge to the Colorado River would be in compliance with state water quality (thermal) standards.

Given that (1) STPNOC and NRC mathematical modeling has shown thermal effects from reservoir blowdown would be limited to the immediate area of the blowdown diffuser ports and would not block up- or downstream movement of aquatic organisms, (2) it has not been necessary to blow down the MCR in more than 20 years of STP operation, suggesting that discharges will always be infrequent, (3) blowdown rate is keyed to river flow, ensuring significant dilution, and (4) STPNOC is required to meet state water quality standards for temperature, standards that are presumed to be protective of local aquatic (fish and shellfish) resources, STPNOC believes that any impacts to fish and shellfish resources would be SMALL and would not warrant mitigative measures beyond those already in place.

4.5 GROUNDWATER USE CONFLICTS (PLANTS USING >100 GPM OF GROUNDWATER)

NRC

> "If the applicant's plant…pumps more than 100 gallons (total onsite) of groundwater per minute, an assessment of the impact of the proposed action on groundwater use must be provided." 10 CFR 51.53(c)(3)(ii)(C)

> "…Plants that use more than 100 gpm may cause ground-water use conflicts with nearby ground-water users…." 10 CFR 51, Subpart A, Table B-1, Issue 33

NRC made groundwater use conflicts a Category 2 issue because, at a withdrawal rate of more than 100 gallons per minute (gpm), a cone of depression could extend offsite. This could deplete the groundwater supply available to offsite users, an impact that could warrant mitigation. Information to ascertain includes: (1) STP Units 1 & 2 groundwater withdrawal rate (whether greater than 100 gpm), (2) drawdown at property boundary location, and (3) impact on neighboring wells.

As discussed in Section 3.1.2, STP Units 1 & 2 use two influent cooling water sources: the lower Colorado River and groundwater. There are five active permitted wells at STP (Wells 5 through 8, and the NTF well) installed in the Deep Chicot Aquifer (Section 2.3) that provide water for domestic use, fire protection, the makeup demineralizer system, chill water for the cooling tower, makeup water to the Essential Cooling Pond, and the Nuclear Support Center. STP is currently permitted by the Coastal Plains Groundwater Conservation District (CPGCD) to use up to 9,000 acre-feet of groundwater over an approximately three year period (Section 2.3.3). As summarized in Table 2.3-2, from 2005 through 2009, STP Units 1 & 2 pumped groundwater from these wells at an average production rate of 1,234 acre-feet per year (765 gpm). The five permitted STP production wells were originally designed to pump at a rate of 200-500 gpm. Therefore, the issue of groundwater use conflicts applies to STP Units 1 & 2.

The Shallow Chicot Aquifer in the site area is primarily used for livestock watering and other low-yield requirements. The Deep Chicot Aquifer, which is separated from the overlying Shallow Chicot Aquifer by a 250- to 300-foot thick clay confining unit, is used as the primary source of water for the region due to higher aquifer yield. Therefore, STPNOC concludes that impacts to the Shallow Chicot Aquifer from the STP production wells would be SMALL.

In 2007, a groundwater model was performed to evaluate the drawdown and production capacity of Wells 5 through 8. The equations used in the calculations assume that the deep aquifer is homogenous, isotropic, of uniform thickness, of infinite aerial extent, and with negligible recharge and gradient. For the Theis non-equilibrium equation input into the model, a distance of 2,500 feet was selected as the minimum distance to the pumping well. This distance was selected to correspond to CPGCD's rule that a distance of 2,500 feet separate all pumping wells in an attempt to limit potential interference between wells.

The results of the confined, nonleaky scenario model indicated that drawdown at a distance of 2,500 feet from any STP site well for the 500-gpm design yield during the initial 40-year operating period of STP Units 1 & 2 is 18 to 20 feet (STPNOC 2009).

In reality, the actual drawdown at 2,500 feet away from any STP well would be less than 18 to 20 feet since (1) the STP wells are pumped at a rate less than their design yield of 500 gpm used as input to the model, (2) the model assumes that the STP wells are screened across the full thickness of the aquifer, and (3) the non-leaky confined aquifer scenario used for the model does not account for any recharge. Hydrographs and potentiometric surface maps prepared using groundwater level data collected between 1996 and 2006 from STP monitoring peizometer 613, which is located in the influence of STP Well 6, indicate that the potentiometric surface flows towards the site's production wells and that drawdown in the Deep Chicot Aquifer is limited to onsite areas (STPNOC 2009).

There are three public drinking water wells installed in the Deep Chicot Aquifer located approximately 3.3 miles southeast of STP Well 7. These wells supply potable water to the Exotic Isles Subdivision (TWDB #8016903), the Selkirk water system (TWDB #8109701), and the Selkirk Island Utilities (TWDB #8109702) (TWDB 2009a). These wells vary in depth from 548 to 800 feet. The closest nonpublic well water supply wells to the site is a 500-foot-deep livestock well that is 1,800 feet north of STP Well 5 and a 400-foot-deep agricultural well that is 2,230 feet west of STP Well 6 (CPGCD 2009). Both livestock wells are screened from 200 to 300 feet above the screened intervals of STP Wells 5 and 6.

Local hydrographs were prepared using groundwater level data collected since the 1940s at two Texas Water Development Board (TWDB) observation wells (Well 8015402 and Well 8015301) located near STP (TWDB 2009b). The two wells monitor two different depth intervals in the Deep Chicot Aquifer. Data collected from Well 8015402, which monitors the heavy pumping interval approximately 300 feet below the ground surface, indicates that between 1957 and the early 1990s a significant drop in groundwater level occurred. Since the early 1990s, the groundwater level has been recovering and has nearly returned to the 1957 level. Well 8015301 monitors the deeper zone of the Deep Chicot Aquifer that corresponds to the production zone of the STP wells. This well shows generally stable water levels over the period of record.

It is not expected that changes in operational water needs would occur during the license renewal period. Therefore, based on the following findings, STPNOC concludes that impacts to the Deep Chicot Aquifer from onsite groundwater use over the license renewal period would be SMALL and would not warrant mitigation:

- The actual drawdown at 2,500 feet away from any STP well would be less than 18 to 20 feet since (1) the STP wells are pumped at a rate less than their design yield of 500 gpm used as input to the model, (2) the model assumes that the STP wells are screened across the full thickness of the aquifer, and (3) the non-leaky confined aquifer scenario used for the model does not account for any recharge.

- Hydrographs and potentiometric surface maps prepared using groundwater level data collected between 1996 and 2006 from the STP site indicate that the potentiometric surface flows towards the site's production wells and that drawdown in the Deep Chicot Aquifer is limited to onsite areas.

4.6 GROUNDWATER USE CONFLICTS (PLANTS USING COOLING TOWERS OR COOLING PONDS AND WITHDRAWING MAKEUP WATER FROM A SMALL RIVER)

NRC

> "If the applicant's plant utilizes cooling towers or cooling ponds and withdraws make-up water from a river whose annual flow rate is less than $3.15x10^{12}$ ft^3/year…[t]he applicant shall also provide an assessment of the impacts of the withdrawal of water from the river on alluvial aquifers during low flow." 10 CFR 51.53(3)(ii)(A)

> "…Water use conflicts may result from surface water withdrawals from small water bodies during low flow conditions which may affect aquifer recharge, especially if other groundwater or upstream surface water users come on line before the time of license renewal…" 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 34

NRC made this groundwater use conflicts a Category 2 issue because consumptive use of water withdrawn from small rivers could adversely impact aquatic life, downstream users, and groundwater-aquifer recharge. This is a particular concern during low-flow conditions and could create an adverse cumulative impact if there were additional large consumptive users withdrawing water from the same river. Cooling towers and cooling ponds lose water through evaporation, which is necessary to cool the heated water before it is discharged to the environment.

As discussed in Section 3.1, STP Units 1 & 2 use two influent cooling water sources: the Colorado River and groundwater. From 1948 to 2007, the mean average flow of the lower Colorado River at Bay City (USGS Gauging Station 08162500) was 2,628 cubic feet per second (cfs) (USGS 2008) or 8.29×10^{10} cubic feet per year. Therefore, the lower Colorado River meets the NRC definition of a small river. STP Units 1 & 2 withdraw their cooling water from the Main Cooling Reservoir (MCR) that receives its makeup water from the Reservoir Makeup Pumping Facility located on the lower Colorado River east of the site. The lower Colorado River provides recharge to, and during drought periods, receives discharge from, the alluvial aquifer. The alluvial aquifer occurs in a relatively narrow band that parallels the river, and because the alluvial materials are deposited in a channel incised into the Beaumont Formation, it is likely that the alluvium is in hydraulic contact with the Shallow Chicot Aquifer.

As discussed in Section 2.3, the Shallow Chicot Aquifer in the site area is primarily used for livestock watering and other low-yield requirements. The Deep Chicot Aquifer, which is separated from the overlying Shallow Chicot Aquifer by a 250- to 300-feet-thick clay confining unit, is used as the primary source of water for the region due to higher aquifer yield.

The Coastal Plains Groundwater Conversation District (CPGCD) well database identified 176 wells within six miles of the STP site. Seventy-four of those wells are screened in the Deep Aquifer, while 29 are screened in the Shallow Aquifer. Seventy-six well records did not provide well depth. The 29 wells screened in the Shallow Aquifer consist primarily of livestock and agricultural wells. There are no public supply wells located within six miles of the site that use the Shallow Chicot Aquifer (CPGCD 2009).

As discussed in Section 4.1, STPNOC is permitted to remove water from the lower Colorado River up to a maximum rate of 1,200 cfs (540,000 gpm). However, STP is limited to diverting 55 percent of the flows of the lower Colorado River in excess of a 300 cfs base flow at the authorized diversion point on the river (TWC 1989). STP diverts water from the river only after confirming that the flow at USGS Bay City Gauging Station is capable of supporting the withdrawal of surface water in accordance with the current STPNOC Certificate of Adjudication.

As summarized in Table 4.1-1, between 2003 and 2007, the STP site diverted water from the lower Colorado River at an average annual rate of 35,364 acre-feet/year (48.8 cfs; 21,903 gpm), which is only 34.7 percent of the STP's permitted water use. Between 2003 and 2007, STP's water use ranged from zero percent (2003) to a maximum of 61.1 percent (2004) of the plant's permitted water use.

Based on the following findings, withdrawals of surface water for the operation of Units 1 & 2 during low-flow periods would have a SMALL impact on recharge to the alluvial aquifer and would not warrant mitigation:

- Although the alluvial aquifer is in contact with the Shallow Chicot Aquifer, the shallow aquifer is used for livestock watering and other low-yield requirements.
- STP is limited to diverting 55 percent of the flows of the lower Colorado River in excess of a 300 cfs base flow at the authorized diversion point on the river.
- Between 2003 and 2007, STP diverted water only 34.7 percent of their permitted water use.
- Between 2003 and 2007, STP's water use ranged from zero percent (2003) to a maximum of 61.1 percent (2004) of the plant's permitted water use.
- The MCR was designed for a 100-year drought event that lasts 10 years.

4.7 GROUNDWATER USE CONFLICTS (PLANTS USING RANNEY WELLS)

NRC

> "If the applicant's plant uses Ranney wells…an assessment of the impact of the proposed action on groundwater use must be provided." 10 CFR 51.53(c)(3)(ii)(C)

> "…Ranney wells can result in potential ground-water depression beyond the site boundary. Impacts of large ground-water withdrawal for cooling tower makeup at nuclear power plants using Ranney wells must be evaluated at the time of application for license renewal…." 10 CFR 51, Subpart A, Table B-1, Issue 35

NRC made this groundwater use conflict a Category 2 issue because large quantities of groundwater withdrawn from Ranney wells could degrade groundwater quality at river sites by induced infiltration of poor-quality river water into an aquifer.

This issue does not apply to STP Units 1 & 2 because STP Units 1 & 2 does not use Ranney wells. As Section 3.1.2 describes, there are two influent water sources to STP: the Colorado River and groundwater. Groundwater is supplied via five groundwater production wells.

4.8 DEGRADATION OF GROUNDWATER QUALITY

NRC

"If the applicant's plant is located at an inland site and utilizes cooling ponds, an assessment of the impact of the proposed action on groundwater quality must be provided." 10 CFR 51.53(c)(3)(ii)(D)

"…Sites with closed-cycle cooling ponds may degrade ground-water quality. For plants located inland, the quality of the ground water in the vicinity of the ponds must be shown to be adequate to allow continuation of current uses…." 10 CFR 51, Subpart A, Appendix B, Table B 1, Issue 39

NRC made degradation of groundwater quality a Category 2 issue because evaporation from closed-cycle cooling ponds concentrates dissolved solids in the water and settles suspended solids. In turn, seepage into the water table aquifer could degrade groundwater quality.

The issue of groundwater degradation applies to STP Units 1 & 2 because the plant uses a cooling pond (the MCR). As Section 3.1.2 describes, the Circulating Water Systems and the Auxiliary Cooling Water Systems draw water from and discharge to the 7,000-acre MCR. The Essential Cooling Pond Water Systems draw water from the Essential Cooling Pond which can be blown down to the MCR.

The MCR is completely enclosed by approximately 12.4 miles of embankment consisting of clay fill that is constructed above natural ground. The MCR contains approximately 202,600 acre-feet of water when at the normal maximum operating level of elevation 49 feet MSL; however, there is currently a procedural limit of 47 feet for two-unit operation. Makeup water for the MCR is diverted from the Colorado River using the Reservoir Makeup Pumping Facility (RMPF) and two buried 108-inch diameter makeup water pipelines.

As discussed in Section 3.1.2, there is currently no routine discharge from the MCR to the Colorado River. STP has not discharged water from the MCR to Colorado River, except during one brief period in 1997. MCR water quality is currently maintained by selective pumping during high river flow conditions (>1,200 cfs) and control of the discharges into the MCR. Discharge from the MCR to the Colorado River is allowed per the site's Texas Pollutant Discharge Elimination System (TPDES) permit, which is the Texas equivalent to a NPDES permit.

In 2005, several nuclear plants discovered tritium in groundwater on their sites at levels exceeding the U.S. Environmental Protection Agency's (USEPA) drinking water limits, mainly near underground process or effluent pipes. To determine if this were the case at the STP site, monitoring wells screened in the Shallow Chicot Aquifer near underground process and effluent pipes were tested for tritium. Although some results were positive, all results were below the EPA drinking water limits. Tritium concentrations in the wells have remained stable since monitoring began in 2005.

Tritium is produced in the reactor coolant system and is released via liquid discharges to the MCR. Consistent with normal operations of STP Units 1 & 2, approximately 1,400 curies of tritium were released to the MCR in 2007 (STPNOC 2008a). Radioactive liquid effluent discharges are by batch and are sampled and analyzed prior to discharge per NRC regulations.). All radioactive liquid effluents are diluted into the 7,000-acre MCR.

The MCR contains tritium with a maximum concentration of 17,410, picocuries per liter (pCi/L) (reported in 1996), which is below the USEPA drinking water standard of 20,000 pCi/L. Tritium concentrations in the MCR decreased to 8,200 pCi/L by the last quarter of 2007, but increased to 13,200 pC/L by the end of 2008 due to limited diversion of makeup water from the river during a flow period in 2008.

The MCR is unlined, allowing seepage of water from the MCR through the reservoir floor. During the design stage, total seepage from the MCR, based on a maximum operating water level of 49 feet above mean sea level, was estimated to be 3,530 gpm, or approximately 5,700 acre-feet per year. Seepage discharge from the MCR has two flow paths: 1) part of the seepage is collected by the relief well system, which is installed in the Upper Shallow Aquifer, and then is discharged into surface water; and 2) part of the seepage bypasses the relief wells and continues in the Upper Shallow Aquifer southeast towards the Colorado River. At a travel time of 40 feet per year, seepage from the MCR would not discharge to the river for approximately 100 years. The half-life of tritium is 12.3 years, indicating that during the 100 year travel time, tritium concentrations would decay over 8 half lives resulting in a concentration of less than 1 percent of the original concentration seeping from the MCR.

As discussed in Section 2.3, STP has been monitoring tritium migration from the MCR into the Shallow Chicot Aquifer downgradient to the west, south and southeast of the MCR near the site boundary. In 2006, extensive monitoring around the MCR indicated that tritium had migrated to two wells (MW-258 and MW-259) about 700 feet west of the MCR and near the western property boundary. In 2007 and 2008, STPNOC developed a Conceptual Site Model (CSM) to characterize radionuclides in groundwater at the site and to design a groundwater monitoring network in accordance with the Nuclear Energy Institute (NEI) Industry Ground Water Protection Initiative (NEI 07-07).

Groundwater data evaluated as part of CSM indicates that most of the wells around the MCR have reported low concentrations of tritium. In 2008, the two wells MW-258 and MW-259 near the western site boundary had reported tritium concentrations of 260 pCi/L and 400 pCi/L, respectively. Two other monitoring locations (MW-235 and MW-251) near the MCR also had reported elevated concentrations of tritium. MW-235 is located 600 feet south of the MCR and had reported tritium concentrations up to 740 pCi/L in 2007 with concentrations increasing to 1,000 pCi/L in 2008. However, trend analyses show that tritium concentrations in MW-251, which is located 600 feet southeast of the MCR, have been relatively stable over time, with the highest concentration reported at 5,000 pCi/L in 2006. Although these two locations contain elevated tritium, there are additional wells in the area that indicate that tritium does not extend beyond the site boundary to the south and southeast (Mactec 2009).

As discussed in Section 2.3, the Shallow Chicot Aquifer is separated from the Deep Chicot Aquifer by more than 250 feet of predominantly clay sediments which effectively seal the deep aquifer from reservoir seepage. The deep aquifer is the primary source of groundwater, including drinking water, in the area. The shallow aquifer water quality is marginal to very poor, and shallow wells are rarely used in the STP site area except for occasional livestock watering.

NRC's Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NRC 1996) classifies the STP site as an estuary site. The GEIS states that groundwater quality impacts of cooling ponds located in salt marshes would be of small significance in all cases because salt marshes already have poor water quality. Consequently, any potential salts leaching from the MCR would not be significantly impact the existing poor water quality of the shallow aquifer. As discussed in Section 2.3, wells near the STP site and screened in the

Shallow Chicot Aquifer typically have elevated chloride and total dissolved solid concentrations ranging from marginal to very poor groundwater quality.

Analytical data from samples collected in 2007 from the site groundwater production wells screened in the deep aquifer indicate only natural background concentrations of radioactivity (STPNOC 2008b).

In summary, because (1) the shallow aquifer water quality is marginal to very poor, and shallow wells are rarely used in the STP site area, (2) groundwater production wells screened in the deep aquifer indicate only natural background concentrations of radioactivity, and (3) tritium concentrations in groundwater remain within the USEPA drinking water standards, impact on groundwater quality as a result of continued operation of STP Units 1 & 2 would be SMALL and would not likely warrant mitigation.

4.9 IMPACTS OF REFURBISHMENT ON TERRESTRIAL RESOURCES

NRC

> The environmental report must contain an assessment of "…the impact of refurbishment and other license-renewal-related construction activities on important plant and animal habitats…." 10 CFR 51.53(c)(3)(ii)(E)
>
> "…Refurbishment impacts are insignificant if no loss of important plant and animal habitat occurs. However, it cannot be known whether important plant and animal communities may be affected until the specific proposal is presented with the license renewal application…." 10 CFR 51, Subpart A, Table B-1, Issue 40
>
> "…If no important resource would be affected, the impacts would be considered minor and of small significance. If important resources could be affected by refurbishment activities, the impacts would be potentially significant…." (NRC 1996)

NRC made impacts to terrestrial resources from refurbishment a Category 2 issue because the significance of ecological impacts cannot be determined without considering site- and project-specific details (NRC 1996). Aspects of the site and project to be ascertained are: (1) the identification of important ecological resources, (2) the nature of refurbishment activities, and (3) the extent of impacts to plant and animal habitats.

As discussed in Section 3.2, STPNOC has no plans for refurbishment or other license-renewal-related construction activities at STP. Therefore the issue of potential impacts of refurbishment on terrestrial resources is not applicable to STP.

4.10 THREATENED OR ENDANGERED SPECIES

NRC

"Additionally, the applicant shall assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act." 10 CFR 51.53(c)(3)(ii)(E)

"Generally, plant refurbishment and continued operation are not expected to adversely affect threatened or endangered species. However, consultation with appropriate agencies would be needed at the time of license renewal to determine whether threatened or endangered species are present and whether they would be adversely affected." 10 CFR 51, Subpart A, Appendix B, Table B 1, Issue 49

NRC made impacts to threatened and endangered species a Category 2 issue because the status of many species is being reviewed, and site-specific assessment is required to determine whether any identified species could be affected by refurbishment activities or continued plant operations through the renewal period. In addition, compliance with the Endangered Species Act requires consultation with the appropriate federal agency (NRC 1996).

Section 2.2 of this Environmental Report describes the aquatic communities at STP. Section 2.4 describes important terrestrial habitats at STP and along the associated transmission corridors. Section 2.5 discusses threatened or endangered species that occur or may occur in the vicinity of STP and along STP-associated transmission corridors. As discussed in Section 3.1.3, the transmission lines that connect STP to the regional transmission system are owned and maintained by four companies: AEP Texas Central Company, City Public Services of the City of San Antonio, City of Austin, and CenterPoint Energy.

With the exception of the species identified in Section 2.5, STP is not aware of any threatened or endangered terrestrial or aquatic species that occur at STP or along the associated transmission corridors. The three federally listed species mentioned in Section 2.5 as occurring on STP, alligator (*Alligator mississippiensis*), bald eagle (*Haliaeetus leucocephalus*), and brown pelican (*Pelecanus occidentalis*), have existed on-site during its years of operation, and brown pelicans likely would not occur at STP were it not for the presence of the MCR. Although additional threatened or endangered terrestrial species could occur along the transmission corridors described in Section 3.1.3, the STP transmission corridors are primarily located in agricultural lands and rangelands, and in general they do not require significant maintenance in terms of mowing, trimming, or clearing. Therefore, current operations of STP and vegetation management practices along STP transmission corridors are not believed to affect any listed terrestrial or aquatic species or its habitat. Furthermore, plant operations and transmission line maintenance practices are not expected to change significantly during the license-renewal term. Therefore, no adverse impacts to threatened or endangered terrestrial or aquatic species from future operations are anticipated.

STPNOC wrote to the Texas Parks and Wildlife Department and the U.S. Fish and Wildlife Service requesting information on any listed species or critical habitats that might occur at STP or along the associated transmission corridors, with particular emphasis on species that might be adversely affected by continued operation over the license-renewal period. Agency responses are provided in Attachment B.

4.11 AIR QUALITY DURING REFURBISHMENT

NRC

> "If the applicant's plant is located in or near a nonattainment or maintenance area, an assessment of vehicle exhaust emissions anticipated at the time of peak refurbishment workforce must be provided in accordance with the Clean Air Act as amended." 10 CFR 51.53(c)(3)(ii)(F)

> "Air quality impacts from plant refurbishment associated with license renewal are expected to be small. However, vehicle exhaust emissions could be cause for concern at locations in or near nonattainment or maintenance areas. The significance of the potential impact cannot be determined without considering the compliance status of each site and the numbers of workers expected to be employed during the outage…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 50

NRC made impacts to air quality during refurbishment a Category 2 issue because vehicle exhaust emissions could be cause for some concern, and a general conclusion about the significance of the potential impact could not be drawn without considering the compliance status at each site and the number of workers expected to be employed during an outage (NRC 1996). Information needed would include: (1) the attainment status of the plant-site area, and (2) the number of additional vehicles as a result of refurbishment activities.

As Section 3.2 describes, STPNOC has no plans for refurbishment activities at STP Units 1 & 2. Therefore, this issue does not apply.

4.12 MICROBIOLOGICAL ORGANISMS

NRC

> "If the applicant's plant uses a cooling pond, lake, or canal or discharges into a river having an annual average flow rate of less than 3.15×10^{12} ft^3/year (9×10^{10} m^3/year), an assessment of the impact of the proposed action on public health from thermophilic organisms in the affected water must be provided." 10 CFR 51.53(c)(3)(ii)(G)
>
> "…These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals that discharge to small rivers. Without site-specific data, it is not possible to predict the effects generically…." 10 CFR 51, Subpart A, Table B-1, Issue 57

Due to the lack of sufficient data for facilities using cooling ponds, lakes, or canals or discharging to small rivers, NRC designated impacts on public health from thermophilic organisms a Category 2 issue. Information to be determined is: (1) whether the plant uses a cooling pond, lake, or canal or discharges to a small river and (2) whether discharge characteristics (particularly temperature) are favorable to the survival of thermophilic organisms.

This issue is applicable to STP Units 1 & 2 because, as discussed in Section 3.1, the plant uses a cooling pond, the Main Cooling Reservoir (MCR), that is authorized under the plant's Texas Pollution Discharge Elimination System (TPDES) permit (No. WQ0001908000) to discharge to the Colorado River. With the exception of a single discharge in 1997 as part of a system test, the plant has never discharged to the Colorado River during the operation of STP Units 1 & 2. Although the MCR is effectively a closed system, the capability for discharge will be retained should it be necessary to discharge MCR water in the future.

Access to the MCR is strictly controlled per administrative controls and security patrols. The MCR is located within the fenced site boundary, preventing access by members of the public.

Organisms of concern should the MCR discharge to the Colorado River include the enteric pathogens *Salmonella* and *Shigella*, the *Pseudomonas aeruginosa* bacterium, thermophilic *Actinomycete*s ("fungi"), the many species of *Legionella* bacteria, and pathogenic strains of the free-living *Naegleria* amoeba. Healthy adults are generally resistant to infections of *Naegleria fowleri*, but once infected, death is generally the end result.

Thermophilic bacteria are known to exist at temperatures from 77°F to 176°F, with optimum growth at 122°F to 140°F (Joklik and Smith 1972). The optimum temperature is usually a reflection of the normal environment of the organism. Accordingly, these bacteria are able to survive in the human digestive tract, which has a temperature around 99°F (Joklik and Smith 1972). Many of the pathogenic microorganisms (e.g., *Pseudomonas*, *Salmonella*, and *Shigella*) are ubiquitous in nature, occurring in the digestive tracts of wild mammals and birds (and thus in natural waters), but are usually only a problem when the host is immunologically compromised.

The TPDES permit for STP 1 & 2 contains limits on daily average (95°F) and daily maximum (97°F) discharge temperatures of MCR water to the Colorado River. Given that the maximum temperature of the MCR discharge would be 97°F, which is well below the temperature at which thermophilic microorganisms grow and thrive (122–140°F), the potential for residents of streamside houses or recreational users of the Colorado River to be exposed to thermophilic pathogens appears to be remote if STPNOC were to discharge to the Colorado River.

Since (1) there is no public access to the MCR, (2) any potential future MCR discharges to the Colorado River would comply with the effluent temperature limits between 95º and 97ºF, and (3) the potential discharges would occur during high river flow periods (winter and spring) when river temperatures are significantly lower than the discharge temperature and not conducive to survival and growth of *Naegleria*. STPNOC believes the risk to public health from thermophilic microorganisms associated with the potential discharge of MCR water to the Colorado River is SMALL and would not warrant mitigation.

STPNOC has written the Texas Department of State Health and Services (TDSHS) requesting information on any concerns TDSHS may have relative to these organisms in the MCR or the Colorado River downstream of STP Units 1 & 2. The TDSHS has not responded to STPNOC's request for information. Copies of STPNOC's correspondence with TDSHS are presented in Attachment E.

4.13 ELECTRIC SHOCK FROM TRANSMISSION LINE INDUCED CURRENTS

NRC

The environmental report must contain an assessment of the impact of the proposed action on the potential shock hazard from transmission lines". [i]f the applicant's transmission lines that were constructed for the specific purpose of connecting the plant to the transmission system do not meet the recommendations of the National Electric Safety Code for preventing electric shock from induced current…" 10 CFR 51.53(c)(3)(ii)(H)

"Electrical shock resulting from direct access to energized conductors or from induced charges in metallic structures have not been found to be a problem at most operating plants and generally are not expected to be a problem during the license renewal term. However, site-specific review is required to determine the significance of the electric shock potential at the site." 10 CFR 51, Subpart A, Appendix B, Table B 1, Issue 59

NRC made impacts of electric shock from transmission lines a Category 2 issue because, without a review of each plant's transmission line conformance with the National Electrical Safety Code (NESC) (IEEE 2006) criteria, NRC could not determine the significance of the electrical shock potential. In the case of STP, there have been no previous NRC or NEPA analyses of transmission-line-induced current hazards. Therefore, this section provides an analysis of the plant's transmission lines' conformance with the NESC standard. The analysis is based on computer modeling of induced current under the lines.

Objects located near transmission lines can become electrically charged due to their immersion in the lines' electric field. This charge results in a current that flows through the object to the ground. The current is called "induced" because there is no direct connection between the line and the object. The induced current can also flow to the ground through the body of a person who touches the object. An object that is insulated from the ground can actually store an electrical charge, becoming what is called "capacitively charged." A person standing on the ground and touching a vehicle or a fence receives an electrical shock due to 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 of which the magnitude depends on several factors, including the following:

- the strength of the electric field which, in turn, depends on the voltage of the transmission line as well as its height and geometry
- the size of the object on the ground
- the extent to which the object is grounded.

In 1977, a provision to the NESC was adopted (Part 2, Rules 232C1c and 232Dd3c) that describes how to establish minimum vertical clearances to the ground for electric lines having voltages exceeding 98-kilovolt alternating current to ground. The clearance must limit the induced current (or steady-state current) due to electrostatic effects to 5 milliamperes if the largest anticipated truck, vehicle, or equipment were short-circuited to ground. By way of comparison, the setting of ground fault circuit interrupters used in residential wiring (special breakers for outside circuits or those with outlets around water pipes) is 4 to 6 milliamperes.

As described in Section 3.1.3, there are nine 345-kV lines that were specifically constructed to distribute power from STP to the electric grid. STPNOC's analysis of these transmission lines began by identifying the limiting case for each line. The limiting case is the configuration along each line where the potential for current-induced shock would be greatest. Once the limiting case was identified, STPNOC calculated the electric field strength for each transmission line, then calculated the induced current.

STPNOC calculated electric field strength and induced current using a computer code called ACDCLINE, produced by the Electric Power Research Institute. The results of this computer program have been field-verified through actual electrostatic field measurements by several utilities. The input parameters included the design features of the limiting-case scenario and the maximum vehicle size under the lines (a tractor-trailer).

The results of the analysis are presented in Table 4.13-1. Details of the analysis, including the input parameters, can be found in TtNUS (2010). Five locations (two on Hill Country, two on Skyline, and one on Hillje) exceed the 5 milliampere standard. As can be seen in the table, other lines have locations that approach 5 milliamperes. The Skyline exceedances are in parking lots on private property behind industrial facilities and on low traffic roads. The Hill Country exceedances are on very small, remote rural roads. The single Hillje exceedance is on the rural road in front of the plant. The locations that approach 5 milliamperes are also on small, rural roads unlikely to have large trucks parked in these locations.

The various transmission service providers (Section 3.1.3) for the STP transmission lines have surveillance and maintenance procedures that provide assurance that design ground clearances will not change. These procedures include routine aerial inspections that include checks for encroachments, broken conductors, broken or leaning structures, and signs of trees burning, any of which would be evidence of clearance problems. Ground inspections include examination for clearance at questionable locations, integrity of structures, and surveillance for dead or diseased trees that might fall on the transmission lines. Problems noted during any inspection are brought to the attention within the appropriate organization(s) for corrective action.

STPNOC's assessment under 10 CFR 51 concludes that electric shock is of MODERATE significance, because 1) there are few exceedances of the NESC standard, 2) the exceedances are a small percentage of the standard, 3) the locations of the exceedances are very remote or on private property, 4) the transmission service providers have not received any complaints about induced-current shock. Accordingly, no mitigation measures are required.

4.14 HOUSING IMPACTS

NRC

> The environmental report must contain "...[a]n assessment of the impact of the proposed action on housing availability…" 10 CFR 51.53(c)(3)(ii)(I)
>
> "…Housing impacts are expected to be of small significance at plants located in a medium or high population area and not in an area where growth control measures that limit housing development are in effect. Moderate or large housing impacts of the workforce associated with refurbishment may be associated with plants located in sparsely populated areas or areas with growth control measures that limit housing development…." 10 CFR 51, Subpart A, Table B-1, Issue 63
>
> "...[S]mall impacts result when no discernible change in housing availability occurs, changes in rental rates and housing values are similar to those occurring statewide, and no housing construction or conversion occurs…." (NRC 1996)

NRC made housing impacts a Category 2 issue because impact magnitude depends on local conditions that NRC could not predict for all plants at the time of GEIS publication (NRC 1996). Local conditions that need to be ascertained are: (1) population categorization as small, medium, or high and (2) applicability of growth control measures.

Refurbishment activities and continued operations could result in housing impacts due to increased staffing. As described in Section 3.2, STPNOC does not plan to perform refurbishment at the STP and thus, no additional workers would be necessary. Therefore, STPNOC concludes that there would be no refurbishment-related impacts to area housing and that no analysis is required.

Likewise, STPNOC estimates that no additional workers would be needed to support STP operations during the license renewal term (Section 3.4). Therefore, STPNOC concludes that there would be no license renewal-related impacts to area housing and that no analysis is required. The appropriate characterization of STP license renewal housing impacts is SMALL and no mitigation would be required.

4.15 PUBLIC UTILITIES: PUBLIC WATER SUPPLY AVAILABILITY

NRC

> The environmental report must contain "…an assessment of the impact of population increases attributable to the proposed project on the public water supply." 10 CFR 51.53(c)(3)(ii)(I)
>
> "An increased problem with water shortages at some sites may lead to impacts of moderate significance on public water supply availability." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 65
>
> "Impacts on public utility services are considered small if little or no change occurs in the ability to respond to the level of demand and thus there is no need to add capital facilities. Impacts are considered moderate if overtaxing of facilities during peak demand periods occurs. Impacts are considered large if existing service levels (such as quality of water and sewage treatment) are substantially degraded and additional capacity is needed to meet ongoing demands for services." (NRC 1996)

NRC made public utility impacts a Category 2 issue because an increased problem with water availability, resulting from pre-existing water shortages, could occur in conjunction with plant demand and plant-related population growth (NRC 1996). Local information needed would include: (1) a description of water shortages experienced in the area, and (2) an assessment of the public water supply system's available capacity.

NRC's analysis of impacts to the public water supply system considered both plant demand and plant-related population growth demands on local water resources. STP obtains most non-cooling water and all potable water from four groundwater wells on site (Section 2.3). In 2007, STP withdrew less than half of its permitted limit.

Section 2.12.1 describes the public water supply systems in the area, their production capacities, and current demands. Currently, there is excess capacity in all of the major public water suppliers' systems. However, TWDB does predict future water shortages and, in its "Water for Texas, 2007" planning document, presents water management strategies and mitigations for addressing such shortages.

As discussed in Section 3.4, STPNOC has no plans to increase STP staffing due to refurbishment or plant aging management activities. Also, STPNOC has identified no operational changes during the STP license renewal term that would increase plant water use. Therefore, because STPNOC has no plans to increase plant water use or employment for license renewal purposes, STPNOC concludes that impacts on public water supply would be SMALL and not require mitigation.

4.16 EDUCATION IMPACTS FROM REFURBISHMENT

NRC

> The environmental report must contain "…[a]n assessment of the impact of the proposed action on…public schools (impacts from refurbishment activities only) within the vicinity of the plant…." 10 CFR 51.53(c)(3)(ii)(I)
>
> "…Most sites would experience impacts of small significance but larger impacts are possible depending on site- and project-specific factors…." 10 CFR 51, Subpart A, Table B-1, Issue 66
>
> "…[S]mall impacts are associated with project-related enrollment increases of 3 percent or less. Impacts are considered small if there is no change in the school systems' abilities to provide educational services and if no additional teaching staff or classroom space is needed. Moderate impacts are generally associated with 4 to 8 percent increases in enrollment. Impacts are considered moderate if a school system must increase its teaching staff or classroom space even slightly to preserve its pre-project level of service….Large impacts are associated with project-related enrollment increases above 8 percent…." (NRC 1996)

NRC made refurbishment-related impacts to education a Category 2 issue because site- and project-specific factors determine the significance of impacts (NRC 1996). Local factors to be ascertained include: (1) project-related enrollment increases and (2) status of the student/teacher ratio.

The issue of education impacts from refurbishment is not applicable to STP because, as discussed in Section 3.2, STPNOC has no plans for refurbishment or other license-renewal-related construction activities at STP.

4.17 OFFSITE LAND USE

4.17.1 Offsite Land Use - Refurbishment

NRC

The environmental report must contain "… [a]n assessment of the impact of the proposed action on...land-use" 10 CFR 51.53(c)(3)(ii)(I)

"…Impacts may be of moderate significance at plants in low population areas…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 68

"… [I]f plant-related population growth is less than 5 percent of the study area's total population, off-site land-use changes would be small, especially if the study area has established patterns of residential and commercial development, a population density of at least 60 persons per square mile (2.6 km^2), and at least one urban area with a population of 100,000 or more within 80 km (50 miles)…." (NRC 1996, Section 3.7.5, pg. 3-21)

NRC made impacts to offsite land use as a result of refurbishment activities a Category 2 issue because land use changes could be considered beneficial by some community members and adverse by others. Local conditions to be ascertained include: (1) plant-related population growth, (2) patterns of residential and commercial development, and (3) proximity to an urban area with a population of at least 100,000.

This issue is not applicable to STP because, as Section 3.2 "Refurbishment Activities" discusses, STPNOC has no plans for refurbishment at STP Units 1 & 2.

4.17.2 Offsite Land Use – License Renewal Term

NRC

The environmental report must contain "An assessment of the impact of the proposed action on…land-use…" 10 CFR 51.53(c)(3)(ii)(I)

"…Significant changes in land use may be associated with population and tax revenue changes resulting from license renewal…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 69

"…I]f plant-related population growth is less than 5 percent of the study area's total population, off-site land-use changes would be small…." (NRC 1996).

"If the plant's tax payments are projected to be small relative to the community's total revenue, new tax-driven land-use changes during the plant's license renewal term would be small, especially where the community has preestablished patterns of development and has provided adequate public services to support and guide development…." (NRC 1996).

NRC made impacts to offsite land use during the license-renewal term a Category 2 issue, because land-use changes may be perceived as beneficial by some community members and adverse by others. Therefore, NRC could not assess the potential significance of site-specific offsite land-use impacts. Site-specific factors to consider in an assessment of new tax-driven land-use impacts include: (1) the size of plant-related population growth compared to the area's total population, (2) the size of the plant's tax payments relative to the community's total revenue, (3) the nature of the community's existing land-use pattern, and (4) the extent to which the community already has public services in place to support and guide development.

The GEIS presents an analysis of offsite land use for the renewal term that is characterized by two components: population-driven and tax-driven impacts (NRC 1996).

Population-Related Impacts

Based on the GEIS case-study analysis, NRC concluded that all new population-driven land-use changes during the license renewal term at all nuclear plants would be small. Population growth caused by license renewal would represent a "much smaller percentage" of the local area's total population than the percent change represented by operations-related growth (NRC 1996). SPTNOC agrees with the NRC conclusion that population-driven land-use impacts would be SMALL. Mitigation would not be warranted.

Tax-Revenue-Related Impacts

Determining tax-revenue-related land-use impacts is a two-step process. First, the significance of the plant's tax payments on taxing jurisdictions' tax revenues is evaluated. Then, the impact of the tax contribution on land use within the taxing jurisdiction's boundaries is assessed.

Tax Payment Significance

NRC has determined that the significance of tax payments as a source of local government revenue would be large if the payments are greater than 20 percent of revenue, moderate if the payments are between 10 and 20 percent of revenue, and small if the payments are less than 10 percent of revenue (NRC 1996).

Land Use Significance

NRC defined the magnitude of offsite land-use changes as follows (NRC 1996):

SMALL - very little new development and minimal changes to an area's land-use pattern.

MODERATE - considerable new development and some changes to land-use pattern.

LARGE - large-scale new development and major changes in land-use pattern.

NRC's case study analyses for projecting the potential new impacts of operations during the license renewal term examined the land-use changes associated with past operations. The conclusion from these analyses was that, if the plant's tax payments are projected to be small relative to the community's total revenue, new tax-driven land-use changes during the plant's license renewal term would be small. This would be especially true where the community has pre-established patterns of development and has provided adequate public services to support and guide development in the past (NRC 1996).

STP Units 1 & 2 Tax Impacts

Section 2.10 provides a comparison of total tax payments made by the owners of STP to Matagorda County, various special taxing districts, and the Palacios Independent School District (ISD) and total revenues. For the fiscal years 2001 through 2007, the tax payments made by the owners of STP to Matagorda County have represented more than 20 percent of Matagorda County's revenues and the tax payments to Palacios ISD were likewise more than 20 percent of total revenues for the ISD. Using NRC's criteria, tax payments made by the owners of STP Units 1 & 2 are of LARGE significance to Matagorda County and Palacios ISD.

STP Units 1 & 2 Land Use Impacts

Land-use patterns have remained largely unchanged since STP Units 1 & 2 commenced operations. Matagorda County is largely rural with nearly 85 percent being classified as agricultural, forest, or rangeland. The urban or built-up portion occupies 2.24 percent of Matagorda County (Table 2.11-1). Palacios ISD is located entirely within Matagorda County and includes one urbanized area, Palacios. The land-use patterns remaining largely unchanged since STP Units 1 & 2 began operation and the small percentage of land classified as urban or built-up indicate that the tax payments made by the owners of STP Units 1 & 2 have had minimal influence on the land-use patterns.

In conclusion, there will be no increase in license-renewal-related population. Drivers for future land-use changes considered in this assessment were population and tax payments. STPNOC's tax payments are a large percentage of Matagorda County's and Palacios ISD's total revenues, but the tax contribution to the County and ISD has not resulted in land-use changes. License renewal would not generate additional annual tax revenues for Matagorda County or Palacios ISD, but would lead to a continuation of tax payments by STPNOC. Therefore, the land-use impacts of STP Units 1 & 2's license renewal term are expected to be SMALL and mitigation would not be warranted.

4.18 TRANSPORTATION

NRC

The environmental report must "...assess the impact of highway traffic generated by the proposed project on the level of service of local highways during periods of license renewal refurbishment activities and during the term of the renewed license." 10 CFR 51.53(c)(3)(ii)(J)

"…Transportation impacts…are generally expected to be of small significance. However, the increase in traffic associated with additional workers and the local road and traffic control conditions may lead to impacts of moderate or large significance at some sites…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 70

Small impacts would be associated with U.S. Transportation Research Board Level of Service A, having the following condition: "…Free flow of the traffic stream; users are unaffected by the presence of others." and Level of Service B, having the following condition: "…Stable flow in which the freedom to select speed is unaffected but the freedom to maneuver is slightly diminished…." (NRC 1996)

NRC made impacts to transportation a Category 2 issue, because impact significance is determined primarily by road conditions existing at the time of license renewal, which NRC could not forecast for all facilities (NRC 1996). Local road conditions to be ascertained are: (1) level of service conditions and (2) incremental increases in traffic associated with refurbishment activities and license renewal staff.

As described in Section 3.2, no refurbishment is planned and no refurbishment impacts to local transportation are therefore anticipated. As described in Section 3.4, no additional license renewal employment increment is expected. Therefore, STPNOC expects license-renewal impacts to transportation to be SMALL and mitigation would not be necessary.

4.19 HISTORIC AND ARCHAEOLOGICAL RESOURCES

NRC

The environmental report must contain an assessment of ". . . whether any historic or archaeological properties will be affected by the proposed project." 10 CFR 51.53(c)(3)(ii)(K)

"Generally, plant refurbishment and continued operation are expected to have no more than small adverse impacts on historic and archaeological resources. However, the National Historic Preservation Act requires the Federal agency to consult with the State Historic Preservation Officer to determine whether there are properties present that require protection." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 71

"Sites are considered to have small impacts to historic and archaeological resources if (1) the State Historic Preservation Officer (SHPO) identifies no significant resources on or near the site; or (2) the SHPO identifies (or has previously identified) significant historic resources but determines they would not be affected by plant refurbishment, transmission lines, and license renewal term operations and there are no complaints from the affected public about altered historic character; and (3) if the conditions associated with moderate impacts do not occur." (NRC 1996)

NRC made impacts to historic and archaeological resources a Category 2 issue, because determinations of impacts to historic and archaeological resources are site-specific in nature and the National Historic Preservation Act mandates that impacts must be determined through consultation with the State Historic Preservation Officer (SHPO) (NRC 1996).

In the FES for operations (NRC 1986), NRC concluded that nothing of known historic or archaeological interest would be disturbed by the operation of STP Units 1 & 2. The Texas SHPO concurred that there would be no impacts to properties listed on or eligible for listing on the National Register of Historic Places as a result of operations and maintenance of Units 1 & 2 and the associated transmission lines (NRC 1986).

STPNOC is not aware of any historic or archaeological resources that have been affected by STP Units 1 & 2 operations, including operation and maintenance of transmission lines. However, STPNOC is aware that the site vicinity and the surrounding environs have the potential for containing cultural resources. STPNOC has an environmental review and evaluation procedure to ensure the protection and consideration of cultural resources discovered during operations and maintenance activities on the site and along its transmission corridors (STPNOC 2008).

As discussed in Section 3.2, STPNOC has no plans for refurbishment or license-related construction activities at STP Units 1 & 2 during the license renewal term. In addition, STPNOC has developed corporate procedures to address discovery of cultural resources during activities. STPNOC has consulted with the Texas SHPO regarding this conclusion. The Texas SHPO concurs that license renewal and associated operation and maintenance activities would have no effect on historic or archaeological resources. Copies of this correspondence are presented in Attachment D. Therefore, STPNOC concludes that impacts to historic or archaeological resources from license renewal and associated operation and maintenance activities over the license-renewal term would be SMALL, and no mitigation would be warranted.

4.20 SEVERE ACCIDENT MITIGATION ALTERNATIVES

NRC

The environmental report must contain a consideration of alternatives to mitigate severe accidents "…if the staff has not previously considered severe accident mitigation alternatives for the applicant's plant in an environmental impact statement or related supplement or in an environment assessment..." 10 CFR 51.53(c)(3)(ii)(L)

"…The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to ground water, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 76

Section 4.20 summarizes STPNOC's analysis of alternative ways to mitigate the impacts of severe accidents. Attachment F provides a detailed description of the severe accident mitigation alternatives (SAMA) analysis.

The term "accident" refers to any unintentional event (i.e., outside the normal or expected plant operation envelope) that results in the release or a potential for release of radioactive material to the environment. NRC categorizes accidents as "design basis" or "severe." Design basis accidents are those for which the risk is great enough that NRC requires plant design and construction to prevent unacceptable accident consequences. Severe accidents are those that NRC considers too unlikely to warrant design controls.

NRC concluded in its license renewal rulemaking that the unmitigated environmental impacts from severe accidents met its Category 1 criteria. However, NRC made consideration of mitigation alternatives a Category 2 issue because not all plants had completed ongoing regulatory programs related to mitigation (e.g., individual plant examinations and accident management). Site-specific information to be presented in the license renewal environmental report includes: (1) potential SAMAs; (2) benefits, costs, and net value of implementing potential SAMAs; and (3) sensitivity of analysis to changes in key underlying assumptions.

STPNOC maintains a probabilistic safety assessment model to use in evaluating the most significant risks of radiological release from STP fuel into the reactor and from the reactor into the containment structure. For the SAMA analysis, STPNOC used the model output as input to an NRC-approved model that calculates economic costs and dose to the public from hypothesized releases from the containment structure into the environment (Attachment F). Then, using NRC regulatory analysis techniques, STPNOC calculated the monetary value of the unmitigated STP severe accident risk. The result represents the monetary value of the base risk of dose to the public and worker, offsite and onsite economic impacts, and replacement power. This value became a cost/benefit-screening tool for potential SAMAs; a SAMA whose cost of implementation exceeded the base risk value could be rejected as being not cost-beneficial.

STPNOC used industry, NRC, and STP-specific information to create a list of SAMAs for consideration. STPNOC analyzed this list and screened out SAMAs that would not apply to the

STP design, that STPNOC had already implemented, or that would achieve results that STPNOC had already achieved by other means. STPNOC prepared cost estimates for the remaining SAMAs and used the base risk value to screen out SAMAs that would not be cost-beneficial. This screening identified 5 SAMAs for more detailed consideration.

STPNOC calculated the risk reduction that would be attributable to each remaining candidate SAMA (assuming SAMA implementation) and re-quantified the risk value. The difference between the base risk value and the SAMA-reduced risk value is the averted risk, or the value of implementing the SAMA. STPNOC used this information in conjunction with the cost estimates for implementing each SAMA to perform a detailed cost/benefit comparison.

STPNOC performed additional analyses to evaluate how the SAMA results would change if certain key parameters were changed, including re-assessing the cost-benefit calculations using the 95th percentile level of the failure probability distributions. The results of the uncertainty analysis are discussed in Attachment F, Section F.7.

Based on the results of this SAMA analysis, none of the SAMAs has a positive net value, even when the 95th percentile PRA results were considered. Therefore, no SAMAs are being considered for implementation as part of license renewal.

4.21 CUMULATIVE IMPACTS

This section discusses the cumulative impacts to the region's environment that could result from the continued operation of STP Units 1 & 2. A cumulative impact is defined in the Council of Environmental Quality 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 non-federal or person undertakes such other actions.".

For the purposes of this analysis, past actions are those related to the resources at the time of the power plant licensing and construction. Present actions are those related to the resources at the time of current operation of the power plant, and future actions are considered to be those that are reasonably foreseeable through the end of plant operation, including the 20-year license renewal license term for STP Units 1 & 2.

The impacts of operations of STP Units 1 & 2, as described in Chapter 4, are combined with other past, present, and reasonably foreseeable future actions in the vicinity of STP that would affect the same resources. The geographic area is dependent on the type of action considered and is described below for each impact area. The following sections consider the cumulative impacts of other projects and activities in the region as listed in Section 2.15, as well as the cumulative effects of the proposed STP Units 3 & 4 with current operations at existing STP Units 1 & 2.

4.21.1 Water Use and Quality

This section analyzes the cumulative impacts of existing STP Units 1 & 2 and proposed Units 3 & 4 on water use and water quality.

Surface Water Use

As described in Section 4.1, the impacts from the license renewal of STP Units 1 & 2 on surface water use would be SMALL, and would not warrant mitigation.

Section 2.15 identifies existing and reasonably foreseeable projects that potentially have impacts cumulative with STP Units 1 & 2. Given the nature of the projects and their distance from STP, only the proposed STP Units 3 & 4 and the proposed White Stallion Energy Center would likely have cumulative impacts.

Additional makeup water would be diverted from the lower Colorado River to support the operation of the proposed STP Units 3 & 4. Because the Main Cooling Reservoir (MCR) was designed for four units and has sufficient storage to allow flexibility in scheduling of diversions from the river, the combined operation of STP Units 1 & 2 and proposed STP Units 3 & 4 would continue to comply with the existing permit limits on diversion of water from the river. The current STPNOC water rights of 102,000 acre-feet per year for existing and proposed units is accounted for in Region K planning (TWDB 2006). Together, the four units would consume approximately 74,513 acre-feet per year under normal operations and 75,250 acre-feet per year under maximum demand conditions. If no water management strategies are implemented in Region K, the combined water use of the existing and proposed units at STP would be 6 percent of the current estimated water supply and 8 percent of the available 2060 Region K water supply.

STPNOC concludes that the cumulative impacts on downstream users due to withdrawal of water from the lower Colorado River to support four-unit operation would be SMALL and would not warrant mitigation.

White Stallion is proposing to build a 1320-megawatt electric generating plant approximately 4 mile north-northeast of STP (White Stallion 2009). White Stallion submitted a water-supply contract application to the Lower Colorado River Authority (LRCA) on October 13, 2008 for diversion of 22,000 acre feet of water from the lower Colorado River (LCRA 2009). The White Stallion water use of 22,000 acre-feet per year would be 2 percent of the current estimated water supply and 2.5 percent of the 2060 water supply in Region K without implementation of water management strategies, and 1 percent of the 2060 Region K water supply with implementation of all water management strategies. In its evaluation of cumulative impacts for Units 1, 2, 3, and 4, NRC (2010) concluded that cumulative impacts with the White Stallion Colorado River water use would be minimal.

Groundwater Use

As described in Section 4.5, the impacts from the license renewal of STP Units 1 & 2 on groundwater use would be SMALL, and would not warrant mitigation.

Groundwater usage would increase during the construction and operation of proposed STP Units 3 & 4. As discussed in Section 2.3, the withdrawal rate permitted by the Coastal Plains Groundwater Conservation District (CPGCD) is 1,822 annual average gpm. After deducting the average amount of groundwater consumed (765 gpm) by STP Units 1 & 2 from 2005 through 2009, approximately 1,057 gpm would be available for proposed STP Units 3 & 4. Of the total 1,950 gpm design capacity of the five wells, not more than approximately 1,650 gpm is considered to be available based on operating experience and the fact that use of the Nuclear Training Facility (NTF) well pump is limited to providing fire protection water for the NTF. Therefore, STPNOC intends to install at least one additional site groundwater well with a design capacity of 500 gpm. The additional design capacity will allow for sufficient groundwater withdrawal to meet water uses required for 1) operation of STP Units 1 & 2 and the construction, initial testing, and operation of proposed STP Units 3 & 4 and 2) potential temporary capacity reduction as a result of equipment failure/unavailability. Any additional wells would be properly permitted under applicable CPGCD and Texas Commission on Environmental Quality (TCEQ) requirements, and would not involve a request for an increase in the permit limit. Therefore, cumulative impacts to the groundwater during operation of the four units would be SMALL and not warrant mitigation.

Selkirk is the closest community to STP that has production wells installed in the Deep Chicot Aquifer. Selkirk is located immediately east of the STP site’s eastern boundary, and the closest STP groundwater production well is located about 1 mile from this community. STP and Selkirk use groundwater wells permitted and governed by CPGCD rules. As noted in NRC (2010), the purpose of the CPGCD is to provide for the conservation, preservation, protection, and recharge of groundwater. While potential impacts from groundwater use could be excessive drawdown, saltwater intrusion, or land subsidence, groundwater use under the rules of CPGCD is designed to minimize the potential for these impacts to arise and affect neighboring groundwater users. As discussed in Section 4.5, in an attempt to limit potential interference between wells, CPGCD rules specify that production wells must be spaced at a distance of at least 2,500 feet apart. The Selkirk wells are nearly double that distance from the STP production wells.

The results of the confined, nonleaky scenario model conducted at STP indicated that drawdown at a distance of 2,500 feet from any STP Unit 1 & 2 site well for the 500-gpm design yield during the initial 40-year operating period of STP Units 1 & 2 is 18 to 20 feet (STPNOC 2009).

In reality, the actual drawdown at 2,500 feet away from any STP well would be less than 18 to 20 feet since (1) the STP wells are pumped at a rate less than their design yield of 500 gpm used as input to the model, (2) the model assumes that the STP wells are screened across the full thickness of the aquifer, and (3) the non-leaky confined aquifer scenario used for the model does not account for any recharge. Hydrographs and potentiometric surface maps prepared using groundwater level data collected between 1996 and 2006 from STP monitoring peizometer 613, which is located in the influence of STP Well 6, indicate that the potentiometric surface flows towards the site's production wells and that drawdown in the Deep Chicot Aquifer is limited to onsite areas.

STPNOC concludes that cumulative groundwater use impacts would be SMALL and no mitigation is required.

Groundwater Quality

As described in Section 4.8, the impacts from the license renewal of STP Units 1 & 2 on groundwater quality would be SMALL, and would not warrant mitigation.

NRC concludes that the combined groundwater quality impacts from the construction and preconstruction of the proposed Units 3 & 4 would be SMALL (NRC 2010).

The addition of STP Units 3 & 4 would not result in any changes to the design or operating philosophy of the plant or MCR. As described in Section 4.8, the MCR is connected hydraulically to the underlying Upper Shallow Aquifer and water from the MCR seeps into the aquifer. Groundwater plumes with the MCR as their source would be local to the STP site and region immediately downgradient of the site to the Colorado River. Impacts from radioactive contaminants in the MCR and seepage from the MCR would be minimal as described in Section 4.8. Consequently, any potential groundwater quality impacts of plant operations or seepage from the MCR during the combined operations of STP Units 1 & 2 and proposed Units 3 & 4 would be SMALL and would not warrant mitigation.

4.21.2 Ecological Impacts

4.21.2.1 Terrestrial Resources

The STP site is located within the coastal prairie region of Texas, although no remnants of native prairie remain on the site. Thus, the construction of new STP Units 3 & 4 on the site's previously-disturbed lands (now primarily mowed grasslands and scrub/shrub habitat) and use of existing transmission corridors should not impact regional terrestrial resources. Similarly, proposed construction of the White Stallion Energy Center on a 1,200-acre tract approximately 5 miles northeast of STP should not destabilize regional terrestrial resources. Proposed new transmission corridors associated with White Stallion and the proposed Victoria County Nuclear Station could result in some habitat loss, but given that regional land uses are dominated by agriculture and/or rangeland, impacts associated with this new construction would be negligible. The cumulative effects of these on-going and proposed projects will result in a further fragmentation of land cover in this region, but given the region's long history of land cover shifts from native coastal prairies to agriculture and pasture/rangelands, these effects should not destabilize terrestrial ecological resources.

The cumulative effects of these projects should also not impact listed terrestrial fauna associated with STP. Both brown pelicans and bald eagles utilize the MCR, which will experience a slight increase in water level associated with operation of new Units 3 & 4. This slight increase should not affect their use of the MCR as a foraging and/or roosting site. Based on the discussion above, STPNOC concludes that cumulative impacts of Units 1, 2, 3, & 4 on terrestrial resources would be SMALL.

4.21.2.2 Aquatic Resources

As discussed in Sections 4.2, 4.3, and 4.4, field studies and impact assessments conducted over a period of more than 25 years suggest that the impact of continued operation (license renewal) on the aquatic communities of the MCR and lower Colorado River would be SMALL. Section 2.15 identifies on-going and reasonably foreseeable projects that could have impacts on aquatic communities cumulative with license renewal. Two of these projects, operation of proposed STP Units 3 & 4 and operation of the proposed White Stallion Energy Center, would require diversion of additional lower Colorado River water for condenser cooling and could result in cumulative impacts to aquatic communities.

The NRC (2010) evaluated the potential cumulative impacts of operating four units at the STP site and concluded that withdrawal of makeup water at the RMPF would have “insignificant and minor” impacts on important aquatic species. Similarly, the NRC (2010) determined that the combined (four-unit) discharge from the MCR to the lower Colorado River would not noticeably alter or destabilize aquatic communities. With regard to the potential incremental impact of the White Stallion project, the NRC (2010) observed that withdrawal of fresh water for plant cooling could affect salinity gradients in the lower river, thus, the distribution of aquatic organisms, a phenomenon observed in 1970s and 1980s studies during alternating wet and dry (drought) years. As freshwater flows increase and salinities decrease, riverine fishes from upstream dominate. During low-flow drought periods, salinities increase and more marine and estuarine species move into the lower river. STPNOC therefore concludes that the cumulative impact of operating STP Units 1 & 2, 3, & 4 and the proposed White Stallion Energy Center would be SMALL and limited to temporary shifts in the species composition of aquatic communities in the lower Colorado River.

4.21.3 Air Quality Impacts

The STP site is located in Matagorda County, Texas. Consequently, the region of geographic interest for this cumulative impact analysis is Matagorda County. Matagorda County is designated as attainment/unclassifiable for all criteria pollutants (40 CFR 81.344). The air quality attainment status for Matagorda County reflects the effects of past and present emissions from all pollutant sources in the region.

As discussed in Section 2.13, STP Units 1 & 2 have a number of stationary emission sources, such as standby emergency power supply diesel generators, an auxiliary boiler to furnish steam for start-up when the nuclear steam supply is unavailable, and several petroleum fuel storage tanks. Emissions from these sources are regulated by the TCEQ. As reported to TCEQ, actual total emissions from all sources at STP from 2004 to 2009 were 62.86 tons per year (tpy), 58.15 tpy, 56.24 tpy, 47.07 tpy, 60.68 tpy, and 59.97 tpy, respectively. With the exception of volatile organic compounds (VOC), the highest emissions were reported in 2004: 1.11 tpy of particulate matter (PM10), 12.41 tpy of carbon monoxide (CO), 46.62 tpy of oxides of nitrogen (NOx), and 0.78 tons per year of sulfur dioxide (SO2). As stated in Section 4.11, STPNOC has no plans for refurbishment activities at STP Units 1 & 2 during the license renewal period.

Section 2.15 identifies existing and reasonably foreseeable projects that potentially have impacts cumulative with STP Units 1 & 2. Given the nature of the projects and their distance from STP, the proposed STP Units 3 & 4 and the proposed White Stallion Energy Center would likely have the most substantial cumulative impacts. Other new projects identified in Section 2.15 would have immeasurably small cumulative impacts.

NRC (2010) concluded that the air quality impact from construction of the proposed STP Units 3 & 4 would be local and temporary; and the distance from building activities to the site boundary would be sufficient to generally avoid significant air quality impacts. Stationary emission sources associated with the operation of Units 3 & 4 would be similar to those associated with Units 1 & 2. During operation of Units 3 & 4, releases would be intermittent and made at low levels with little or no vertical velocity. Because of the intermittent nature of the releases and the small quantities of effluents being released, the cumulative impacts associated with the four STP units would be negligible.

The proposed White Stallion Energy Center is a 1320-MW petroleum coke/bituminous-fired plant that would be constructed about 5 miles northeast of the STP site. In the Draft Environmental Impact Statement for STP Units 3 & 4 (NRC 2010), NRC noted that impacts from the emissions from similar plants are characterized as being clearly noticeable but not destabilizing. Effluents from power plants like the White Stallion Energy Center are typically released through stacks with significant vertical velocity. Because this project would be subject to institutional controls, it is unlikely that air quality in the region would degrade to the extent that Matagorda County would be in non-attainment of the National Air Quality Standards.

Based on all of the above, STPNOC concludes that combined with the emissions from other past, present, and reasonably foreseeable future actions, cumulative air pollutant emissions on air quality from STP Units 1 & 2 related actions would be SMALL. When considered with respect to an alternative of building a fossil-fuel powered plant (see Chapter 7), continuing the operation of the STP Units 1 & 2 could represent a net cumulative beneficial environmental impact in terms of reducing hazardous and criteria air emissions.

4.21.4 Nonradiological Health Impacts

Section 2.15 identifies existing and reasonably foreseeable projects that potentially have impacts cumulative with STP Units 1 & 2. Given the nature of the projects and their distance from STP, only the proposed STP Units 3 & 4 and the proposed White Stallion Energy Center would likely have cumulative nonradiological health impacts. Potential cumulative impacts could include fugitive dust and vehicle emissions, occupational injuries, noise from construction and operation, exposure to etiological agents, exposure to electromagnetic fields, and the transportation of materials and personnel. However, license renewal of STP Units 1 & 2 would not involve construction or refurbishment, so fugitive dust and construction noise would not be cumulative. Vehicle emissions, occupational injuries, and noise from operations were not evaluated in Chapter 4 for license renewal. Although these impacts could be cumulative with construction and operation of STP Units 3 & 4, STP Units 1 & 2 would provide a small contribution to the much larger STP Units 3 & 4 construction impacts, which NRC (2010) concluded were small for both direct and cumulative impacts. This leaves exposure to etiological agents and exposure to electromagnetic fields for further evaluation.

STP Units 1, 2, 3, & 4 would all use the MCR which would then infrequently blowdown to the Colorado River. In its evaluation of cumulative impacts for Units 1, 2, 3, & 4, NRC (2010) concluded that cumulative impacts from etiological agents produced by heated effluent would be

SMALL because of the infrequent discharge of heated effluent, the unsuitability of the river for recreation during times of greatest thermal discharge, and the low incidence of water-borne diseases in the area. NRC's conclusion also considered the White Stallion Energy Center contribution.

NRC (2010) concluded that the nonradiological health impacts from chronic exposure to electromagnetic fields cannot be clearly linked to adverse health effects. This is the same conclusion NRC reached in its Generic EIS for license renewal (NRC 1996). However, acute effects of electric shock from induced current under transmission lines could, potentially, be cumulative. STP Units 3 & 4 would use the same transmission lines as are currently used by STP Units 1 & 2. Induced current would not increase with the increased transmission current in the transmission lines. Induced current increases with voltage, which would not change. Therefore, there is no cumulative induced current impact.

STPNOC concludes that cumulative nonradiological impacts would be SMALL and no mitigation is required.

4.21.5 Socioeconomic Impacts

Section 2.15 presents a list of other projects and activities in the region that, when combined with license renewal activities, could create impacts to the region's socioeconomic and historic and archaeological resources. However, as indicated below, license renewal activities would not contribute to cumulative impacts to these resources in the region.

As discussed in Sections 4.14 through 4.19, continued operation of STP Units 1 & 2 during the license renewal term would have no impact on socioeconomic conditions in the region beyond those already experienced. Since STPNOC has no plans to hire additional workers during the license renewal term, overall expenditures and employment levels at STP Units 1 & 2 would remain relatively constant with no additional demand for permanent housing and public services. In addition, since employment levels and tax payments would not change, there would be no population or tax revenue-related land use impacts. There would also be no disproportionately high and adverse health and environmental impacts on minority and low-income populations in the region. Based on this and other information presented in these sections, there would be no cumulative socioeconomic impacts from the continued operation of STP Units 1 and 2 during the license renewal term beyond what is currently being experienced.

NRC considered the cumulative impacts of construction, preconstruction, and operation of Units 3 & 4 plus other past, present, and reasonably foreseeable future activities over the life of the two units (NRC 2010). Housing and schools may experience noticeable adverse cumulative impacts early in the operations period of the two new units. In general, however, because the combined population increases related to Units 3 & 4 would be slight during the operations period, adverse socioeconomic cumulative impacts during operations would be SMALL (NRC 2010).

4.21.6 Historic and Archeological Resources

As discussed in Section 4.19, continued operation of STP Units 1 & 2 during the license renewal term would have a SMALL impact on historic and archaeological resources on or near the STP Units 1 & 2 site. STPNOC has no plans to alter the STP Units 1 & 2 site for license renewal. Any future land disturbing activities would be carried out under corporate procedures. Should plans change, further consultation would be initiated by STPNOC with the State Historic Preservation Officer.

In its Draft EIS for the COLA, NRC (2010) concluded that the impacts to historic and archeological resources from the construction and operation of Units 3 & 4, as well as from other projects in the area, would be small. STPNOC concurs with this assessment and concludes cumulative impacts would be SMALL and not require mitigation.

4.21.7 Fuel Cycle, Transportation, and Decommissioning

4.21.7.1 Uranium Fuel Cycle

The uranium fuel cycle is comprised of uranium mining and milling, the production of uranium hexafluoride, isotopic enrichment, fuel fabrication, transportation of radioactive materials, and management of low level wastes and spent nuclear fuel. In NRC regulation 10 CFR 51.51(a), Table S-3, NRC presents the impacts of the uranium fuel cycle for a single 1,000 MWe reference reactor operating at 80 percent capacity factor. Advances in the uranium fuel cycle since NRC developed Table S-3, which would reduce these impacts, are discussed in Section 5.7 of STPNOC's environmental report submitted with its COL application for Units 3 & 4 (STPNOC 2009). Uranium fuel cycle impacts are not accrued at any one location, but are spread across multiple locations.

NRC's analysis of the cumulative impact of the uranium fuel cycle for STP Units 1, 2, 3, & 4 is reported in the Draft EIS for the COL application (NRC 2010). NRC's analysis is based on scaling the Table S-3 analysis for the capacity factors and net MWe for the four units. This results in a multiplication factor no greater than 5. NRC concludes that the cumulative impacts would be small. This is consistent with NRC's generic analysis in the Generic EIS for license renewal (NRC 1996).

STPNOC concurs with NRC's analysis and concludes that cumulative fuel cycle impacts of the four STP units would be SMALL and that mitigation would not be required.

4.21.7.2 Transportation

Nonradiological Transportation

Section 4.18 states that there would be no additional workers during the license renewal term, and thus, the traffic impacts, including traffic congestion and accidents, would be small. However, the current traffic from STP Units 1 & 2 operations would continue into the license renewal term. Construction of Units 3 & 4 would present considerably larger traffic congestion and accidents than operation of those units. Section 4.4.2.2.4 of the STP COL environmental report for Units 3 & 4 examined the combined impact of Units 1 & 2 operations traffic with STP Units 3 and 4 construction traffic and determined that the impact would be moderate to large, and that mitigation measures would be required. NRC's evaluation of nonradiological transportation impacts in Section 4.8.3 of the Draft EIS for the COL application (NRC 2010) concluded that with the mitigation measures proposed for a traffic management plan, that the impacts would be minimal. STPNOC concurs that cumulative nonradiological transportation impacts would be SMALL, considering proposed mitigation measures.

Radiological Transportation

NRC has standardized the analysis of radiological transportation impacts for nuclear reactors in Table S-4 of 10 CFR 51.52. Table S-4 provides the impacts for normal conditions of transport and accidents for a reference 1100-MWe reactor operating at 80 percent capacity factor. Consequently, NRC's conclusion in the Generic EIS for license renewal (NRC 1996; NRC 1999) states that radiological transportation can be considered a small impact for all plants.

In its Draft EIS for the COL application (NRC 2010), NRC determined that the combined transportation of fuel and waste to and from STP Units 1, 2, 3, & 4 is consistent with Table S-4. Therefore, NRC concluded that impacts are small. STPNOC concurs with this conclusion that radiological transportation impacts are SMALL and no further mitigation would be required.

4.21.7.3 Decommissioning

In the Generic EIS for license renewal (NRC 1996), NRC examined six issues related to decommissioning and concluded that all of them are Category 1 issues. Accordingly, decommissioning was not examined in Chapter 4 of this environmental report. However, environmental impacts from the activities associated with the decommissioning of any reactor are evaluated in the Generic EIS on Decommissioning (NRC 2002). In the Draft EIS for the COL application for Units 3 & 4, NRC concluded that, as long as the regulatory requirements on decommissioning activities to limit the impacts of decommissioning are met, the decommissioning activities would result in a small impacts for all four STP units. STPNOC concurs with NRC's assessment that cumulative impacts from decommissioning of STP Units 1, 2, 3, & 4 would have a SMALL impact. Mitigation measures would be considered in the development of the units' decommissioning plans.

4.21.8 Land Use Impacts

As described in Section 4.17, the impacts from the license renewal of STP Units 1 & 2 on land use would be SMALL, and would not warrant mitigation.

NRC's analysis of the cumulative land-use impacts associated with proposed Units 3 & 4 and other projects in the 15-mile geographic area of interest, including the proposed White Stallion Energy Center, would be MODERATE. NRC concludes that the incremental impacts of Units 1, 2, 3, & 4 would be SMALL, and would not contribute significantly to the MODERATE impact characterization.

4.21.9 Postulated Accidents

NRC classifies potential accidents at nuclear power plants as either design basis accidents or severe accidents. Design basis accidents are those for which the plant has been specifically designed to withstand, to within certain offsite dose limits. Severe accidents are those involving significant core damage but are considered too improbable to warrant specific plant design features. Where design basis accidents are deterministic (consequences reported in dose), severe accidents are probabilistic (consequences reported as dose times probability or dose-risk).

The dose consequences of severe accidents (without the probability component) are typically larger than the dose consequences of design basis accidents and are, therefore, bounding.

Furthermore, doses from more than one unlikely event cannot be added to determine cumulative impact, since the probability of more than one accident occurring at the same site are vanishingly small. Therefore, the consideration of cumulative impacts for accidents focuses on severe accidents only. Dose-risk from multiple severe accidents is additive.

Attachment F reports the dose-risk for Unit 1 or Unit 2 as 2.48 person-rem per reactor-year. Multiplying by two reactors gives 4.96 person-rem per year. In its application for a COL for Units 3 and 4 (STPNOC 2009), STPNOC reported a severe accident dose-risk of 4.3×10^{-3} person-rem per reactor year. Again, multiplying by 2, the total risk from Units 3 & 4 is approximately 8.6×10^{-3} person-rem per year. Therefore the total dose-risk for Units 1, 2, 3, & 4 is 4.97 person-rem per year.

STPNOC concludes that the cumulative dose-risk is essentially unchanged (0.2 percent difference) from the Units 1 & 2 dose-risk, and, thus, the cumulative impacts are SMALL. As described in Section 4.20, STPNOC has examined potential severe accident mitigation alternatives.

4.21.10 Radiological Health Impacts

Sources of radioactivity that could potentially be cumulative with STP Units 1 & 2 would be within a 50-mile radius of STP. These sources would include the proposed STP Units 3 & 4, the Old Steam Generator Storage Facility, the Onsite Staging Facility, and the proposed Long Term Storage Facility. Some hospitals and industrial facilities that use radioactive materials are also likely within the 50-mile radius.

The STP radiological environmental monitoring program has been measuring radiation and sampling for radioactivity within 50 miles of the plant since 1986. This program would include all sources of radioactivity including hospitals and industrial facilities. The STP radiological environmental monitoring program augments the plant effluent monitors and provides assurance that the plant continues to operate within the regulations and ALARA parameters established for responsible environmental management.

The principal cumulative impacts would be those from the combined operation of Units 1, 2, 3, & 4. All STP units would release small quantities of radioactivity to the environment through permitted liquid and gaseous releases, as well as emit direct radiation. STPNOC considered the combined operation of all four units in its application for a COL (STPNOC 2009) for Units 3 & 4. The significance evaluation of SMALL is carried forward to this environmental report.

4.21.10.1 Occupational Doses

As stated in Subsection 5.4.5 of the COL environmental report (STPNOC 2009), the annual occupational radiation dose from STP Units 3 & 4 is expected to be approximately 200 person-rem. Using 2005 data (an outage year) for Units 1 & 2, the collective radiation dose to workers was approximately 250 person-rem. There are no regulatory limits on worker collective dose, but this cumulative occupational dose from the four units is typical of the industry and would be considered SMALL. Additional mitigation beyond STPNOC's ALARA program is not warranted. Individual doses would be limited by the same procedures and ALARA program for all four units and would not be expected to change during license renewal.

4.21.10.2 Public Doses

Section 5.4.2 of the COL environmental report states that the calculated dose to a hypothetical maximally exposed member of the public from STP Units 1 & 2 was 0.011 millirem in 2005. The estimated dose to the maximally exposed individual from STP Units 3 & 4 is 5.70 millirem per year. Therefore, if the same hypothetical individual were the maximally exposed individual for all four STP units, the total annual dose would be approximately 5.71 millirem per year. The regulatory limit in 40 CFR Part 190 for exposure to an offsite member of the public is 25 millirem per year. Given that this combined dose to the maximally exposed individual from all four units is a small fraction of the regulatory limit, the cumulative impacts would be SMALL and would not warrant mitigation.

Section 5.4.2 of the COL environmental report further presents the annual collective total body dose to the population within 50 miles of STP Units 1 & 2 (0.02 person-rem) and STP Units 3 & 4 (0.6 person-rem). This collective dose is less than 0.001 percent of that received by the population from natural causes. Therefore, collective impacts to members of the public from operation of the four units would be SMALL and would not warrant additional mitigation.

4.22 TABLES

Table 4.1-1. STP Units 1 & 2 Colorado River Water Use (Acre-Feet)

Month	2003	2004	2005	2006	2007	2003 - 2007 Average Monthly River Water Diversion)
January	0	0	0	0	27,977	5,595
February	0	0	0	0	5,602	1,120
March	0	829	0	819	3,837	1,097
April	0	22,761	0	4,195	221	5,435
May	0	18,225	0	4,133	1,543	4,780
June	0	4,551	0	11,422	5,112	4,217
July	0	0	2,908	8,448	47	2,281
August	0	0	343	307	0	130
September	0	0	802	2,321	0	625
October	0	15,018	1,497	16,815	7,948	8,256
November	0	990	144	1,167	5,363	1,533
December	0	0	0	385	1,090	295
Total ac ft/yr	0	62,374	5,694	50,012	58,740	35,364
Total cfs	0	86.2	7.9	69.1	81.1	48.8

Sources: STPNOC 2004; STPNOC 2005a; STPNOC 2006b; STPNOC 2007; STPNOC 2008

Table 4.1-2. STP Units 1 & 2 Colorado River Maximum Monthly Water Usage (2003-2007) Versus Colorado River Flow Data

Month	2003 - 2007 Maximum Monthly STP River Water Withdrawal (cfs)	River Flow at USGS Station 08162500 (cfs) for the Indicated Month	Percent of Maximum Monthly River Flow Lost to STP Monthly Withdrawal
Jan-07	14,105	149,050	9.5%
Feb-07	2,828	24,327	11.6%
Mar-07	1,934	114,854	1.7%
Apr-04	11,490	59,163	19.4%
May-04	9,176	113,463	8.1%
Jun-06	5,760	28,805	20.0%
Jul-06	4,247	41,831	10.2%
Aug-05	173	16,963	1.0%
Sep-06	1,131	19,093	5.9%
Oct-06	8,463	51,034	16.6%
Nov-07	2,703	84,819	3.2%
Dec-07	549	35,074	1.6%

Sources: STNOC 2004; STPNOC 2005a; STPNOC 2006b; STPNOC 2007; STPNOC 2008; USGS 2004; USGS 2005; USGS 2006; USGS 2007; USGS 2008.

Table 4.13-1. Results of Induced Current Analysis

Transmission Line	Limiting Case Induced Current (milliamperes)
Velasco	4.98
Blessing	4.95
Hillje (Lon Hill Loop)	3.15
Hillje	5.04
Hillje (W.A. Parish loop)	3.44
Holman	4.60
Hill Country	6.79
Skyline	6.53
White Point loop	4.80

Source: TtNUS 2010

4.23 CHAPTER 4 REFERENCES

Section 4.0

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5.0 CHAPTER 5 - ASSESSMENT OF NEW AND SIGNIFICANT INFORMATION

NRC

"The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware." 10 CFR 51.53(c)(3)(iv)

5.1 STPNOC PROCESS FOR IDENTIFYING NEW AND SIGNIFICANT INFORMATION

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants and provides for license renewal, requiring a license renewal application that includes an environmental report (10 CFR 54.23). NRC regulations at 10 CFR 51 prescribe the environmental report content and identify the specific analyses the applicant must perform. In an effort to streamline the environmental review, NRC has resolved most of the environmental issues generically (Category 1) and only requires an applicant's analysis of the remaining issues (Category 2).

While NRC regulations do not require an applicant's environmental report to contain analyses of the impacts of Category 1 issues, the regulations [10 CFR 51.53(c)(3)(iv)] do require that an applicant identify any new and significant information of which the applicant is aware that would negate any of the generic findings that NRC has codified or evaluated in the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) (NRC 1996). The purpose of this requirement is to alert NRC staff to such information, so the staff can determine whether to seek the Commission's approval to waive or suspend application of the rule with respect to the affected generic analysis. NRC has explicitly indicated, however, that an applicant is not required to perform a site-specific validation of GEIS conclusions.

STP Nuclear Operating Company (STPNOC) expects that new and significant information would include:

- Information that identifies a significant environmental issue not covered in the GEIS and codified in the regulation, or
- Information that was not covered in the GEIS analyses of a particular environmental issue and that leads to an impact finding significantly different from that codified in the regulation.

NRC does not define the term "significant," although for the purpose of its review, STPNOC used guidance available in Council on Environmental Quality (CEQ) regulations. The National Environmental Policy Act authorizes CEQ to establish implementing regulations for federal agency use. NRC requires license renewal applicants to provide NRC with input, in the form of an environmental report, that NRC will use to meet National Environmental Policy Act requirements as they apply to license renewal (10 CFR 51.10). CEQ guidance provides that federal agencies should prepare environmental impact statements for actions that would significantly affect the environment (40 CFR 1502.3), focus on significant environmental issues (40 CFR 1502.1), and eliminate from detailed study issues that are not significant [40 CFR 1501.7(a)(3)]. The CEQ guidance includes a lengthy definition of "significantly" that requires consideration of the context of the action and the intensity or severity of the impact(s) (40 CFR 1508.27). STPNOC expects that moderate or large impacts, as defined by NRC, would be significant. Chapter 4 presents the NRC definitions of “moderate” and “large” impacts.

The new and significant assessment process that STPNOC used during preparation of this license renewal application includes:

- Interviews with STPNOC and STP Units 1 & 2 staff with various responsibilities including environmental, engineering, radiological waste, chemistry, industrial health and safety, communications, operations support, and information related to the conclusions in the GEIS as they relate to STP Units 1 & 2
- Review of STP Units 1 & 2 environmental management systems for how current programs manage potential impacts and/or provide mechanisms for STP Units 1 & 2 staff to become aware of new and significant information
- Correspondence with state and federal regulatory agencies to determine if the agencies had concerns
- Review of documents related to environmental issues at STP Units 1 & 2 and regional environs
- Credit for oversight provided by inspections of plant facilities and environmental monitoring operations by state and federal regulatory agencies
- Participation in review of other licensees’ Environmental Reports, audits, and industry initiatives
- Independent review of plant-related information through STP Units 1 & 2 contracts with industry experts on license renewal environmental impacts
- Examination of issues related to the COL application for Units 3 and 4.

STPNOC is not aware of any new and significant information regarding the plant’s environment or operations that would make any generic conclusion codified by the NRC for Category 1 issues not applicable to STP Units 1 & 2, that would alter regulatory or GEIS statements regarding Category 2 issues, or that would suggest any other measure of license renewal environmental impact.

As part of its investigation for new and significant information at STP Units 1 & 2, STPNOC evaluated information about tritium in the ground water beneath the site (Sections 2.3 and 4.8). Based on that evaluation, STPNOC has concluded that changes in groundwater quality would not preclude current or future uses of the groundwater.

5.2 CLEAN WATER ACT SECTION 316(b)

CWA Section 316(b) requires that structures that withdraw cooling water use the best technology available (BTA) for minimizing adverse environmental impact related to entrainment. NRC made impacts resulting from entrainment and impingement Category 2 issues for plants with once-through and cooling pond heat dissipation systems because it could not assign a single significance level (small, moderate, or large) to the issues. The impacts of entrainment and impingement are small at many facilities, but may be moderate or large at others (NRC 1996). Information needing to be ascertained includes (1) type of cooling system (whether once-through or cooling pond), and (2) status of Clean Water Act Section (CWA) 316(b) determination or equivalent state documentation. NRC has categorized STP Units 1 & 2 as having a closed-cycle cooling pond (NRC 1996).

The State of Texas issued the first Texas Pollutant Discharge Elimination System (TPDES) permit for STP Units 1 & 2 on November 2, 2000 and has issued one renewal since (Attachment B). The state has never required STPNOC to conduct a 316(b) study for STP Units 1 & 2. The STP system intake is in compliance with Section 316(b) because of its closed-cycle design. On June 2, 2009 STPNOC submitted with the TPDES permit renewal application a letter dated May 24, 2007, which is a description of how the cooling water intake structure (CWIS) is a closed-cycle recirculating system and as such meets Best Technology (BTA) for minimizing Adverse Environmental Impacts (AEI). The Main Cooling Reservoir (MCR) from which water is passed through cooling loops and then returned for heat dissipation is not a water of the United States or a water of the state. Based upon best professional judgement (BPJ) the TCEQ Water Quality Division has determined that the CWIS reflects BTA for AEI through use of a closed-cycle recirculating system.

Historically, National Pollutant Discharge Elimination System (NPDES) permitting authorities relied on best professional judgment to determine what constituted BTA. In 2004, the USEPA issued a regulation that would have replaced best professional judgment with regulatorily proscribed performance standards for what constitutes BTA. One alternative standard would have been to demonstrate that the facility's cooling water intake flow was commensurate with that of a closed-cycle recirculating system. In 2007, the USEPA suspended the regulation in response to a U.S. Court of Appeals ruling (72 Federal Register 37107; July 9, 2007) and advised NPDES permitting authorities to continue using best professional judgment to determine BTA.

Regardless of the outcome of the legal challenge to the EPA rule or EPA's responsive rulemaking, STPNOC expects the STP intake system to be in compliance with Section 316(b) because of its closed-cycle design. STPNOC does not consider potential revisions to the USEPA Phase II Rule to be new and significant information for STP Units 1 & 2.

5.3 CHAPTER 5 REFERENCES

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6.0 CHAPTER 6 – SUMMARY OF LICENSE RENEWAL IMPACTS AND MITIGATING ACTIONS

6.1 LICENSE RENEWAL IMPACTS

STPNOC has reviewed the environmental impacts of renewing the STP Units 1 & 2 operating licenses and has concluded that all impacts except for those associated with induced current would be SMALL and would not require additional mitigation. Although the impact of induced current shock is of MODERATE significance no mitigation measures are required.

This environmental report documents the basis for STPNOC's conclusion. Chapter 4 incorporates by reference the NRC findings for the 48 Category 1 issues that apply to STP Units 1 & 2, all of which have impacts that are SMALL (Attachment A, Table A-1). Chapter 4 also analyzes Category 2 issues. Table 6.1-1 identifies the impacts that STP Units 1 & 2 license renewal would have on resources associated with Category 2 issues.

6.2 MITIGATION

NRC

"The report must contain a consideration of alternatives for reducing adverse impacts…for all Category 2 license renewal issues…" 10 CFR 51.53(c)(3)(iii)

"…The environmental report shall include an analysis that considers and balances…alternatives available for reducing or avoiding adverse environmental effects.…" 10 CFR 51.45(c) as incorporated by 10 CFR 51.53(c)(2) and 10 CFR 51.53(c)(3)(iii)

All impacts of license renewal, except for impact related to induced current shock, are SMALL and would not require mitigation. Although the impact of induced current shock is of MODERATE significance no mitigation measures are required.

Current operations include monitoring activities that would continue during the term of the license renewal. STPNOC performs routine monitoring activities to ensure the safety of workers, the public, and the environment. These activities include:

- The Radiological Environmental Monitoring Program
- Water quality monitoring
- Emissions monitoring
- Groundwater level monitoring
- Environmental Protection Plan monitoring and reporting requirements

These monitoring programs and activities ensure that the plant's permitted emissions and discharges are within regulatory limits and any unusual or off-normal emissions or discharges would be quickly detected, thus, assuring mitigation of potential impacts.

6.3 UNAVOIDABLE ADVERSE IMPACTS

NRC

The environmental report shall discuss "Any adverse environmental effects which cannot be avoided should the proposal be implemented;" 10 CFR 51.45(b)(2) as adopted by 10 CFR 51.53(c)(2)

6.3.1 Existing Unavoidable Adverse Impacts

This environmental report adopts by reference NRC findings for applicable Category 1 issues, including discussions of any unavoidable adverse impacts (Attachment A, Table A-1). STPNOC examined 21 Category 2 issues and identified the following unavoidable adverse impacts of license renewal. However, the impacts are not a result of license renewal specifically, but are continuations of existing impacts.

- STP Units 1 & 2 uses an average of 35,364 acre-feet per year of water from the Colorado River and an average of 765 gallons per minute (gpm) of groundwater from the Deep Chicot Aquifer. This water will be unavailable for other uses.

- Because the land surrounding the plant is flat, some structures and the MCR embankments are visible from off site. This visual impact will continue during the license renewal term.

- Disposal of sanitary, chemical, and radioactive wastes have adverse impacts on land commitments. STP Units 1 & 2 waste disposal procedures are intended to reduce adverse impacts from these sources to acceptably low levels. A small impact will be present as long as the plant is in operation. Solid radioactive wastes are a product of plant operations, and long-term disposal of these materials must be considered.

- Operation of STP Units 1 & 2 results in a very small increase in radioactivity in the air. However, radiation dose increase to the local population due to plant operation is less than that due to natural fluctuation over natural background radiation levels. Operation of STP Units 1 & 2 also establishes a very low-probability risk of accidental radiation exposure to inhabitants of the area.

6.3.2 Greenhouse Gas Emissions

The NRC analysis in the GEIS (NRC 1996) presented qualitative discussions regarding the greenhouse gas (GHG) impacts of the nuclear fuel cycle and the operating impacts associated with new coal-fired and oil-fired power plants, but no quantitative assessment of GHG emissions was presented. The GEIS did not address GHG impacts of the nuclear fuel cycle relative to other potential alternatives, such as natural gas and renewable energy sources.

Since the development of the GEIS, several authoritative lifecycle analyses of GHG emissions from nuclear and other electricity-generating technologies have been performed. For the Indian Point Nuclear Generating Plant (NRC 2008), the NRC reviewed a number of these analyses to evaluate carbon dioxide and other GHG emissions associated with license renewal. The NRC found that the estimates and projections of the carbon footprint of the nuclear power lifecycle vary widely, and considerable debate exists regarding the relative impacts on GHG emissions of nuclear and other electricity-generating technologies. The NRC determined that, a consensus exists that nuclear power produces GHG emissions that are of the same order of magnitude as those for renewable energy sources and are less than GHG emissions from fossil-fuel-based electricity-generating technologies. Lifecycle GHG emissions from the complete nuclear fuel cycle currently range from 2.5 to 55 grams (g) of carbon equivalents per kilowatt hour (C_{eq}/kWh). The comparable lifecycle GHG emissions from the use of coal range from 264 to 1250 g C_{eq}/kWh, and GHG emissions from the use of natural gas range from 120 to 780 g C_{eq}/kWh. Based on current technology, estimated GHG lifecycle emissions from renewable energy sources are: solar-photovoltaic (17 to 125 g C_{eq}/kWh), hydroelectric (1 to 64.6 g C_{eq}/kWh), biomass (8.4 to 99 g C_{eq}/kWh), wind (2.5 to 30 g C_{eq}/kWh), and tidal (25 to 50 g C_{eq}/kWh). The NRC also determined that nuclear fuel production is the most significant contributor to possible future increases in GHG emissions from nuclear power, and because most renewable energy sources lack a fuel component, it is likely that GHG emissions from renewable energy sources would be lower than those associated with nuclear power at some point during the period of extended operation.

STPNOC has reviewed the NRC analysis and believes it to be sound. STPNOC has adopted the NRC analysis and concludes that GHG emissions associated with renewal of the STP Units 1 & 2 operating licenses would be similar to the lifecycle GHG emissions from renewable energy sources and lower than those associated with fossil-fuel-based energy sources.

6.4 IRREVERSIBLE AND IRRETRIEVABLE RESOURCE COMMITMENTS

NRC

> The environmental report shall discuss "Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." 10 CFR 51.45(b)(5) as adopted by 10 CFR 51.53(c)(2)

The continued operation of STP Units 1 & 2 for the license-renewal term will result in irreversible and irretrievable resource commitments, including the following:

- Nuclear fuel, which is consumed in the reactor and converted to radioactive waste
- The land required to dispose of spent nuclear fuel and low-level radioactive wastes generated as a result of plant operations and to dispose of solid and sanitary wastes generated from normal industrial operations.
- Elemental materials that will become radioactive by neutron activation
- Materials used for the nonradiological industrial operations of the plant that cannot be recovered or recycled or that are consumed or reduced to unrecoverable forms.

6.5 SHORT-TERM USE VERSUS LONG-TERM PRODUCTIVITY OF THE ENVIRONMENT

NRC

The environmental report shall discuss “The relationship between local short-term uses of man’s environment and the maintenance and enhancement of long-term productivity...” 10 CFR 51.45(b)(4) as adopted by 10 CFR 51.53(c)(2)

The current balance between short-term use and long-term productivity at the STP Units 1 & 2 site was established with the decision to construct the plant. The Final Environmental Statement related to the proposed STP Units 1 and 2 (NRC 1975) evaluated the impacts of constructing and operating STP in Matagorda County, Texas. Natural resources used in the short term would include land and water. Much of the 12,220-acre site was cropland and rangeland prior to facility construction. Approximately 8,000 acres were disturbed and modified by plant construction activities. Plant structures and related facilities occupy approximately 65 acres, the Essential Cooling Pond occupies approximately 46 acres, and the MCR occupies approximately 7,000 acres. Existing transmission corridors were used when feasible, reducing the need for new right-of-way acquisition to 5,685 acres, the majority of which was returned to agricultural use after construction. Consumptive use and the discharge of effluents have no effect on the commercial use of the Colorado River.

After decommissioning, many environmental disturbances would cease and some restoration of the natural habitat would occur. It is likely that the MCR would continue to be used as a cooling system or that it would be developed into a recreation area. Thus, the “trade-off” between the production of electricity and changes in the local environment is reversible to some extent.

Experience with other experimental, developmental, and commercial nuclear plants has demonstrated the feasibility of decommissioning and dismantling such plants sufficiently to restore a site to its former use. The degree of dismantlement will take into account the intended new use of the site and a balance among health and safety considerations, salvage values, and environmental impact. However, decisions on the ultimate disposition of these lands have not yet been made. Continued operation for an additional 20 years would not increase the short-term productivity impacts described here.

6.6 TABLES

Table 6.1-1. Category 2 Environmental Impacts Related to License Renewal at STP Units 1 and 2.

No.	Issue	Environmental Impact
		Surface Water Quality, Hydrology, and Use (for all plants)
13	Water use conflicts (plants with cooling ponds or cooling towers using make-up water from a small river with low flow)	SMALL - STP Units 1 & 2 use a closed cycle cooling pond (MCR) that receives its makeup water from the lower Colorado River. STP Units 1 & 2 average amount of water diverted from the Colorado River from 2003 to 2007 was 35,364 acre-feet, which is 34.7 percent of the plant's permitted water use. The amount of water used by STP Units 1 & 2 is approximately 1.9 percent of the average annual flow of the lower Colorado River at the USGS gaging station at Bay City.
		Aquatic Ecology (for plants with once-through and cooling pond heat dissipation systems)
25	Entrainment of fish and shellfish in early life stages	SMALL - Volume of Colorado River water diverted at the RMPF for MCR makeup is limited by a Certificate of Adjudication issued by the Texas Water Commission. Water is diverted infrequently and, when possible, during periods of high river flow, when early life stages of important marine species are less likely to be entrained.
26	Impingement of fish and shellfish in early life stages	SMALL - Volume of Colorado River water diverted at the RMPF for MCR makeup is limited by a Certificate of Adjudication issued by the Texas Commission on Environmental Quality. Water is diverted infrequently and, when possible, during periods of high river flow, when important marine species are largely absent. Several design features of the RMPF also reduce the rate of impingement and mitigate impacts of impingement.
27	Heat shock	SMALL - The STP TPDES permit contains limits on MCR discharge (blowdown) temperatures and discharge flows, but the MCR has been blown down only once in two decades.
		Groundwater Use and Quality
33	Groundwater use conflicts (potable and service water, and dewatering; plants that use > 100 gpm)	SMALL - Although STP is permitted to use up to 1,822 gpm of groundwater from the Deep Chicot Aquifer, STP Units 1 & 2 withdraw an average of 765 gpm. A predicted conservative drawdown of 18 to 20 feet at a distance of 2,500 feet from any STP site well was estimated to occur during the life of the current operating permit. The actual drawdown is less. Groundwater level data collected between 1996 and 2006 from the STP site indicate that the potentiometric surface flows towards the site's production wells and that drawdown in the Deep Chicot Aquifer is limited to onsite areas.

Table 6.1-1. Category 2 Environmental Impacts Related to License Renewal at STP Units 1 and 2. (Continued)

No.	Issue	Environmental Impact
34	Groundwater use conflicts (plants using cooling towers or cooling ponds that withdraw make-up water from a small river)	SMALL - STP is limited to diverting 55 percent of the flows of the lower Colorado River in excess of a 300-cfs base flow at the authorized diversion point on the river. STP Units 1 & 2 average annual use is approximately 35,364 acre-feet/year, which is 34.7 percent of the plant's permitted water use. Although the alluvial aquifer is in contact with the Shallow Chicot Aquifer, the shallow aquifer is used for livestock watering and other low-yield requirements. The MCR was designed for a 100-year drought event that lasts 10 years.
35	Groundwater use conflicts (Ranney wells)	None - STP Units 1 & 2 do not use Ranney wells. Therefore, this issue does not apply.
39	Groundwater quality degradation (cooling ponds at inland sites)	SMALL - The shallow aquifer water quality is marginal to very poor, and shallow wells are rarely used in the STP site area. Tritium concentrations in the shallow aquifer remain within the USEPA drinking water standards. Groundwater production wells screened in the deep aquifer indicate only natural background concentrations of radioactivity.
		Terrestrial Resources
40	Refurbishment impacts	None - No impacts are expected because STP Units 1 & 2 will not undertake refurbishment.
		Threatened or Endangered Species
49	Threatened or endangered species	SMALL - No observed impacts from current operations and transmission line maintenance practices. STPNOC has no plans to alter current operations over the license-renewal period, and resource agencies contacted by STPNOC have indicated that license renewal is unlikely to affect any listed species.
		Air Quality
50	Air quality during refurbishment (nonattainment and maintenance areas)	None. No impacts are expected because STP Units 1 & 2 will not undertake refurbishment.
		Human Health
57	Microbiological organisms (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	SMALL - Access to the MCR is strictly controlled. The STP TPDES permit contains limits on MCR discharge (blowdown) temperatures and discharge flows. Blowdown would occur when river temperatures are significantly lower than the discharge temperature and not conducive to survival and growth of *Naegleria*. Hence, continued operation of STP Units 1 & 2 would not stimulate the growth of thermophilic pathogens.
59	Electric shock from transmission line-induced currents	MODERATE – Five locations along the STP Units 1 & 2 transmission lines exceed 5.0 milliamperes, which is the National Electric Safety Code standard for preventing electric shock from induced current. Mitigation measures are not required since there are 1) few exceedances of the NESC standard, 2) the exceedances are a small percentage of the standard, 3) the locations of the exceedances are very remote or on private property, 4) the transmission service providers have not received any complaints about induced-current shock.

Table 6.1-1. Category 2 Environmental Impacts Related to License Renewal at STP Units 1 and 2. (Continued)

No.	Issue	Environmental Impact
		Socioeconomics
63	Housing impacts	SMALL - For the purpose of license renewal, STPNOC does not plan to undertake refurbishment and does not plan to add employees. Therefore, there will be no increased demand on housing because of license renewal.
65	Public services: public utilities	SMALL - For the purpose of license renewal, STPNOC does not plan to undertake refurbishment and does not plan to add employees. Therefore, there will be no increased demand on public utilities because of license renewal.
66	Public services: education (refurbishment)	None - No impacts are expected because STP Units 1 & 2 will not undertake refurbishment.
68	Offsite land use (refurbishment)	None - No impacts are expected because STP Units 1 & 2 will not undertake refurbishment.
69	Offsite land use (license renewal term)	SMALL - No plant-induced changes to offsite land use are expected from license renewal.
70	Public services: transportation	SMALL - STP Units 1 & 2 will not undertake refurbishment and STPNOC does not plan to add employees. Therefore, there will be no increased demand on the local transportation infrastructure because of license renewal.
71	Historic and archaeological resources	SMALL - STPNOC does not plan to undertake refurbishment or transmission-line corridor changes during the license renewal term. In addition, STPNOC has developed corporate procedures to address discovery of cultural resources during activities. Continued plant site operations are not expected to impact cultural resources. The Texas State Historic Preservation Office concurs.
		Postulated Accidents
76	Severe accidents	SMALL – No mitigation measures were found to be cost-effective.

6.7 CHAPTER 6 REFERENCES

NRC (U.S. Nuclear Regulatory Commission) 1975. Final Environmental Statement Related to the Proposed South Texas Project, Units 1 and 2. Houston Lighting & Power Company, City Public Service Board of San Antonio, Central Power and Light Company, and City of Austin. Docket Nos. 50-498 and 50-499. Office of Nuclear Reactor Regulation. Washington, DC. March.

NRC (Nuclear Regulatory Commission) 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants. NUREG-1437, Volumes 1 and 2, Washington, DC.

NRC (U.S. Nuclear Regulatory Commission) 2008. Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Indian Point Nuclear Generating Unit Nos. 2 and 3, Draft Report for Comment. NUREG-1437, Supplement 38, Volume 1. Office of Nuclear Reactor Regulation. Washington, DC. December. NRC ADAMS Accession No. ML083540594.

7.0 CHAPTER 7 - ALTERNATIVES TO THE PROPOSED ACTION

NRC

> The environmental report shall discuss "Alternatives to the proposed action…" 10 CFR 51.45(b)(3), as adopted by reference at 10 CFR 51.53(c)(2)
>
> "...The report is not required to include discussion of need for power or economic costs and benefits of ... alternatives to the proposed action except insofar as such costs and benefits are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation...." 10 CFR 51.53(c)(2)
>
> "While many methods are available for generating electricity, and a huge number of combinations or mixes can be assimilated to meet a defined generating requirement, such expansive consideration would be too unwieldy to perform given the purposes of this analysis. Therefore, NRC has determined that a reasonable set of alternatives should be limited to analysis of single, discrete electric generation sources and only electric generation sources that are technically feasible and commercially viable…" (NRC 1996a).
>
> "…The consideration of alternative energy sources in individual license renewal reviews will consider those alternatives that are reasonable for the region, including power purchases from outside the applicant's service area...." (NRC 1996b).

Chapter 7 evaluates alternatives to STP Units 1 & 2 license renewal. The chapter identifies actions that the owners of STP Units 1 & 2 might take, and associated environmental impacts, if NRC chooses not to renew the plant's operating licenses, *i.e.*, the no action alternative. The chapter also addresses other energy alternatives. In this regard, STPNOC divided its alternatives discussion into two categories, "no-action" and "alternatives that meet system generating needs." In considering the level of detail and analysis that it should provide for each category, STPNOC relied on the NRC decision-making standard for license renewal:

> …the NRC staff, adjudicatory officers, and Commission shall determine whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decision makers would be unreasonable. [10 CFR 51.95(c)(4)]

STPNOC has determined that the analysis of alternatives should focus on comparative impacts, specifically whether an alternative's impacts would be greater, smaller, or similar to the proposed action.

Providing additional detail or analysis serves no function if it only brings to light additional adverse impacts of alternatives to license renewal. This approach is consistent with regulations of the Council on Environmental Quality, which provide that the consideration of alternatives (including the proposed action) should enable reviewers to evaluate their comparative merits (40 CFR 1500-1508). STPNOC considers Chapter 7 sufficient with regard to providing detail about alternatives to establish the basis for necessary comparisons to the Chapter 4 discussion of impacts from the proposed action.

In characterizing environmental impacts from alternatives, STPNOC has used the same definitions of SMALL, MODERATE, and LARGE that are presented in the introduction to Chapter 4.

7.1 NO-ACTION ALTERNATIVE

STPNOC uses "no-action alternative" to refer to a scenario in which NRC does not renew the STP Units 1 & 2 operating licenses. Components of this alternative include replacing the generating capacity of STP Units 1 & 2 and decommissioning the facility, as described below.

STP Units 1 & 2 provide approximately 2,560 megawatts of electricity (MWe) to the plant's customers (EIA 2008a). STPNOC believes that any alternative would be unreasonable if it did not include replacing the baseload capacity of STP Units 1 & 2. Replacement could be accomplished by (1) building new generating capacity, (2) purchasing power from the wholesale market, or (3) reducing power requirements through demand reduction. Section 7.2.1 describes each of these possibilities in detail, and Section 7.2.2 describes environmental impacts from feasible alternatives.

The Generic Environmental Impact Statement (GEIS) for license renewal (NRC 1996a) defines decommissioning as the safe removal of a nuclear facility from service and the reduction of residual radioactivity to a level that permits release of the property for unrestricted use and termination of the license. NRC-evaluated decommissioning options include immediate decontamination and dismantlement and safe storage of the stabilized and defueled facility for a period of time, followed by additional decontamination and dismantlement. Regardless of the option chosen, decommissioning must be completed within a 60-year period. Under the no-action alternative, STPNOC would continue operating STP Units 1 & 2 until the existing licenses expire, then initiate decommissioning activities in accordance with NRC requirements. The GEIS describes decommissioning activities based on an evaluation of a smaller reactor than the units at STP Units 1 & 2 (the "reference" pressurized-water reactor is the 1,175 MWe Trojan Nuclear Plant). This description is applicable to decommissioning activities that STPNOC would conduct at STP Units 1 & 2.

As the GEIS (NRC 1996a) notes, NRC has evaluated environmental impacts from decommissioning. NRC-evaluated impacts include impacts of occupational and public radiation dose, impacts of waste management, impacts to air and water quality, and ecological, economic, and socioeconomic impacts. NRC indicated in the Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities; Supplement 1 (NRC 2002) that the environmental effects of greatest concern (i.e., radiation dose and releases to the environment) are substantially less than the same effects resulting from reactor operations. STPNOC adopts by reference the NRC conclusions regarding environmental impacts of decommissioning.

STPNOC notes that decommissioning activities and their impacts are not discriminators between the proposed action and the no-action alternative. STPNOC will have to decommission STP Units 1 & 2 regardless of the NRC decision on license renewal; license renewal would only postpone decommissioning for another 20 years. NRC has established in the GEIS that the timing of decommissioning operations does not substantially influence the environmental impacts of decommissioning. STPNOC adopts by reference the NRC findings (10 CFR 51, Appendix B, Table B 1, Decommissioning) to the effect that delaying decommissioning until after the renewal term would have small environmental impacts. The discriminators between the proposed action and the no-action alternative are to be found within the choice of generation replacement options. Section 7.2.2 analyzes the impacts from these options.

STPNOC concludes that the decommissioning impacts under the no-action alternative would not be substantially different from those occurring following license renewal, as identified in the

GEIS (NRC 1996a) and in the decommissioning generic environmental impact statement (NRC 2002). These impacts would be temporary and would occur at the same time as the impacts from meeting system generating needs.

7.2 ALTERNATIVES THAT MEET SYSTEM GENERATING NEEDS

STP Units 1 & 2 have a net capacity of 2,560 MWe, and in 2007 generated approximately 22.2 terawatt-hours of electricity (EIA 2008a). This power, equivalent to the energy used by approximately 4,070,000 residential customers (Denholm and Margolis 2007), would be unavailable to the customers of STP's owners if its operating licenses were not renewed. If the operating licenses were not renewed, the owners of STP Units 1 & 2 would need to build new generating capacity, purchase power, or reduce power requirements through demand reduction to ensure they meet the electric power requirements of their customers.

STP Units 1 & 2 are located within the Electric Reliability Council of Texas (ERCOT) region of Texas. ERCOT is one of eight regional reliability councils in North America and operates under the reliability and safety standards set by the North American Electric Reliability Council. ERCOT is unique because it is located entirely within the boundaries of the state of Texas. While most of the other reliability councils fall under the jurisdiction of FERC, the Public Utility Commission of Texas (PUCT) is responsible for overseeing ERCOT. ERCOT is the independent system operator for the electric grid for most of Texas and manages the flow of electric power to approximately 21 million Texas customers, representing 85 percent of the state's electric load and 75 percent of the state's land area (TPPF 2007; ERCOT 2009a).

The current mix of power generation options in ERCOT is one indicator of what STPNOC considers to be feasible alternatives. In 2008, electric generators in ERCOT had an installed generating capacity of approximately 83,000 MWe. This capacity includes units fueled by natural gas (64.0 percent), coal (20.6 percent), wind (8.2 percent), nuclear (6.4 percent), hydroelectric (0.8 percent), and other sources (0.1 percent) (ERCOT 2008a). In 2008, the electric generators in ERCOT provided approximately 309 terawatt-hours of electricity. Actual utilization of generating capacity in ERCOT was dominated by natural gas (43.0 percent) followed by coal (37.1 percent), nuclear (13.2 percent), wind (4.9 percent) hydroelectric (0.2 percent), and other sources (1.6 percent) (ERCOT 2009b). Figures 7.2-1 and 7.2-2 illustrate ERCOT's electric industry generating capacity and utilization, respectively.

Comparison of generating capacity with actual utilization of this capacity (Figures 7.2-1 and 7.2-2) indicates that coal and nuclear are used by electric generators in ERCOT substantially more, relative to their capacity, than gas-fired generation. This condition reflects the relatively low fuel cost and baseload suitability for nuclear power and coal-fired plants, and relatively higher use of gas-fired units to meet peak loads. Energy production from renewable sources is similarly preferred from a cost standpoint, but capacity is limited and utilization can vary substantially depending on resource availability.

7.2.1 Alternatives Considered

Technology Choices

For the purposes of this environmental report, STPNOC evaluated alternative generating technologies to identify candidate technologies that would be capable of replacing the net baseload capacity of STP Units 1 & 2.

Based on these evaluations, it was determined that feasible new plant systems to replace the capacity of STP Units 1 & 2 are limited to pulverized-coal, gas-fired combined-cycle, and new nuclear units for baseload operation. STPNOC would use gas as the primary fuel in its combined-cycle turbines because of the economic and environmental advantages of gas over oil. Large standard sizes of combined-cycle gas turbines now manufactured are economically attractive and suitable for high-capacity baseload operation. For the purposes of the STP Units 1 & 2 license-renewal environmental report, STPNOC has limited its analysis of new generating capacity alternatives to the technologies it considers feasible: pulverized coal-fired, gas-fired, and advanced light water reactor units. STPNOC chose to evaluate combined-cycle turbines in lieu of simple-cycle turbines because the combined-cycle option is more economical. The benefits of lower operating costs for the combined-cycle option outweigh its higher capital costs.

Mixture

NRC indicated in the GEIS that, while many methods are available for generating electricity and a large number of combinations or mixes can be assimilated to meet system needs, it would be impractical to analyze all the combinations. Therefore, NRC determined that alternatives evaluation should be limited to analysis of single discrete electrical generation sources and only those electric generation technologies that are technically reasonable and commercially viable (NRC 1996a). Consistent with the NRC determination, STPNOC has not evaluated mixes of generating sources. The impacts from coal-fired, gas-fired, and nuclear generation presented in this chapter would bound the impacts from any combination of the three technologies.

Electric Power Industry Restructuring

Nationally, the electric power industry has been undergoing a transition from a regulated industry to a competitive market environment. Efforts to deregulate the electric utility industry began with passage of the National Energy Policy Act of 1992, which created opportunities nationwide for non-utility power generators to enter the wholesale electricity market.

Texas began electric industry restructuring in 1995 when the Texas Legislature passed Senate Bill 373 (SB 373), which authorized competition in ERCOT's wholesale electric market and mandated non-discriminatory open access to the ERCOT's electric transmission system. Provisions of SB 373 allowed the PUCT to designate ERCOT as the independent system operator for the wholesale market within its footprint. The wholesale market began operating on September 1, 1996 (TPPF 2007).

Texas began restructuring ERCOT's retail electric market in 1999 when the Texas Legislature enacted Senate Bill 7 (SB 7). SB 7 set a timetable for the introduction of competition in ERCOT's retail electric market by January 1, 2002. SB 7 allowed retail customers of investor-owned utilities (IOUs) to choose their electric energy supplier, but allowed municipally owned utilities and electric cooperatives to remain non-opt-in entities (NOIEs) until they choose to enter competition. Under the terms of SB 7, NOIEs may remain vertically integrated electric utilities offering generation, transmission, and distribution services. Municipal utilities, electric co-ops, and other entities providing transmission and distribution service are obligated to deliver the electricity to retail customers (TPPF 2007).

Retail sales activities in the IOU service areas are performed by retail electric providers (REPs) on a “customer choice” basis. These are the only entities authorized to sell electricity to retail customers. REPs buy electricity from power generating companies, power marketers, or other parties and may resell that electricity to retail customers at any location in Texas other than within the service areas of municipal utilities and electric co-ops (TPPF 2007).

Alternatives

The following sections present fossil-fuel-fired generation (Section 7.2.1.1), nuclear generation (Section 7.2.1.2), and purchased power (Section 7.2.1.3) as reasonable alternatives to license renewal. Section 7.2.1.4 discusses reduced demand (referred to as demand-side management) and presents the basis for concluding that it is not a reasonable alternative to license renewal. Section 7.2.1.5 discusses other alternatives that STPNOC has determined are not reasonable and the bases for these determinations.

7.2.1.1 Construct and Operate Fossil-Fuel-Fired Generation

STPNOC analyzed locating hypothetical new gas- and coal-fired units at the existing STP site and at an undetermined greenfield site. STPNOC concluded that STP is the preferred site for new construction because this approach would minimize environmental impacts by building on previously disturbed land and by making the most use possible of existing facilities, such as transmission lines, roads and parking areas, office buildings, and components of the cooling system. Locating hypothetical units at the existing site has, therefore, been applied to the coal- and gas-fired units.

For comparability, STPNOC selected gas- and coal-fired units of equal electric power capacity. Four units, each with a net capacity of 640 MWe were assumed to replace the 2,560-MWe STP Units 1 & 2 net capacity. It must be emphasized, however, that these are hypothetical scenarios. The owners of STP Units 1 & 2 do not have plans for such construction at the STP site.

Gas-Fired Generation

NRC has routinely evaluated gas-fired generation alternatives for nuclear plant license renewal. In the GEIS Supplement for Susquehanna Steam Electric Station (NRC 2008), NRC analyzed 2,400 MWe of gas-fired generation capacity. STPNOC has reviewed the NRC analysis, considers it to be sound, and notes that it analyzed less generating capacity than the 2,560 MWe discussed in this analysis. In defining the STP Units 1 & 2 gas-fired alternative, STPNOC has used site- and ERCOT-specific input and has applied the NRC analysis, where appropriate.

For purposes of this analysis, STPNOC assumed development of a modern natural gas-fired combined-cycle plant. STPNOC based its emission control technology and percent control assumptions on alternatives that the U.S. Environmental Protection Agency (USEPA) has identified as being available for minimizing emissions (USEPA 2000b). STPNOC assumes that the representative plant would be located at the STP Units 1 & 2 site, which offers potential advantages of existing infrastructure (e.g., cooling water system, transmission, roads, and technical and administrative support facilities). Table 7.2-1 presents the basic gas-fired alternative characteristics.

Coal-Fired Generation

NRC has routinely evaluated coal-fired generation alternatives for nuclear plant license renewal. In the GEIS Supplement for Susquehanna Steam Electric Station (NRC 2008), NRC analyzed 2,400 MWe of coal-fired generation capacity. STPNOC has reviewed the NRC analysis, considers it to be sound, and notes that it analyzed less generating capacity than the 2,560 MWe discussed in this analysis. In defining the STP Units 1 & 2 coal-fired alternative, STPNOC has used site- and ERCOT-specific input and has applied the NRC analysis, where appropriate.

For purposes of this analysis, STPNOC assumed development of a supercritical coal-fired plant. STPNOC based its emission control technology and percent control assumptions on alternatives that the USEPA has identified as being available for minimizing emissions (USEPA 1998). Table 7.2-2 presents the basic coal-fired alternative emission control characteristics. STPNOC assumes that the representative plant would be located at the STP Units 1 & 2 site, which offers potential advantages of existing infrastructure (e.g., cooling water system, transmission, roads, and technical and administrative support facilities). For the purposes of analysis, STPNOC has assumed that coal and lime (calcium oxide) would be delivered to STP Units 1 & 2 via an existing rail spur.

7.2.1.2 Construct and Operate New Nuclear Reactors

Starting in 1997, the NRC has certified four standard designs for nuclear power plants under 10 CFR 52, Subpart B; several other designs are under review or have vendor applications being prepared. These designs are the U.S. Advanced Boiling Water Reactor (ABWR) (10 CFR 52, Appendix A), the System 80+ Design (10 CFR 52, Appendix B), the AP600 Design (10 CFR 52, Appendix C), and the AP1000 Design (10 CFR 52, Appendix D). All of these plants are light-water reactors. In the combined license application (COLA) environmental report for STP Units 3 & 4 (STPNOC 2009), STPNOC evaluated the construction and operation of two ABWRs at the STP site. Each ABWR would have a net electrical output of approximately 1,300 MWe. In defining the new nuclear reactor alternative, STPNOC assumed development of two ABWR units to replace STP Units 1 & 2. While two ABWR units would provide more generating capacity than the 2,560-MWe capacity of STP Units 1 & 2, STPNOC's experience indicates that an NRC-certified standard design would have inherent economic and schedule advantages over custom-sized nuclear units. STPNOC assumes that the representative plant would be located at the STP site, which offers potential advantages of existing infrastructure (e.g., cooling water system, transmission, roads, and technical and administrative support facilities). For the purposes of analysis, STPNOC has assumed that fuel would be delivered to STP Units 1 & 2 via an existing rail spur.

7.2.1.3 Purchased Power

As noted in Section 7.2.1, electric industry restructuring initiatives in the ERCOT region are designed to promote competition in energy supply markets by facilitating participation by generation companies. ERCOT has implemented market rules to appropriately anticipate and meet electricity demands in the resulting wholesale electricity market. As an additional facet of this restructuring effort, most retail customers in the region now may choose among any REP to supply their power. In view of these conditions, STPNOC assumes for purposes of this analysis that adequate supplies of electricity would be available, and that purchased power would be a reasonable alternative to meet STP's load requirements in the event the existing operating licenses for STP Units 1 & 2 are not renewed.

Because ERCOT operates wholly within the state of Texas and does not interconnect synchronously to import or export power with neighboring reliability regions, the source of purchased power may reasonably include new generating facilities developed elsewhere in the ERCOT region. The technologies that would be used to generate this purchased power are similarly speculative. STPNOC assumes that the generating technology used to produce purchased power would be one of those that NRC analyzed in the GEIS. For this reason, STPNOC is adopting by reference the GEIS description of the alternative generating technologies as representative of the purchased power alternative. Of these technologies, facilities fueled by coal, combined-cycle facilities fueled by natural gas, and advanced light-water reactor facilities are the most cost-effective for providing baseload capacity.

STPNOC anticipates that additional transmission infrastructure would be needed in the event that the owners of STP purchase power to replace STP Units 1 & 2 capacity.

7.2.1.4 Demand Side Management

Demand-side management (DSM) programs include energy conservation and load management measures. Because there would be no construction, there would be no new environmental impacts created from this alternative. As discussed in the GEIS (NRC 1996a), the DSM alternative does not fulfill the stated purpose and need of the proposed action because it does not "provide power generation capability." Nevertheless DSM is considered here because energy conservation and load management are important energy management tools for meeting projected demand.

Historically, state regulatory bodies have required regulated utilities to institute programs designed to reduce demand for electricity. In the current deregulated ERCOT market, electric transmission/distribution utilities, including CPS Energy and Austin Energy (two of the owners of STP Units 1 & 2), are required to use DSM measures to reduce their customers' energy consumption by a minimum of 20 percent of the utility's annual growth in demand by December 31, 2009. Beginning in 2009, a utility's demand-reduction goal in MWe for a given year is required to be not less than the previous year's goal. The Texas Legislature is currently considering several bills that would increase demand-reduction mandates in ERCOT and other regions of Texas.

Both CPS Energy and Austin Energy have aggressive DSM programs that include load-curtailment incentives during periods of peak demand; rebates and financial incentives for commercial, industrial, and residential customers for installation of energy-efficient appliances and equipment; and the adoption of updated energy codes for new building construction. Although both utilities have aggressive DSM programs, electricity demand in their respective service areas continues to grow and both utilities anticipate the need for new power supplies by 2020. Thus, it is unlikely that implementation of additional DSM measures in the CPS Energy and Austin Energy service areas could offset the electricity generated by STP Units 1 & 2. NRG Energy, an independent power producer (IPP) and one of the owners of STP Units 1 & 2, anticipates it would not be able to offer competitively priced power if required to retain an extensive conservation and load modification incentive program. As an IPP, NRG Energy has no business connection to the end users of its electricity and, therefore, no ability to implement DSM. Because they have no ability to implement DSM, the NRC determined that DSM is not a reasonable alternative (NRC 2005) for IPPs. The NRC determination was upheld by the Seventh Circuit Court of Appeals (U.S. Court of Appeals for the 7th Circuit 2006).

Because the owners of STP sell power into the ERCOT interconnection, DSM measures promoted by other utilities may also help to offset the power produced by STP Units 1 & 2. However, ERCOT has instituted measures to capture energy conservation potential and load management in its resource planning. Consequently, additional DSM measures are already incorporated in the load forecast. As a practical matter, it would be highly unlikely that energy savings from demand reductions could be increased by an additional 2,560 MWe by 2026 to replace the STP Units 1 & 2 baseload capacity.

Although DSM is an important tool for meeting projected electricity demand and the impacts from the DSM alternative are generally small, DSM does not does not fulfill the stated purpose and need to “provide power generation capability.” DSM measures are already captured in state and regional load projections, and additional DSM measures would offset only a fraction of the energy supply lost by the shutdown of STP Units 1 & 2. In addition, NRG Energy is an IPP that sells wholesale power and has no business connection to end users of its electricity and, therefore, no ability to implement DSM. For these reasons, STPNOC does not consider DSM to represent a reasonable alternative to renewal of the STP Units 1 & 2 operating licenses.

7.2.1.5 Other Alternatives

This section identifies alternatives that STPNOC has determined are not reasonable for replacing STP Units 1 & 2 and the bases for these determinations. STPNOC accounted for the fact that STP Units 1 & 2 are baseload generators and that any feasible alternative to STP Units 1 & 2 would also need to be able to generate baseload power. In performing this evaluation, STPNOC relied heavily on NRC’s GEIS (NRC 1996a).

Wind

As discussed in Section 8.3.1 of the GEIS (NRC 1996a) wind power, due to its intermittent nature, is not suitable for baseload generation. Wind power systems produce power only when the wind is blowing at a sufficient velocity and duration. While recent advances in technology have improved wind turbine capacity, average annual capacity factors for wind power systems are relatively low (22 to 47 percent) compared to 90 to 97 percent industry average for a baseload plant such as a nuclear plant (EERE 2008a; NRRI 2007). The average capacity factor for wind power systems in Texas is 30.4 percent (EERE 2008b, Table 7). In conjunction with energy storage mechanisms, wind power might serve as a means of providing baseload power. However, current energy storage technologies are too expensive to permit wind power to serve as a large baseload generator (Schainker 2008).

The energy potential in the wind is expressed by wind generation classes that range from 1 (least energetic) to 7 (most energetic). In a Class 1 region, the average wind speed is less than 12.5 miles per hour (mph) and offers a wind power of less than 200 watts per square meter. A Class 7 region has an average of more than 19.7 mph and offers a wind power of more than 800 watts per square meter. These speed ranges are based on wind speeds measured at 164 feet above ground surface (AWEA 2007a). Current wind technology can operate economically on Class 4, while Class 3 wind regimes will require further technical development for utility-scale application. (APPA 2004)

Within ERCOT, there are three areas with significant wind power potential: the Great Plains, the Gulf Coast, and specific areas in the Trans-Pecos region (TCPA 2008). AWS Truewind submitted a Wind Generation Assessment to ERCOT in January 2007 that identifies 25 viable Competitive Renewable Energy Zones distributed across the state with an estimated 1,200 potential wind project sites. The estimated wind energy potential (i.e., potential installed capacity) exceeds 130,000 MWe in a typical historical year. Most of these Competitive Renewable Energy Zones are located in the north, west, and central areas of the ERCOT region, although viable areas are also present near the coast southwest of Galveston (AWS Truewind 2007). As of December 2008, a total of 8,000 MWe of land-based wind energy had been developed in the ERCOT region (ERCOT 2009a).

Wind resources off the coast of Texas also offer potential for wind-based energy production (TSECO 2009), but the technology is not sufficiently demonstrated at this time. Only 1,077 MW of offshore wind capacity has been installed worldwide (EERE 2008b). In the United States, at least 10 offshore wind energy projects ranging from 10 MW to 450 MW have been proposed, but none has made it past the planning stage (Musial and Ram 2008).

In open, flat terrain, a utility-scale wind plant requires about 60 acres per megawatt of installed capacity. However, about 5 percent (3 acres) of this area is actually occupied by turbines, access roads, and other equipment. The remaining area can be used for compatible activities such as farming or ranching (AWEA 2007b). When the wind farm is located on land already used for intensive agriculture, the additional impact to wildlife and habitat will likely be minor, while disturbance caused by wind farms in more remote areas may be more significant. Replacement of STP Units 1 & 2 generating capacity (2,560 MWe) with wind power, assuming a capacity factor of 30.4 percent, would require a large greenfield site about 711 square miles (455,000 acres) in size, of which approximately 36 square miles (22,700 acres) would be disturbed and unavailable for other uses.

Based on this analysis, STPNOC has determined that wind energy is developed, proven, and available in the ERCOT region within the life of the proposed project; however, the capacity factor for wind energy is inadequate to provide baseload power. In addition, wind energy has large land-use requirements and the associated construction and ecological impacts. For these reasons, wind power alone is not a feasible alternative for baseload power in the ERCOT region.

Solar

Two basic types of solar technologies produce electrical power: photovoltaic and solar thermal power. Photovoltaics convert sunlight directly into electricity using semiconducting materials. Solar thermal power systems use mirrors to concentrate sunlight on a receiver holding a fluid or gas, heat it, and cause it to turn a turbine or push a piston coupled to an electric generator. Solar thermal systems can be equipped with a thermal storage tank to store hot heat-transfer fluid, providing thermal energy storage. By using thermal storage, a solar thermal plant can provide dispatchable electric power (Leitner and Owens 2003).

Solar technologies produce more electricity on clear, sunny days with more intense sunlight and when the sunlight is at a more direct angle (i.e., when the sun is perpendicular to the collector). Cloudy days can significantly reduce output, and no solar radiation is available at night. To work effectively, solar installations require consistent levels of sunlight (solar insolation) (Leitner and Owens 2003).

The lands with the best solar resources are usually arid or semi-arid. In addition, the average annual amount of solar energy reaching the ground needs to be 6.0 kilowatt-hours per square meter per day (kW/m^2/day) or higher for solar thermal power systems (NREL 2002). The ERCOT region receives 3.5 to 7.0 kW/m^2/day. The western portions of the ERCOT region receive 75 percent more direct solar radiation than the eastern ERCOT regions. Based on solar radiation maps, numerous areas of the ERCOT region would meet or exceed the 6.0 kW/m^2/day minimum insulation standard, especially in the far western portion of the ERCOT region (TSECO 1995). The western portions of the ERCOT region are also arid while humidity is high in the eastern portions, particularly in coastal areas. Environmental advantages shared by both solar technologies are near-zero emissions and an unlimited supply of fuel (sunlight). Environmental disadvantages shared by both solar technologies are sizeable land-use requirements, aesthetic intrusion, and potential use of hazardous materials (lead) to store energy. Additional discussion of concentrating thermal solar power and photovoltage technologies is provided below.

Land requirements for solar plants are high. Estimates based on existing installations indicate that utility-scale plants would occupy at least 2.5 acres per MWe for photovoltaic and 4.9 acres per MWe for solar thermal systems (EERE 2004). Utility-scale solar plants have mainly been used in regions that receive high concentrations of solar radiation such as the western U.S. A utility-scale solar plant located in the region of interest would occupy about 2.6 acres per MWe for photovoltaic and 6.6 acres per MWe for solar thermal systems. To provide 2,560 MWe of net power to the ERCOT grid using these estimated land requirements, a solar photovoltaic system with a capacity factor of 23 percent would require nearly 25,830 acres. A concentrating thermal system operating at 40 percent capacity would require nearly 37,955 acres. These numbers are conservative estimates and could be considerably higher. Based on recent solar energy project applications to the BLM California Desert District, photovoltaic systems are averaging 11 acres per MWe and solar thermal systems are averaging 13 acres per MWe (BLM 2008).

Solar powered technologies, photovoltaic cells and solar thermal power do not currently compete with conventional technologies in grid-connected applications. Recent estimates indicate that the cost of electricity produced by photovoltaic cells is in the range of 21 to 38 cents per kilowatt-hour, and electricity from solar thermal systems can be produced for a cost in the range of 12 to 17 cents per kilowatt-hour (EERE 2008a).

STPNOC has concluded that, due to the high cost, low capacity factors, and the substantial amount of land needed to produce the desired output, solar power is not a reasonable alternative to STP Units 1 & 2 license renewal.

Hydropower

Hydroelectric power uses the energy of falling water to turn turbines and generate electricity. Power production increases with both greater water flow and greater fall. The summer capacity for hydropower in ERCOT is about 586 MWe, which represents roughly 0.8 percent of ERCOT's electric generation capacity (ERCOT 2008b). Most of the terrain in Texas does not lend itself to large-scale hydroelectric plants, and there are no new hydroelectric plants planned. If all of the state's potential hydroelectric sites were developed, the total hydroelectric capacity would still be less than 1.5 percent of the state's total (TCPA 2008).

The GEIS estimates land use of 1,600 square miles per 1,000 MWe for hydroelectric power. Based on this estimate, replacement of STP Units 1 & 2 generating capacity would require flooding approximately 4,096 square miles, resulting in a large impact on land use. Further, operation of a hydroelectric facility would alter aquatic habitats above and below the dam, which would impact existing aquatic communities.

Based on this analysis, STPNOC has determined that although hydropower is developed and proven, the potential for future hydropower development in the ERCOT region is inadequate to satisfy the need for power. In addition, hydropower has large land use requirements along with the associated environmental impacts. For these reasons, hydropower is not a feasible alternative for replacing STP's baseload power in the ERCOT region.

Geothermal

Geothermal energy is a proven resource for power generation. Geothermal power plants use naturally heated fluids as an energy source for electricity production. To produce electric power, underground high-temperature reservoirs of steam or hot water are tapped through wells. The heated fluid is then routed to an electrical generation system (NRRI 2007).

Geothermal energy can achieve capacity factors ranging from 86 to 95 percent and can be used for baseload power where this type of energy source is available (EERE 2008a). As of 2008, geothermal energy was not being used to generate electricity in Texas (TCPA 2008).

Shallow, high-temperature convective geothermal reservoirs have not been discovered in the ERCOT region or the state. However, recent research indicates that it may be feasible to extract geothermal electric power from geopressured reservoirs of hot water and natural gas or hot wastewater from deep oil and gas wells, using a binary system. Over 600,000 oil and gas wells have been drilled in Texas, most of which are located in the ERCOT region. High-temperature fluid (250°F or greater) has been encountered in many of the wells that are 16,000 feet or deeper, with the highest temperatures above 400°F. Texas also has significant geopressured geothermal resources (GEA 2007).

Researchers have estimated that electric power production potential from Texas oil and gas wells range from 400 MWe in the near-term to over 2,000 MWe once the technology is demonstrated (GEA 2007).

Geothermal power generation facilities require between 1 and 8 acres per MWe (Shibaki 2003). Based on a 95-percent capacity factor and an average land requirement of 4.5 acres per MWe, a geothermal power plant with a net output of 2,560 MWe would require approximately 10,914 acres.

The primary impacts of geothermal plant construction and energy production are gaseous emissions, land use, noise, and potential ground subsidence. Subsidence and reservoir depletion may be a concern if withdrawal of geothermal fluids exceeds natural recharge or injection (Shibaki 2003).

Based on this analysis, STPNOC has determined that although geothermal power is developed and proven, there are no high temperature geothermal sources in the ERCOT region. The potential for future geothermal power to satisfy the need for power does not exist. For this reason, geothermal power is not a feasible alternative for replacing STP's baseload power in the ERCOT region.

Wood Energy

As discussed in the GEIS (NRC 1996a), the use of wood waste to generate electricity is largely limited to those states with significant wood resources. The pulp, paper, and paperboard industries in states with adequate wood resources generate electric power by consuming wood and wood waste for energy, benefiting from the use of waste materials that could otherwise represent a disposal problem.

Texas has an estimated 4,600 MWe of total wood energy capacity. There are currently no operational wood-fired biomass power plants in Texas, although two plants are planned, a 100-MWe wood-fired biomass power plant and an 8-MWe wood gasification power plant (TCPA 2008). Wood-fired biomass has some potential for Texas, particularly East Texas, but the cost of fuel is too high to make such plants viable.

Further, as discussed in Section 8.3.6 of the GEIS (NRC 1996a), construction of a wood-fired plant would have an environmental impact that would be similar to that for a coal-fired plant, although facilities using wood waste for fuel would be built on a smaller scale. Like coal-fired plants, wood-waste plants require large areas for fuel storage, processing, and waste (i.e., ash) disposal. Additionally, operation of wood-fired plants has environmental impacts, including impacts on the aquatic environment and air. Wood has a low heat content that makes it unattractive for baseload applications. It is also difficult to handle and has high transportation costs.

STPNOC has concluded that because of the lack of an environmental advantage, low heat content, handling difficulties, and high costs, wood energy is not a reasonable alternative to STP Units 1 & 2 license renewal.

Municipal Solid Waste

The decision to burn municipal solid waste to generate energy is usually driven by the need for an alternative to landfills, rather than by energy considerations. The use of landfills as a waste disposal option is likely to increase in the near term; however, it is unlikely that many landfills will begin converting waste to energy because of unfavorable economics, particularly with electricity prices declining.

As discussed in Section 8.3.7 of the GEIS (NRC 1996a), the initial capital costs for municipal solid waste plants are greater than for comparable steam turbine technology at wood-waste facilities. This is due to the need for specialized waste separation and handling equipment.

Estimates in the GEIS suggest that the overall level of construction impacts from a waste-fired plant should be approximately the same as that for a coal-fired plant. Additionally, waste-fired plants have the same or greater operational impacts (including impacts on the aquatic environment, air, and waste disposal). Some of these impacts would be moderate, but still larger than the environmental effects of STP Units 1 & 2 license renewal.

STPNOC has concluded that, due to the high costs and lack of environmental advantages, burning municipal solid waste to generate electricity is not a reasonable alternative to STP Units 1 & 2 license renewal.

Biomass Related Fuels

In addition to wood and municipal solid waste fuels, there are several other concepts for fueling electric generators, including burning energy crops, converting crops to a liquid fuel such as ethanol (ethanol is primarily used as a gasoline additive), and gasifying energy crops (including wood waste). As discussed in the GEIS, none of these technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a baseload plant such as STP Units 1 & 2.

Further, estimates in the GEIS suggest that the overall level of construction impacts from a crop-fired plant should be approximately the same as that for a wood-fired plant. Additionally, crop-fired plants would have similar operational impacts (including impacts on the aquatic environment and air). These systems also have large impacts on land use, due to the acreage needed to grow the energy crops.

STPNOC has concluded that, due to the high costs and lack of environmental advantage, burning other biomass-derived fuels is not a reasonable alternative to STP Units 1 & 2 license renewal.

Petroleum

Based on the ERCOT Unit Data Report for June 2008, petroleum-fueled (i.e., diesel) generation facilities within the ERCOT region produce about 38 MWe (ERCOT 2008b). Future increases in petroleum prices are expected to make petroleum-fired generation increasingly more expensive than gas- or coal-fired generation. Also, construction and operation of an oil-fired plant would have environmental impacts. For example, Section 8.3.11 of the GEIS (NRC 1996a) estimates that construction of a 1,000-MWe petroleum-fired plant would require about 120 acres. A petroleum–fired power plant with a net output of 2,560 MWe and a 95 percent capacity factor would require approximately 291 acres. 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.

STPNOC has concluded that, due to the high costs and lack of obvious environmental advantage, petroleum-fired generation is not a reasonable alternative to the STP Units 1 & 2 license renewal.

Fuel Cells

Fuel cells work without combustion and its environmental side effects. Power is produced electrochemically by passing a hydrogen-rich fuel over an anode and air over a cathode and separating the two by an electrolyte. The only by-products are heat, water, and carbon dioxide. Hydrogen fuel can come from a variety of hydrocarbon resources by subjecting them to steam under pressure. Natural gas is typically used as the source of hydrogen.

Fuel cell power plants are in the initial stages of commercialization. Although more than 900 large stationary fuel cell systems have been built and operated worldwide, the global stationary fuel cell electricity generation capacity in 2008 was only 175 MWe (FCT 2008, graphs 2&3). The largest stationary fuel cell power plant ever built is the 50-MWe POSCO facility in Korea (FC2000 2009). Even so, fuel cell power plants typically generate much less (2 MWe or lower) power (NRRI 2007).

One of the major barriers to full commercialization of stationary fuel cells is the product cost. Current large stationery fuel cell designs are approximately $3,000 per kW (Samuelsen 2008). To make fuel cells more competitive with other generating technologies, the Department of Energy formed the Solid State Energy Conversion Alliance (SECA), with the goal of producing new fuel cell technologies at a cost of $400/kW or lower by 2010 (DOE 2006).

Based on this analysis, STPNOC believes that fuel cell technology has not matured sufficiently to support production for a baseload facility, and is therefore not a reasonable alternative for baseload capacity due to the cost and production limitations.

Delayed Retirement

As the NRC noted in the GEIS (NRC 1996a), extending the lives of existing non-nuclear generating plants beyond the time they were originally scheduled to be retired represents another potential alternative to license renewal. STPNOC is not aware of plans for retiring any of ERCOT's electric generating plants and the state expects to need additional capacity in the near future. Fossil plants slated for retirement tend to be ones that are old enough to have difficulty in meeting today's restrictions on air contaminant emissions. In the face of increasingly stringent restrictions, delaying retirement in order to compensate for a plant the size of STP Units 1 & 2 would appear to be unreasonable without major construction to upgrade or replace plant components. STPNOC concludes that the environmental impacts of such a scenario are bounded by its coal- and gas-fired alternatives. For these reasons, the delayed retirement of non-nuclear generating units is not considered a reasonable alternative to STP Units 1 & 2 license renewal.

7.2.2 Environmental Impacts of Alternatives

This section evaluates the environmental impacts from what STPNOC has determined to be reasonable alternatives to the proposed project: pulverized coal-fired generation, gas-fired generation, construction and operation of new nuclear generation, and purchased power. STPNOC has identified the significance of the impacts associated with each issue as SMALL, MODERATE, or LARGE. This characterization is consistent with the criteria that NRC established criteria in 10 CFR 51, Appendix B, Table B-1, Footnote 3, and presented as follows:

- SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purpose of radiological impacts assessment, 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.

In accordance with National Environmental Policy Act (NEPA) practice, STPNOC considered ongoing and potential additional mitigation in proportion to the significance of the impact to be addressed (i.e., impacts that are small receive less mitigative consideration than impacts that are large).

7.2.2.1 Gas-Fired Generation

NRC evaluated environmental impacts from gas-fired generation alternatives in the GEIS, focusing on combined-cycle plants. Section 7.2.1.1 presents STPNOC reasons for defining the gas-fired generation alternative as a four-unit combined-cycle plant at STP. Land-use impacts from gas-fired units on STP would be less than those from the existing plant. Reduced land requirements, due to a smaller facility footprint, would reduce impacts to ecological, aesthetic, and cultural resources. A smaller workforce could have adverse socioeconomic impacts due to loss of jobs. Combustion of natural gas would impact air quality to a degree much greater than nuclear power.

Air Quality

Natural gas is a relatively clean-burning fossil fuel that primarily emits nitrogen oxides (NO_x), a regulated pollutant, during combustion. A natural gas-fired plant would also emit small quantities of sulfur dioxide (SO_2), particulate matter, and carbon monoxide, all of which are regulated pollutants. Control technology for gas-fired turbines focuses on NO_x emissions. STPNOC estimates the gas-fired alternative would use about 116.9 billion standard cubic feet of natural gas per year and would generate these emissions:

- SO_2 = 39 tons per year
- NO_x = 652 tons per year
- CO = 135 tons per year
- CO_2 = 6.60 million tons per year
- PM = 114 tons per year (all particulates have a diameter of less than 25 microns, $PM_{2.5}$)

Table 7.2-3 presents the calculation of these emissions.

The acid rain requirements of the Clean Air Act Amendments establish a cap on the allowable SO_2 emissions from power plants. Each company with fossil-fuel-fired units was allocated SO_2 allowances. To be in compliance with the Act, the companies must hold enough allowances to cover their annual SO_2 emissions. In year 2006, emissions from generators within Texas ranked highest nationally for NO_x and fifth highest nationally for SO_2 (EIA 2007). Both SO_2 and NO_x emissions would increase if a new gas-fired plant were operated at STP. To operate a fossil-fuel generation plant, the owners of STP Units 1 & 2 would have to purchase SO_2 allowances from the open market or shut down existing fossil-fired capacity and apply the credits from that plant to the new one.

In March 2005, EPA issued the final Clean Air Interstate Rule (CAIR) which addresses power plant SO_2 and NO_x emissions that contribute to non-attainment of the 8-hour ozone and $PM_{2.5}$ standards in downwind states. Texas is not covered under the CAIR program for 8-hour ozone, but is participating in the federal CAIR program for $PM_{2.5}$. The CAIR program for $PM_{2.5}$ calls for further reductions of NO_x and SO_2 emissions from power plants. These reductions can be accomplished by the installation of additional emission controls at existing coal-fired facilities or by the purchase of emission allowances from a cap-and-trade program.

Texas has regions that are designated as non-attainment with respect to the National Ambient Air Quality Standards for one or more criteria pollutants. Therefore, the state of Texas was required to submit a State Implementation Plan (SIP) to the EPA (1) to establish control strategies to reduce criteria pollutant emissions, and (2) to identify the technical and regulatory processes to demonstrate compliance with the SIP. The Texas SIP includes a cap and trade program for NO_x, SO_2, and mercury (Hg) emissions. New stationary fossil fuel facilities in Texas must acquire trade credits to cover the new potential emissions. Compliance with the NO_x and SO_2 standards identified in the SIP must be achieved by January 01, 2009, and January 01, 2010, respectively (TCEQ 2007). The closest nonattainment region to the proposed project location is the Houston-Galveston-Brazoria region. Brazoria County is east of and conterminous with Matagorda County. This region is designated as moderate nonattainment with respect to the 8-hour ozone standard (40 CFR 81.344). As discussed in Section 2.13, Matagorda County is not included as part of the non-attainment area.

NO_x effects on ozone levels, SO_2 allowances, and NO_x emission offsets could all be issues of concern for gas-fired combustion. While gas-fired turbine emissions are less than coal-fired boiler emissions, and regulatory requirements are less stringent, the emissions are still substantial. STPNOC concludes that emissions from the gas-fired alternative at STP Units 1 & 2 would noticeably alter local air quality, but would not destabilize regional resources (i.e., air quality). Air quality impacts would, therefore, be MODERATE.

Waste Management

The GEIS concludes that the solid waste generated from this type of facility would be minimal (NRC 1996a). The only noteworthy waste would be from spent selective catalytic reduction (SCR) used for NO_x control. STPNOC concludes that gas-fired generation waste management impacts would be SMALL.

Other Impacts

Similar to the coal-fired alternative, the ability to construct the gas-fired alternative on the STP site would reduce construction-related impacts relative to construction on a greenfield site.

A new 16-inch-diameter pipeline would need to be constructed from an existing 30-inch-diameter transmission pipeline located about 2.0 miles northwest of the proposed site. Upgrades to the existing pipeline and gas storage facilities would also be required. To the extent practicable, the new gas supply pipeline would be routed in previously disturbed areas to minimize impacts. Based on a 75-foot easement, about 18 acres would need to be graded to permit the installation of the pipeline. Construction of the combined cycle plant would impact approximately 90 acres of land. Because this much previously disturbed acreage is available at the STP site, loss of terrestrial habitat would be minimal. Aesthetic impacts, erosion and sedimentation accumulation, fugitive dust, and construction debris impacts would be similar to the coal-fired alternative, but smaller because of the reduced site size. Socioeconomic impacts would result from the estimated peak construction workforce of 2,038 people to build the facilities and 97 people needed to operate the gas-fired facility. These impacts would be SMALL due to the influence of the nearby Houston-Galveston metropolitan area.

The additional stacks and boilers would increase the visual impact of the existing site. Impacts to cultural resources would be unlikely, due to the previously disturbed nature of the site.

STPNOC estimates that other construction and operation impacts would be SMALL. In most cases, the impacts would be detectable, but they would not destabilize any important attribute of the resource involved. Due to the minor nature of these other impacts, mitigation would not be warranted beyond that previously mentioned.

7.2.2.2 Coal-Fired Generation

NRC evaluated environmental impacts from coal-fired generation alternatives in the GEIS (NRC 1996a). NRC concluded that construction impacts could be substantial, due in part to the large land area required (which can result in natural habitat loss) and the large workforce needed. NRC pointed out that siting a new coal-fired plant where an existing nuclear plant is located would reduce many construction impacts. NRC identified major adverse impacts from operations as human health concerns associated with air emissions, waste generation, and losses of aquatic biota due to cooling water withdrawals and discharges.

The coal-fired alternative that STPNOC has defined in Section 7.2.1.1 would be located on the STP site.

Air Quality

A coal-fired plant would emit SO_2, NO_x, particulate matter, and carbon monoxide, all of which are regulated pollutants. As Section 7.2.1.1 indicates, STPNOC has assumed a plant design that would minimize air emissions through a combination of boiler technology and post-combustion pollutant removal. STPNOC estimates the coal-fired alternative emissions to be as follows:

- SO_2 = 3,004 tons per year
- NO_x = 2,060 tons per year
- CO = 2,861 tons per year
- CO_2 = 27.5 million tons per year
- Hg = 0.47 tons per year
- PM_{10} (particulates with a diameter of less than 10 microns) = 51 tons per year
- $PM_{2.5}$ (particulates with a diameter of less than 2.5 microns) = 13 tons per year

Table 7.2-4 shows how STPNOC calculated these emissions.

The discussion in Section 7.2.2.1 of regional air quality is applicable to the coal-fired generation alternative. In addition, NRC noted in the GEIS that adverse human health effects from coal combustion have led to important federal legislation in recent years and that public health risks, such as cancer and emphysema, have been associated with coal combustion. NRC also mentioned global warming and acid rain as potential impacts. It should also be noted that in 2005, the EPA issued the Clean Air Mercury Rule, which was overturned by the courts at the same time as the CAIR. While the future is unclear, EPA likely will promulgate a new rule to address limits on mercury emissions.

STPNOC concludes that federal legislation and large-scale concerns, such as global warming and acid rain, are indications of concerns about destabilizing important attributes of air resources. However, SO_2 emission allowances, mercury emission allowances, NO_x credits, low NO_x burners, overfire air, fabric filters or electrostatic precipitators, and scrubbers are now, or likely will be in the future, regulatory-imposed mitigation measures. As such, STPNOC concludes that the coal-fired alternative would have MODERATE impacts on air quality; the impacts would be noticeable and greater than those of the gas-fired alternative, but would not destabilize air quality in the area.

Waste Management

STPNOC concurs with the GEIS assessment that the coal-fired alternative would generate substantial solid waste. The coal-fired plant would annually consume approximately 11,443,000 tons of coal with an ash content of 3.9 percent (Tables 7.2-4 and 7.2-2, respectively). After combustion, STPNOC assumed that 43 percent of this ash, approximately 193,000 tons per year, would be marketed for beneficial reuse. The remaining ash, approximately 253,000 tons per year, would be collected and disposed of onsite. In addition, approximately 88,000 tons of scrubber sludge would be disposed of on site each year (based on annual lime usage of nearly 107,000 tons). STPNOC estimates that ash and scrubber waste disposal over a 40-year plant life would require approximately 200 acres. Table 7.2-5 shows how STPNOC calculated ash and scrubber waste volumes. While only half this waste volume and acreage would be attributable to the 20-year license renewal period alternative, the total numbers are pertinent as a cumulative impact.

With proper facility placement, coupled with current waste management and monitoring practices, waste disposal would not destabilize any resources. There would be space within the current STP property for this disposal. After closure of the waste site and revegetation, the land would be available for other uses. For these reasons, STPNOC concludes that waste disposal for the coal-fired alternative would have MODERATE impacts; the impacts of increased waste disposal would be clearly noticeable, but would not destabilize any important resource and further mitigation of the impact would be unwarranted.

Other Impacts

STPNOC estimates that construction of the power block and coal storage area would impact about 353 acres of land and associated terrestrial habitat. Because most of this construction would be on previously disturbed land, impacts at the STP site would be SMALL to MODERATE but would be somewhat less than the impacts of using a greenfield site. Visual impacts would be consistent with the industrial nature of the site. As with any large construction project, some erosion, sedimentation, and fugitive dust emissions could be anticipated, but would be minimized through application of best management practices. Debris from clearing and grubbing could be disposed of on site. STPNOC estimates a peak construction work force of 3,955. Due to the proximity of the site to the Houston-Galveston metropolitan area, the surrounding communities would experience small demands on housing and public services. STPNOC estimates an operational workforce of 348 for the coal-fired alternative. The reduction in workforce would result in adverse socioeconomic impacts. STPNOC contends these impacts would be SMALL, due to STP's proximity to the Houston-Galveston metropolitan area.

The additional stacks, boilers, and rail deliveries would increase the visual impact of the existing site. Impacts to cultural resources would be unlikely, due to the previously disturbed nature of the site.

STPNOC estimates that other construction and operation impacts would be SMALL. In most cases, the impacts would be detectable, but they would not destabilize any important attribute of the resource involved. Due to the minor nature of these other impacts, mitigation would not be warranted beyond that previously mentioned.

7.2.2.3 New Nuclear Reactor

As discussed in Section 7.2.1.2, under the new nuclear reactor alternative STPNOC would construct and operate a two-unit nuclear plant. STPNOC assumed that any new nuclear units constructed to replace STP Units 1 & 2 would be ABWR units, the same design as that for the proposed STP Units 3 & 4.

Air Quality

Air quality impacts would be minimal. Air emissions are primarily from non-facility equipment and diesel generators and are comparable to those associated with the continued operation of STP Units 1 & 2. Overall, emissions and associated impacts would be considered SMALL.

Waste Management

High-level radioactive wastes would be similar to those associated with the continued operation of STP Units 1 & 2. Low-level radioactive waste impacts from a new nuclear plant would be slightly greater but similar to the continued operation of STP Units 1 & 2. The overall impacts are characterized as SMALL.

Other Impacts

Based on the COL Application for STP Units 3 & 4, STPNOC estimates that construction of the reactors and auxiliary facilities would affect approximately 540 acres of land and associated terrestrial habitat. Because most of this construction would be on previously disturbed land, impacts at the STP site would be SMALL to MODERATE. For the purposes of analysis, STPNOC has assumed that the existing rail line would be used for reactor vessel and other deliveries under this alternative; however, deliveries could arrive by truck, rail, or barge, with the heaviest and largest loads arriving by barge. Visual impacts would be consistent with the industrial nature of the site. As with any large construction project, some erosion, sedimentation, and fugitive dust emissions could be anticipated, but would be minimized by using best management practices. Debris from clearing and grubbing could be disposed of on site.

STPNOC estimates a peak construction work force of 5,950 and an operational workforce of 888. Due to the proximity of the site to the Houston-Galveston metropolitan area, STPNOC think that the surrounding communities would experience small demands on housing and public services. Long-term job opportunities would be comparable to continued operation of STP Units 1 & 2. Therefore, STPNOC concludes that the socioeconomic impacts during operation would be SMALL.

STPNOC estimates that other construction and operation impacts would be SMALL. In most cases, the impacts would be detectable, but they would not destabilize any important attribute of the resource involved. Due to the minor nature of these other impacts, mitigation would not be warranted beyond that previously mentioned.

7.2.2.4 Purchased Power

As discussed in Section 7.2.1.2, STPNOC assumed that the generating technology used under the purchased power alternative would be one of those that NRC analyzed in the GEIS.

STPNOC is also adopting by reference the NRC analysis of the environmental impacts from those technologies. Under the purchased power alternative, therefore, environmental impacts would still occur, but they would likely originate from a power plant located elsewhere in ERCOT.

The purchased power alternative would likely include constructing high-voltage (i.e., 345- or 525-kV) transmission lines to get power from the remote locations in the southwest to the Houston, San Antonio, and Austin load centers. STPNOC thinks most of the transmission lines could be routed along existing rights of way. STPNOC assumes that the environmental impacts of transmission line construction would be moderate. As indicated in the introduction to Section 7.2.1.1, the environmental impacts of construction and operation of new nuclear, coal- or gas-fired generating capacity for purchased power at a previously undisturbed greenfield site would exceed those of a new nuclear, coal- or gas-fired alternative located on the STP site.

7.3 TABLES AND FIGURES

Table 7.2-1. Gas-Fired Alternative

Characteristic	Basis
Plant size = 2,560 MWe ISO rating net combined cycle plant consisting of four 640 MWe units	Assumed
Plant size = 2,667 MWe ISO rating gross	Based on 4 percent onsite power usage
Fuel type = natural gas	Assumed
Fuel heating value = 1,023 Btu/ft^3	2007 value for gas used in Texas (EIA 2008b)
Fuel SO_2 content = 0.00066 lb/MMBtu	USEPA 2000a
NO_x control = selective catalytic reduction (SCR) with steam/water injection	Best available for minimizing NO_x emissions (USEPA 2000b)
Fuel NO_x content = 0.0109 lb/MMBtu	Typical for large SCR-controlled gas fired units with water injection (USEPA 2000b)
Fuel CO content = 0.00226 lb/MMBtu	Typical for large SCR-controlled gas fired units (USEPA 2000b)
Fuel PM_{10} content = 0.0019 lb/MMBtu	USEPA 2000a
Heat rate = 5,690 Btu/kWh	Typical for H-Class gas-fired combined-cycle plant (GE 2008)
Capacity factor = 0.90	Assumed based on performance of modern combined-cycle baseload plants

[a] The difference between “net” and “gross” is electricity consumed onsite.

Btu = British thermal unit
CO = carbon monoxide
ft^3 = cubic foot
ISO rating = International Standards Organization rating at standard atmospheric conditions of 59°F, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch
kWh = kilowatt hour
lb = pound
MM = million
MWe = megawatt-electric
NO_x = nitrogen oxides
PM_{10} = particulates having diameter of 10 microns or less
SCR = selective catalytic reduction
SO_2 = sulfur dioxide
≤ = less than or equal to

Table 7.2-2. Coal-Fired Alternative

Characteristic	Basis
Plant size = 2,560 MWe ISO rating net consisting of four 640 MWe (net) Units	Assumed
Plant size = 2,723 MWe ISO rating gross	Based on 6 percent onsite power usage
Boiler type = tangentially fired, dry-bottom	Minimizes nitrogen oxides emissions (USEPA 1998)
Fuel type = sub-bituminous, pulverized coal	Typical for PRB coal used in Texas
Fuel heating value = 8,200 Btu/lb	Typical value for PRB coal (NRG 2006)
Fuel ash content by weight = 3.9 percent	Typical value for PRB coal (NRG 2006)
Fuel sulfur content by weight = 0.3 percent	Typical value for PRB coal (NRG 2006)
Uncontrolled NO_x emission = 7.2 lb/ton	Typical for pulverized coal, tangentially fired, sub-bituminous, NSPS (USEPA 1998)
Uncontrolled CO emission = 0.5 lb/ton	Typical for pulverized coal, tangentially fired, sub-bituminous, NSPS (USEPA 1998)
Heat rate = 8,740 Btu/kWh	Estimated heat rate of supercritical coal-fired boilers going online in 2025 (EIA 2008c)
Capacity factor = 0.90	Typical for large coal-fired units
NO_x control = low NO_x burners, over-fire air and selective catalytic reduction (95 percent reduction)	Best available and widely demonstrated for minimizing NO_x emissions (USEPA 1998)
Particulate control = fabric filters (baghouse-99.9 percent removal efficiency)	Best available for minimizing particulate emissions (USEPA 1998)
SO_2control = wet scrubber - limestone (95 percent removal efficiency)	Best available for minimizing SO_2emissions (USEPA 1998)
Hg control = wet limestone scrubber with fabric Filter (baghouse - 96 percent removal efficiency)	Best available and widely demonstrated for minimizing Hg (USEPA 1998)

[a] The difference between “net” and “gross” is electricity consumed onsite.

Btu = British thermal unit
CO = carbon monoxide
Hg = Mercury
ISO rating = International Standards Organization rating at standard atmospheric conditions of 59°F, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch
kWh = kilowatt hour
lb = pound
MWe = megawatt-electric
NSPS = New Source Performance Standard
NO_x = nitrogen oxides
PRB = Powder River Basin
SO_2 = sulfur dioxide
≤ = less than or equal to

Table 7.2-3. Air Emissions from Gas-Fired Alternative

Parameter	Calculation	Result
Annual gas consumption	$\frac{2667\text{ MW}}{\text{plant}} \times \frac{5690\text{ Btu}}{\text{kWh}} \times \frac{1{,}000\text{ kW}}{\text{MW}} \times \frac{\text{ft}^3}{1{,}023\text{ Btu}} \times 0.90 \times \frac{(24 \text{ x } 365)\text{ hr}}{\text{yr}}$	116,937,008,798 ft^3 of gas per year
Annual Btu input	$\frac{116{,}937{,}008{,}798\text{ ft}^3}{\text{yr}} \times \frac{1{,}023\text{ Btu}}{\text{ft}^3} \times \frac{\text{MMBtu}}{10^6\text{ Btu}}$	119,626,560 MMBtu per year
SO_2[a]	$\frac{0.00066\text{ lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\text{ lb}} \times \frac{119{,}626{,}560\text{ MMBtu}}{\text{yr}}$	39 tons SO_2 per year
NO_x[b]	$\frac{0.0109\text{ lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\text{ lb}} \times \frac{119{,}626{,}560\text{ MMBtu}}{\text{yr}}$	652 tons NO_x per year
CO[b]	$\frac{0.00226\text{ lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\text{ lb}} \times \frac{119{,}626{,}560\text{ MMBtu}}{\text{yr}}$	135 tons CO per year
$PM_{2.5}$[a]	$\frac{0.0019\text{ lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\text{ lb}} \times \frac{119{,}626{,}560\text{ MMBtu}}{\text{yr}}$	114 tons $PM_{2.5}$ per year
CO_2[b]	$\frac{110\text{ lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\text{ lb}} \times \frac{119{,}626{,}560\text{ MMBtu}}{\text{yr}}$	6,579,461 tons CO_2 per year

[a] USEPA 2000a.
[b] USEPA 2000b.
CO = carbon monoxide
CO_2 = carbon dioxide
NO_x = nitrogen oxides
$PM_{2.5}$ = particulates having diameter of 2.5 microns or less
SO_2 = sulfur dioxide

Table 7.2-4. Air Emissions from Coal-Fired Alternative

Parameter	Calculation	Result
Annual coal consumption	$\frac{2723\ \text{MW}}{\text{plant}} \times \frac{1000\ \text{kW}}{\text{MW}} \times \frac{8740\ \text{Btu}}{\text{kMh}} \times \frac{\text{lb}}{8200\ \text{Btu}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times 0.9 \times \frac{(365 \text{ x } 24)\ \text{hr}}{\text{yr}}$	11,442,642 tons of coal per year
SO_2[a,c]	$\frac{35 \times 0.3\ \text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{100 - 95}{100} \times \frac{11{,}442{,}642\ \text{tons}}{\text{yr}}$	3,004 tons SO_2 per year
NO_x[b,c]	$\frac{7.2\ \text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{100 - 95}{100} \times \frac{11{,}442{,}642\ \text{tons}}{\text{yr}}$	2,060 tons NO_x per year
CO[c]	$\frac{0.5\ \text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{11{,}442{,}642\ \text{tons}}{\text{yr}}$	2,861 tons CO per year
PM_{10}[d]	$\frac{2.3 \times 3.9\ \text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{100 - 99.9}{100} \times \frac{11{,}442{,}642\ \text{tons}}{\text{yr}}$	51 tons PM_{10} per year
$PM_{2.5}$[e]	$\frac{0.6 \times 3.9\text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{100 - 99.9}{100} \times \frac{11{,}442{,}642\ \text{tons}}{\text{yr}}$	13 tons $PM_{2.5}$ per year
CO_2[f]	$\frac{4810\ \text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{11{,}442{,}642\ \text{tons}}{\text{yr}}$	27,519,554 tons CO_2 per year
Hg[g]	$\frac{0.000083\ \text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{11{,}442{,}642\ \text{tons}}{\text{yr}}$	0.47 tons Hg per year

[a] USEPA 1998, Table 1.1-1
[b] USEPA 1998, Table 1.1-2
[c] USEPA 1998, Table 1.1-3
[d] USEPA 1998, Table 1.1-4
[e] USEPA 1998, Table 1.1-6
[f] USEPA 1998, Table 1.1-20
[g] USEPA 1998, Table 1.1-18
CO = carbon monoxide
CO_2 = carbon dioxide
NO_x = nitrogen oxides
PM_{10} = particulates having diameter less than 10 microns
$PM_{2.5}$ = particulates having diameter less than 2.5 microns
SO_2 = sulfur dioxide
Hg = mercury

Table 7-2.5. Solid Waste from Coal-Fired Alternative

Parameter	Calculation	Result
Annual SO_2 generated[a]	$\frac{0.30}{100} \times \frac{64.065 \text{ tons } SO_2}{32.066 \text{ tons S}} \times \frac{11{,}442{,}642 \text{ tons coal}}{\text{yr}}$	68,584 tons of SO_2 per year
Annual SO_2 removed	$\frac{65{,}584 \text{ tons } SO_2}{\text{yr}} \times \frac{95}{100}$	65,155 tons of SO_2 per year
Annual ash generated	$\frac{11{,}442{,}642 \text{ tons coal}}{\text{yr}} \times \frac{3.9 \text{ tons ash}}{100 \text{ tons coal}} \times \frac{99.9}{100}$	445,817 tons of ash per year
Annual ash recycled	$445{,}817 \text{ tons ash} \times \frac{43}{100}$	193,268 tons of ash recycled per year
Annual ash disposed	$445{,}817 \text{ tons generated} - 193{,}268 \text{ tons recycled}$	252,549 tons of ash disposed per year
Annual limestone consumption[b]	$\frac{68{,}584 \text{ tons } SO_2}{\text{yr}} \times \frac{100.087 \text{ tons } CaCO_3}{64.065 \text{ tons } SO_2}$	107,147 tons of $CaCO_3$ per year
Calcium sulfite[c]	$\frac{65{,}155 \text{ tons } SO_2}{\text{yr}} \times \frac{120.142 \text{ tons } CaSO_3}{64.065 \text{ tons } SO_2}$	122,186 tons of $CaSO_3$ per year
Annual scrubber sludge generated[d]	$\frac{107{,}147 \text{ tons } CaCO_3}{\text{yr}} \times \frac{100-95}{100} + 122{,}186 \text{ tons } CaSO_3$	127,543 tons scrubber sludge per year
Annual scrubber sludge recycled	$127{,}543 \text{ tons} \times \frac{31}{100}$	39,622 tons scrubber sludge recycled per year
Annual scrubber sludge waste	127,543 tons - 39,622 tons	87,921 tons scrubber waste per year
Total volume of scrubber waste[e]	$\frac{87{,}921 \text{ tons}}{\text{yr}} \times 40 \text{ yr} \times \frac{2{,}000 \text{ lb}}{\text{ton}} \times \frac{\text{ft}^3}{102 \text{ lb}}$	68,958,023 ft^3 of scrubber waste
Total volume of ash disposed[f]	$\frac{202{,}549 \text{ tons}}{\text{yr}} \times 40 \text{ yr} \times \frac{2{,}000 \text{ lb}}{\text{ton}} \times \frac{\text{ft}^3}{100 \text{ lb}}$	202,039,099 ft^3 of ash
Total volume of solid waste	68,958,023 ft^3 + 202,039,099 ft^3	270,997,122 ft^3 of solid waste
Waste pile area (acres)	$\frac{270{,}997{,}122 \text{ ft}^3}{30 \text{ ft}} \times \frac{\text{acre}}{43{,}560 \text{ ft}^2}$	207 acres of solid waste

Table 7.2-5. Solid Waste from Coal-Fired Alternative (continued)

Parameter	Calculation	Result
Waste pile area (ft x ft square)	$\sqrt{(270{,}997{,}122 \text{ ft}^3/30 \text{ ft})}$	3,005.5 feet by feet square of solid waste

Based on annual coal consumption of 11,442,642 tons per year (Table 7.2-4).
[a] Calculations assume 100 percent combustion of coal.
[b] Limestone consumption is based on total SO_2 generated.
[c] Calcium sulfite generation is based on total SO_2 removed.
[d] Total scrubber waste includes scrubbing media carryover.
[e] Density of scrubber sludge is 102 lb/ft^3 (FHA 1998).
[f] Density of coal bottom ash is 100 lb/ft^3 (FHA 1998)
S = sulfur
SO_2 = sulfur dioxide
$CaCO_3$ = calcium carbonate (limestone)
$CaSO_3$ = calcium sulfite

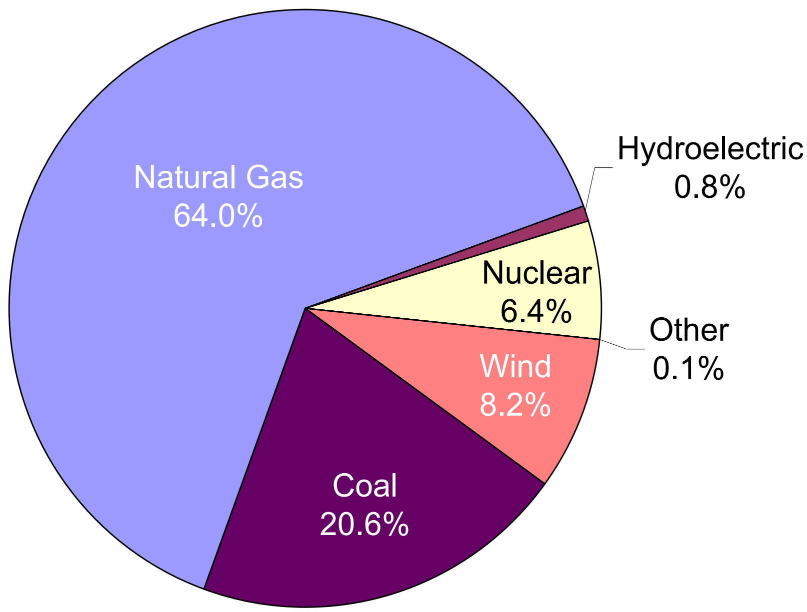

Figure 7.2-1. ERCOT Generating Capacity by Fuel Type, 2008

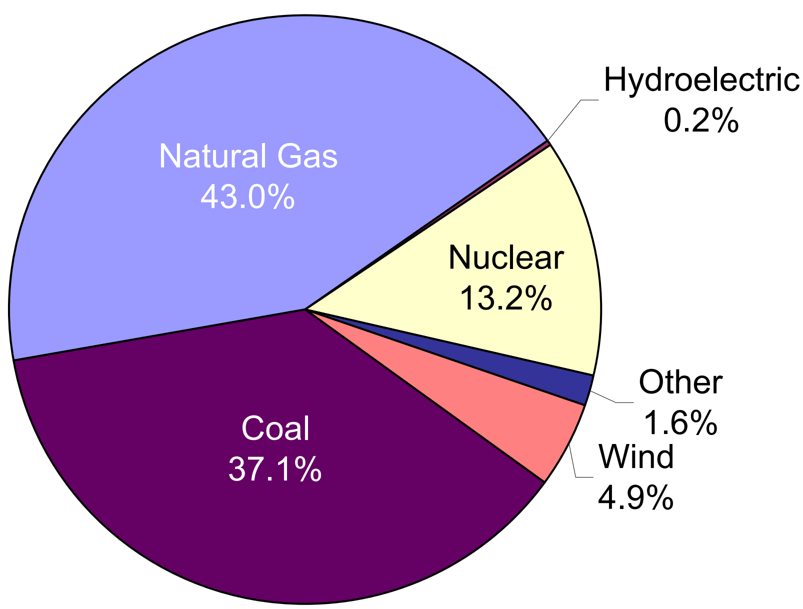

Figure 7.2-2. ERCOT Generation by Fuel Type, 2008

7.4 CHAPTER 7 REFERENCES

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8.0 CHAPTER 8 - COMPARISON OF ENVIRONMENTAL IMPACTS OF LICENSE RENEWAL WITH ALTERNATIVES

NRC

> "To the extent practicable, the environmental impacts of the proposal and the alternatives should be presented in comparative form..." 10 CFR 51.45(b)(3) as adopted by 51.53(c)(2)

Chapter 4 analyzes environmental impacts of STP Units 1 & 2 license renewal and Chapter 7 analyzes impacts of reasonable alternatives. Table 8.1-1 summarizes environmental impacts of the proposed action (license renewal) and the reasonable alternatives, for comparison purposes. The environmental impacts compared in Table 8.1-1 are those that are either Category 2 issues for the proposed action or are issues that the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) identified as major considerations in an alternatives analysis (NRC 1996). For example, although the NRC concluded that air quality impacts from the proposed action would be small (Category 1), the GEIS identified major human health concerns associated with air emissions from alternatives (Section 7.2.2). Therefore, Table 8.1-1 includes a comparison of the air impacts from the proposed action to those of the alternatives. Table 8.1-2 is a more detailed comparison of the alternatives.

8.1 TABLES

Table 8.1-1. Impacts Comparison Summary

Impact	Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives			
			With New Nuclear Power	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Land Use	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL	SMALL to MODERATE
Water	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE
Air Quality	SMALL	SMALL	SMALL	MODERATE	MODERATE	SMALL to MODERATE
Ecological Resources	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL	SMALL to MODERATE
Threatened or Endangered Species	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Human Health	SMALL	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE
Socioeconomics	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE
Waste Management	SMALL	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE
Aesthetics	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE
Cultural Resources	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL

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

MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource. 10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 3.

Table 8.1-2. Impacts Comparison Detail

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives			
		With New Nuclear Power	**With Coal-Fired Generation**	**With Gas-Fired Generation**	**With Purchased Power**
		Alternative Descriptions			
STP Units 1 & 2 license renewal for 20 years, followed by decommissioning	Decommissioning following expiration of current STP Units 1 & 2 licenses. Adopting by reference, as bounding STP Units 1 & 2 decommissioning, GEIS description (NRC 1996)	New construction at the existing site (Section 7.2.1.2)	New construction at the existing site (Section 7.2.1.1)	New construction at the existing site (Section 7.2.1.1)	Would involve construction of new generation capacity in the ERCOT region. Adopting by reference GEIS description of alternate technologies (Section 7.2.1.3)
		Existing rail would be used	Existing rail would be used	Construct 16-inch-diameter gas pipeline in a 75-ft-wide corridor. May require upgrades to existing pipelines.	Construct new transmission lines to interconnect to the ERCOT region
		Two 1,200-MWe nuclear units using the ABWR, an NRC certified standard design	Four 640-MWe (net) tangentially fired, dry-bottom units producing a combined total of 2,560 MWe net. capacity factor 0.90	Four pre-engineered 640-MWe (net) gas-fired combined-cycle systems with heat recovery steam generators, producing combined total of 2,560 MWe. Capacity factor: 0.90	

Table 8.1-2. Impacts Comparison Detail (continued)

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives: With New Nuclear Power	No-Action Alternatives: With Coal-Fired Generation	No-Action Alternatives: With Gas-Fired Generation	No-Action Alternatives: With Purchased Power
			Pulverized sub-bituminous coal, 8,200 Btu/lb; 8,740 Btu/kWh; 3.9% ash; 0.3% sulfur; 7.2 lb/ton nitrogen oxides; 11.4×10^6 tons coal/yr	Natural gas, 1,023 Btu/ft^3; 5,690 Btu/kWh; 0.00066 lb sulfur/MMBtu; 0.0109 lb NO_X/MMBtu; 1.17×10^{11} MMBtu gas/yr	
			Low NO_X burners, over-fire air and selective catalytic reduction (95% NO_X reduction efficiency)	Selective catalytic reduction with steam/water injection	
			Wet scrubber – lime/limestone desulfurization system (95% SO_2 removal efficiency); 107,147 tons limestone/yr		
			Fabric filters 99.9% particulate removal efficiency)		
1,378 permanent and long-term contract employees at STP Units 1 & 2 (Section 3.4)		888 workers (Section 7.2.2.3)	348 workers (Section 7.2.2.2)	97 workers (Section 7.2.2.1)	

Table 8.1-2. Impacts Comparison Detail (continued)

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives			
		With New Nuclear Power	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Land Use Impacts					
SMALL – Adopting by reference Category 1 issue findings (Attachment A, Table A-1, Issues 52, 53)	SMALL – Not an impact evaluated by GEIS (NRC 1996)	SMALL to MODERATE – 540 acres required for the power block and associated facilities at STP Units 1 & 2 location (Section 7.2.2.3)	SMALL to MODERATE – 353 acres required for the power block and associated facilities at STP Units 1 & 2 location; 207 acres for ash disposal during 20-year license renewal term (Section 7.2.2.2)	SMALL– 90 acres for facility at STP Units 1 & 2 location (Section 7.2.2.1). 18 acres for a new gas pipeline that would be built to connect with existing gas pipeline corridor	SMALL to MODERATE – Some transmission facilities could be constructed along existing transmission corridors. Adopting by reference GEIS description of land use impacts from alternate (NRC 1996)
Water Impacts					
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 3and 7, 9-11, and 37). Three Category 2 issues do not apply (Section 4.5, Issue 33 Section 4.7, Issue 35; and Section 4.8, Issue 39). There are no demonstrated adverse impacts related to water use conflicts (Section 4.1, Issue 13) or groundwater use (Section 4.6, Issue 34).	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 89).	SMALL – Construction impacts minimized by use of best management practices. Operational impacts similar to STP Units 1 & 2 by using the existing Main Cooling Reservoir. (Section 7.2.2.3)	SMALL – Construction impacts minimized by use of best management practices. Operational impacts similar to STP Units 1 & 2 by using the existing Main Cooling Reservoir. (Section 7.2.2.2)	SMALL – Water demands would be less than those from operation of STP Units 1 & 2. (Section 7.2.2.1)	SMALL to MODERATE – Adopting by reference GEIS description of water quality impacts from alternate technologies

Table 8.1-2. Impacts Comparison Detail (continued)

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives: With New Nuclear Power	No-Action Alternatives: With Coal-Fired Generation	No-Action Alternatives: With Gas-Fired Generation	No-Action Alternatives: With Purchased Power
Air Quality Impacts					
SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 51). One Category 2 issue does not apply (Section 4.11, Issue 50).	SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issue 88)	SMALL – Air emissions are primarily from non-facility equipment and diesel generators and are comparable to those associated with the continued operation of STP Units 1 & 2 (Section 7.2.2.3)	MODERATE – 3,004 tons SO_2/yr 2,060 tons NO_X/yr 2,861 tons CO/yr 27.5×10^6 tons CO_2/yr 13 tons $PM_{2.5}$/yr 51 tons PM_{10}/yr 0.47 tons mercury/yr (Section 7.2.2.2)	MODERATE – 39 tons SO_2/yr 652 tons NO_X/yr 135 tons CO/yr 6.58×10^6 tons CO_2/yr 114 tons $PM_{2.5}$/yr (Section 7.2.2.1)	SMALL to MODERATE – Adopting by reference GEIS description of air quality impacts from alternate technologies (NRC 1996)
Ecological Resource Impacts					
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 15-24, 28 – 30, and 45-48) and Category 2. One Category 2 issue does not apply (Section 4.9, Issue 40). Entrainment and impingement mitigation measures are already in place and there are no demonstrated adverse impacts (Section 4.2, Issue 25; Section 4.3, Issue 26). Thermal requirements of NPDES permit are being met and no demonstrated impacts due to the thermal discharge (Section 4.4, Issue 27).	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 90)	SMALL to MODERATE – 540 acres of land would be required for the power block and associated facilities at STP Units 1 & 2 location; some would be previously undisturbed land and associated terrestrial habitat (Section 7.2.2.3)	SMALL to MODERATE – 353 acres of the existing site could be required for the power block and associated facilities at STP Units 1 & 2 location. Approximately 200 acres of the existing site could be required for ash/sludge disposal during 20-year license-renewal term (Section 7.2.2.2)	SMALL – 90 acres of land would be required for the power block and associated facilities at STP Units 1 & 2 location; some would be previously undisturbed land and associated terrestrial habitat. 18 acres disturbed during pipeline construction. Pipeline would be routed along previously disturbed areas to minimize impacts (Section 7.2.2.1)	SMALL to MODERATE – Adopting by reference GEIS description of ecological resource impacts from alternate technologies (NRC 1996)

Table 8.1-2. Impacts Comparison Detail (continued)

		No-Action Alternatives			
Proposed Action (License Renewal)	**Base (Decommissioning)**	**With New Nuclear Power**	**With Coal-Fired Generation**	**With Gas-Fired Generation**	**With Purchased Power**
Threatened or Endangered Species Impacts					
SMALL – STPNOC has no plans to alter current operations and maintenance practices and there are no current impacts to threatened or endangered species. (Section 4.10, Issue 49)	SMALL – Not an impact evaluated by GEIS (NRC 1996)	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats
Human Health Impacts					
SMALL to MODERATE – Adopting by reference Category 1 issues (Table A-1, Issues 58, 61, 62). One Category 2 issue does not apply (Section 4.12, Issue 57). Although a few locations exceed NESC code requirements for transmission line induced current, the risk is minimal due to remote nature of the locations (Section 4.13, Issue 59)	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 86)	SMALL – Impacts would be comparable to continued operation of STP Units 1 & 2 (Section 7.2.2.3)	MODERATE – Adopting by reference GEIS conclusion that risks such as cancer and emphysema from emissions are likely (NRC 1996)	SMALL – Adopting by reference GEIS conclusion that some risk of cancer and emphysema exists from emissions (NRC 1996)	SMALL to MODERATE – Adopting by reference GEIS description of human health impacts from alternate technologies (NRC 1996)

Table 8.1-2. Impacts Comparison Detail (continued)

		No-Action Alternatives			
Proposed Action (License Renewal)	**Base (Decommissioning)**	**With New Nuclear Power**	**With Coal-Fired Generation**	**With Gas-Fired Generation**	**With Purchased Power**
		Socioeconomic Impacts			
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 64, 67). Two Category 2 issues findings are not applicable (Section 4.16, Issue 66 and Section 4.17.1, Issue 68). Location in high population area with no growth controls minimizes potential for housing impacts. Section 4.14, Issue 63). Plant property tax payment represents more than 20 percent of the taxes paid to Matagorda County and Palacios ISD. No population growth is expected. (Section 4.17.2, Issue 69). Public utilities and transportation would not be affected because no additional employees are expected (Section 4.15, Issue 65; and Section 4.18, Issue 70)	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 91)	SMALL – Long-term job opportunities would be comparable to continued operation of STP Units 1 & 2 (Section 7.2.2.3)	SMALL – Reduction in permanent workforce at STP Units 1 & 2 would be minimized by the proximity to the Houston-Galveston Metropolitan Area. (Section 7.2.2.2)	SMALL – Reduction in permanent workforce at STP Units 1 & 2 would be minimized by the proximity to the Houston-Galveston Metropolitan Area. (Section 7.2.2.1)	MODERATE – Adopting by reference GEIS description of socioeconomic impacts from alternate technologies (NRC 1996)

Table 8.1-2. Impacts Comparison Detail (continued)

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives			
		With New Nuclear Power	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Waste Management Impacts					
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 77-85)	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 87)	SMALL – radioactive wastes would be similar to those associated with the continued operation of STP Units 1 & 2 (Section 7.2.2.3)	MODERATE – 252,549 tons of coal ash and 87,921 tons of scrubber sludge annually would require 207 acres during 20-year license renewal term (Section 7.2.2.2)	SMALL – The only noteworthy waste would be from spent selective catalytic reduction (SCR) used for NO_X control (Section 7.2.2.1)	SMALL to MODERATE – Adopting by reference GEIS description of waste management impacts from alternate technologies (NRC 1996)
Aesthetic Impacts					
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 73, 74)	SMALL – Not an impact evaluated by GEIS (NRC 1996)	SMALL – Visual impacts would be comparable to those from existing STP Units 1 & 2 facilities (Section 7.2.2.3)	SMALL – Steam turbines, stacks, and rail deliveries would be comparable to those from existing STP Units 1 & 2 facilities (Section 7.2.2.2)	SMALL– Steam turbines and stacks would create visual impacts comparable to those from existing STP Units 1 & 2 facilities (Section 7.2.2.1)	SMALL to MODERATE – Adopting by reference GEIS description of aesthetic impacts from alternate technologies (NRC 1996)

Table 8.1-2. Impacts Comparison Detail (continued)

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives			
		With New Nuclear Power	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Cultural Resource Impacts					
SMALL – SHPO consultation minimizes potential for impact (Section 4.19, Issue 71). No new facilities are planned and corporate procedures address discovery of cultural resources.	SMALL – Not an impact evaluated by GEIS (NRC 1996)	SMALL – Impacts to cultural resources would be unlikely due to developed nature of the site. (Section 7.2.2.3)	SMALL – Impacts to cultural resources would be unlikely due to developed nature of the site. (Section 7.2.2.2)	SMALL – Impacts to cultural resources would be unlikely due to developed nature of the site. (Section 7.2.2.1)	SMALL – Adopting by reference GEIS description of cultural resource impacts from alternate technologies (NRC 1996)

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

MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource. (10 CFR 51, Subpart A, Appendix B, Table B 1, Footnote 3).

a. All particulate matter for gas-fired alternative is $PM_{2.5}$.

Btu =British thermal unit
ft^3 = cubic foot
gal = gallon
GEIS = Generic Environmental Impact Statement (NRC 1996)
kWh = kilowatt hour
lb = pound
MM = million
MW = megawatt
NO_X = nitrogen oxide
ISO-NE = regional electric distribution network
$PM_{2.5}$ = particulates having diameter less than 2.5 microns
PM_{10} = particulates having diameter less than 10 microns
SHPO = State Historic Preservation Officer
SO_2 = sulfur dioxide
Yr = year

8.2 CHAPTER 8 REFERENCES

NRC (U.S. Nuclear Regulatory Commission 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS), Volumes 1 and 2, NUREG-1437, Washington, DC. May.

9.0 CHAPTER 9 - STATUS OF COMPLIANCE

9.1 PROPOSED ACTION

NRC

"The environmental report shall list all federal permits, licenses, approvals and other entitlements which must be obtained in connection with the proposed action and shall describe the status of compliance with these requirements. The environmental report shall also include a discussion of the status of compliance with applicable environmental quality standards and requirements including, but not limited to, applicable zoning and land-use regulations, and thermal and other water pollution limitations or requirements which have been imposed by Federal, State, regional, and local agencies having responsibility for environmental protection…." 10 CFR 51.45(d), as adopted by 10 CFR 51.53(c)(2)

9.1.1 General

Table 9.1-1 lists environmental authorizations for current STP Units 1 & 2 operations. In this context "authorizations" includes any permits, licenses, approvals, or other entitlements STPNOC expects to continue renewing these authorizations during the current license period and through the U.S. Nuclear Regulatory Commission (NRC) license-renewal period. Based on the new and significant information identification process described in Chapter 5, STPNOC concludes that STP Units 1 & 2 are currently in compliance with applicable environmental standards and requirements.

Table 9.1-2 lists additional environmental authorizations and consultations related to renewal of the STP Units 1 & 2 license to operate. As indicated, STPNOC anticipates needing relatively few such authorizations and consultations. Sections 9.1.2 through 9.1.5 discuss some of these items in more detail.

9.1.2 Threatened or Endangered Species

Section 7 of the Endangered Species Act (16 USC 1536) requires federal agencies to ensure that agency action is not likely to jeopardize any species that is listed or proposed for listing as endangered or threatened. Depending on the action involved, the Act requires consultation with the U.S. Fish and Wildlife Service (USFWS) regarding effects on non-marine species, the National Oceanic and Atmospheric Administration (NOAA) Fisheries Service regarding effects on marine species, or both. USFWS and NOAA Fisheries Service have issued joint procedural regulations at 50 CFR 402, Subpart B, that address consultation, and USFWS maintains the joint list of threatened and endangered species at 50 CFR 17.

Although not required of an applicant by federal law or NRC regulation, STPNOC has chosen to invite comment from both federal and state agencies regarding potential effects that STP Units 1 & 2 license renewal might have on threatened and endangered species. Attachment C includes copies of STPNOC correspondence with USFWS, NOAA Fisheries Service, and the Texas Parks and Wildlife Department.

9.1.3 Coastal Zone Management Program Compliance

The Federal Coastal Zone Management Act (16 USC 1451) imposes requirements on applicants for a federal license to conduct an activity that could affect a state's coastal zone. The Act requires the applicant to certify to the licensing agency that the proposed activity would be consistent with the state's federally approved coastal zone management program [16 USC 1456(c)(3)(A)]. The NOAA has promulgated implementing regulations indicating that the requirement is applicable to renewal of federal licenses for activities not previously reviewed by the state [15 CFR 930.51(b)(1)]. The regulation requires that the license applicant provide its certification to the federal licensing agency and a copy to the applicable state agency [15 CFR 930.57(a)].

The NRC Office of Nuclear Reactor Regulation has issued guidance to its staff regarding compliance with the Act (NRC 2004). This Guidance acknowledges that Texas has an approved coastal zone management program (NRC 2004, Attachment E). STP Units 1 & 2 are within the Texas Coastal Zone.

STPNOC submitted a copy of the Environmental Report, including the Coastal Zone Consistency Certification (Attachment G of this document) to the Texas Coastal Coordination Council in fulfillment of the regulatory requirement for submitting a copy of the coastal zone consistency certification to the state. In response, the Texas Coastal Coordination Council determined that pursuant to Section 506.11(13), the license renewal of STP Units 1 & 2 is consistent with the Texas Coastal Management Plan goals and policies).

9.1.4 Historic Preservation

Section 106 of the National Historic Preservation Act (16 USC 470f) requires federal agencies having the authority to license any undertaking, prior to issuing the license, to take into account the effect of the undertaking on historic properties and to afford the Advisory Committee on Historic Preservation an opportunity to comment on the undertaking. Committee regulations provide for establishing an agreement with any State Historic Preservation Officer (SHPO) to substitute state review for Committee review (36 CFR 800.7). Although not required of an applicant by federal law or NRC regulation, STPNOC has chosen to invite comment by the Texas SHPO. Attachment D includes copies of STPNOC correspondence with the Texas Historical Commission regarding potential effects that STP Units 1 & 2 license renewal might have on historic or cultural resources.

9.1.5 Water Quality (401) Certification

Federal Clean Water Act Section 401 requires applicants for a federal license to conduct an activity that might result in a discharge into navigable waters to provide the licensing agency a certification from the state that the discharge will comply with applicable Clean Water Act requirements (33 USC 1341). NRC has indicated in its Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants (GEIS) that issuance of a National Pollutant Discharge Elimination System (NPDES) permit implies certification by the state (NRC 1996). STP Units 1 & 2 hold a Texas Pollutant Discharge Elimination System (TPDES) permit, the Texas equivalent to a NPDES permit. This permit allows discharge to the lower Colorado River from the Main Cooling Reservoir. Such a discharge has only occurred as a test of the blowdown system in 1997. Attachment B contains the first page of the current STP Units 1 & 2 TPDES permit, which authorizes plant discharges. Consistent with the GEIS, STPNOC is providing evidence of STP Units 1 & 2's TPDES permit as evidence of water quality (401) certification.

9.2 ALTERNATIVES

NRC

> "…The discussion of alternatives in the report shall include a discussion of whether the alternatives will comply with such applicable environmental quality standards and requirements." 10 CFR 54.45(d) as adopted by 10 CFR 51.53(c)(2)

Section 7.2 presents fossil-fuel-fired generation (Sections 7.2.1.1 and 7.2.1.2), advanced light water reactor (Section 7.2.1.3), and purchased power (Section 7.2.1.4) as reasonable alternatives to license renewal. These alternatives probably could be constructed and operated to comply with all applicable environmental quality standards and requirements. STPNOC notes that increasingly stringent air quality protection requirements could make the construction of a large fossil-fueled power plant infeasible in many locations. STPNOC also notes that the U.S. Environmental Protection Agency has new requirements for the design and operation of cooling water intake structures at new and existing facilities (40 CFR 125 Subparts I and J).

STP Units 1 & 2 use a closed cycle cooling pond (MCR) that receives its makeup water from the lower Colorado River. As discussed in Sections 4.1 and 4.2, in the original NPDES permit for STP, the EPA permit writers concluded that "…the intake structure is approved by (as) Best Available Technology in accordance with Section 316(b) of the CWA." In addition, a recent evaluation of entrainment and impingement at the circulating water intake on the MCR, concludes that any environmental impact from entrainment or impingement of fish and shellfish in early life stages at STP is SMALL and does not require further mitigation. The cooling water requirements for the coal-fired and advanced light water reactor alternatives would be similar to that of STP Units 1 & 2, while the cooling water requirements for the gas-fired alternative would be less. Therefore, STPNOC concludes that utilizing the existing circulating water intake on the MCR for the coal-fired, gas-fired, and advanced light water reactor alternatives would be consistent with the new requirements.

9.3 TABLES

Table 9.1-1 Environmental Authorizations for Current STP Units 1 & 2 Operations

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
Federal and State Requirements					
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011, et seq.), 10 CFR 50.10	License to operate	NPF-76	Issued: 03/22/1988 Expires: 08/20/2027	Operation of STP Unit 1
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011, et seq.), 10 CFR 50.10	License to operate	NPF-80	Issued: 12/16/1988 Expires: 12/15/2028	Operation of STP Unit 2
U.S. Department of Transportation	49 USC 5108	Registration	062110 550 067S	Issued: 06/21/2010 Expires: 06/30/2011	Hazardous materials shipments
U.S. Army Corps of Engineers	Section 10 of the Rivers and Harbors Act of 1899	Permit for maintenance dredging	Permit No. 10570 (USACE)	Issued: 11/04/2004 Expires: 12/31/2014	Maintenance dredging of barge slip
U.S. Army Corps of Engineers	Section 10 of the Rivers and Harbors Act of 1899	Permit for maintenance dredging	Permit No. SWG-1992-02707	Issued: 07/21/09 Expires: 12/31/2019	Maintenance dredging of intake
Texas Commission on Environmental Quality	Clean Water Act (33 USC Section 1251 et seq.) Texas Administrative Code (TAC) (30 TAC 305)	TPDES Permit	WQ0001908000	Issued: 07/21/2005 Expires: 12/01/2009 Draft permit has been issued, and is in the public notice period. If approved, the expiration date will be 12/1/2014.	Treat wastewater and discharge to Colorado River from Main Cooling Reservoir
Texas Commission on Environmental Quality	30 TAC 116	Air Permit	Permit No. 7410	Issued: 12/23/2004 Expires: 12/23/2014	Air permit for auxiliary boilers and voiding of a PSD permit, PSD-TX-209M1
Texas Commission on Environmental Quality	30 TAC 122	Federal Operating Air Permit	Permit No. 0801	Issued: 01/25/2006 Expires: 01/25/2011	Air permit for various emission sources

Table 9.1-1 Environmental Authorizations for Current STP Units 1 & 2 Operations (continued)

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
Federal and State Requirements (continued)					
Texas Commission on Environmental Quality	30 TAC 335	Registration of Industrial and Hazardous Waste	Solid Waste Registration No: 30651, EPA ID: TXD020810503	Issued: 08/16/1976 Expires: NA, registration must be amended upon changes in waste profile or activities	Registration of industrial and hazardous waste generation and management including onsite disposal of Class III industrial solid waste
Texas Commission on Environmental Quality	30 TAC 290	Potable Water System	TCEQ ID No. 1610103/1610051	Issued: NA Expires: NA Both systems are designated as active	Operation of public potable water system(s)
Texas Water Commission on Environmental Quality	Texas Water Code Sections 11.085 and 11.122	Certificate of Adjudication	14-5437A	Issued: 03/17/2009 Expires: NA	Water rights for diversion and impoundment of water from Colorado River
Tennessee Department of Environment and Conservation	Tennessee Code Annotated 68-202-206	License to ship radioactive material	T-TX-001-L10	Issued: 12/16/2009 Expires: 12/31/2010	Shipments of radioactive material to processing facilities in Tennessee
Utah Department of Environmental Quality	Utah Rule 313-26	License to ship radioactive material	Permit No. 0606003900	Issued: 07/21/2010 Expires: 07/21/2011	Shipments of radioactive material to disposal facility in Utah
Local Requirements					
Coastal Plains Groundwater Conservation District	Texas Water Code Chapter 36	Authorization for groundwater withdrawals	Permit No. OP-04122805	Issued: 02/07/2008 Expires: 02/28/2011	Groundwater withdrawal from five wells

TPDES – Texas Pollutant Discharge Elimination System

TABLE 9.1-2 Environmental Authorization for STP Units 1 & 2 License Renewal

Agency	Authority	Requirement	Remarks
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011 et seq.)	License renewal	Environmental Report submitted in support of license renewal application
U.S. Fish and Wildlife Service (FWS)	Endangered Species Act Section 7 (16 USC 1536)	Consultation	Requires federal agency issuing a license to consult with the FWS (Attachment C)
National Oceanic and Atmospheric Administration -National Marine Fisheries Service (NOAA-NMFS)	Endangered Species Act Section 7 (16 USC 1536)	Consultation	Requires federal agency issuing a license to consult with the NOAA-NMFS (Attachment C)
Texas Parks and Wildlife Department	Endangered Species Act Section 7 (16 USC 1536)	Consultation	TPWD consulted for any concerns related to threatened and endangered species (Attachment C)
Texas Environmental Quality Commission	Clean Water Act Section 401 (33 USC 1341)	Certification	Requires State certification that proposed action would comply with Clean Water Act standards (Attachment B)
Texas Historical Commission	National Historic Preservation Act Section 106 (16 USC 470f)	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with State Historic Preservation Officer (Attachment D)
Texas Coastal Coordination Council	Federal Coastal Zone Management Act (16 USC 1451 et seq.)	Certification	Requires the applicant to certify to the licensing agency that the proposed activity would be consistent with the state's federally approved coastal zone management program

9.4 CHAPTER 9 REFERENCES

NRC (U.S. Nuclear Regulatory Commission) 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants. Volumes 1 and 2. NUREG-1437, Office of Nuclear Regulatory Research. Washington DC. May. NRC ADAMS Accession Numbers ML040690705 and ML040690738.

NRC (U.S. Nuclear Regulatory Commission) 2004. Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues. NRR Office Instruction No. LIC-203, Revision 1. May 24. NRC ADAMS Accession Number ML033550003.

ATTACHMENT A

NRC NEPA ISSUES FOR LICENSE RENEWAL OF NUCLEAR POWER PLANTS

STPNOC has prepared this environmental report in accordance with the requirements of NRC regulation 10 CFR 51.53. NRC included in the regulation a list of National Environmental Policy Act (NEPA) issues for license renewal of nuclear power plants.

Table A-1 lists these 92 issues and identifies the section in which STPNOC addresses each applicable issue in this environmental report. For organization and clarity, STPNOC has assigned a number to each issue and uses the issue numbers throughout the environmental report.

TABLES

Table A-1. STP Units 1 & 2 Environmental Report Cross-Reference of License Renewal NEPA Issues

Issue[a]	Category	Section of this Environmental Report	GEIS Cross Reference (Section/Page)[b]
Surface Water Quality, Hydrology, and Use (for all plants)			
1. Impacts of refurbishment on surface water quality	1	NA	Issue applies to an activity, refurbishment, which STP Units 1 & 2 do not plan to undertake.
2. Impacts of refurbishment on surface water use	1	NA	Issue applies to an activity, refurbishment, which STP Units 1 & 2 do not plan to undertake.
3. Altered current patterns at intake and discharge structures	1	4.0	4.4.2/4-52
4. Altered salinity gradients	1	NA	Issue applies to an activity, discharge to saltwater, which STP Units 1 & 2 do not plan to undertake.
5. Altered thermal stratification of lakes	1	NA	Issue applies to a plant feature, discharge to a lake, which STP Units 1 & 2 do not have.
6. Temperature effects on sediment transport capacity	1	NA	Issue applies to a plant feature, discharge to a river, which STP Units 1 & 2 do not have.
7. Scouring caused by discharged cooling water	1	4.0	4.4.2.2/4-53
8. Eutrophication	1	NA	Issue applies to a plant feature, withdrawal from or discharge to a small body of water, which STP Units 1 & 2 do not have.
9. Discharge of chlorine or other biocides	1	4.0	4.4.2.2/4-53
10. Discharge of sanitary wastes and minor chemical spills	1	4.0	4.4.2.2/4-53
11. Discharge of other metals in waste water	1	4.0	4.4.2.2/4-53
12. Water use conflicts (plants with once-through cooling systems)	1	NA	Issue applies to a plant feature, once-through cooling, which STP Units 1 & 2 do not have.
13. Water use conflicts (plants with cooling ponds or cooling towers using make-up water from a small river with low flow)	2	4.1	4.4.2.1/4-52

Table A-1. STP Units 1 & 2 Environmental Report Cross-Reference of License Renewal NEPA Issues (continued)

Issue[a]	Category	Section of this Environmental Report	GEIS Cross Reference (Section/Page)[b]
Aquatic Ecology (for all plants)			
14. Refurbishment impacts to aquatic resources	1	NA	Issue applies to an activity, refurbishment, which STP Units 1 & 2 do not plan to undertake.
15. Accumulation of contaminants in sediments or biota	1	4.0	4.4.2.2; 4.4.3/4-53; 4-56
16. Entrainment of phytoplankton and zooplankton	1	4.0	4.4.3/4-56
17. Cold shock	1	4.0	4.4.3/4-56
18. Thermal plume barrier to migrating fish	1	4.0	4.4.3/4-56
19. Distribution of aquatic organisms	1	4.0	4.4.3/4-56
20. Premature emergence of aquatic insects	1	4.0	4.4.3/4-56
21. Gas supersaturation (gas bubble disease)	1	4.0	4.4.3/4-56
22. Low dissolved oxygen in the discharge	1	4.0	4.4.3/4-56
23. Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	1	4.0	4.4.3/4-56
24. Stimulation of nuisance organisms (e.g., shipworms)	1	4.0	4.4.3/4-56
Aquatic Ecology (for plants with once-through and cooling pond heat dissipation systems)			
25. Entrainment of fish and shellfish in early life stages for plants with once-through and cooling pond heat dissipation systems	2	4.2	4.4.3/4-56
26. Impingement of fish and shellfish for plants with once-through and cooling pond heat dissipation systems	2	4.3	4.4.3/4-56
27. Heat shock for plants with once-through and cooling pond heat dissipation systems	2	4.4	4.4.3/4-56

Table A-1. STP Units 1 & 2 Environmental Report Cross-Reference of License Renewal NEPA Issues (continued)

Issue[a]	Category	Section of this Environmental Report	GEIS Cross Reference (Section/Page)[b]
Aquatic Ecology (for plants with cooling-tower-based heat dissipation systems)			
28. Entrainment of fish and shellfish in early life stages for plants with cooling-tower-based heat dissipation systems	1	NA	Issue applies to a feature, cooling towers, which STP Units 1 & 2 do not have.
29. Impingement of fish and shellfish for plants with cooling-tower-based heat dissipation systems	1	NA	Issue applies to a feature, cooling towers, which STP Units 1 & 2 do not have.
30. Heat shock for plants with cooling-tower-based heat dissipation systems	1	NA	Issue applies to a feature, cooling towers, which STP Units 1 & 2 do not have.
Groundwater Use and Quality			
31. Impacts of refurbishment on groundwater use and quality	1	NA	Issue applies to an activity, refurbishment, which STP Units 1 & 2 do not plan to undertake.
32. Groundwater use conflicts (potable and service water; plants that use < 100 gpm)	1	NA	Issue applies to a feature, use of <100 gpm of groundwater, which STP Units 1 & 2 do not have.
33. Groundwater use conflicts (potable, service water, and dewatering; plants that use > 100 gpm)	2	4.5	4.8.1.1/4-116 4.8.2.1/4-119
34. Groundwater use conflicts (plants using cooling towers withdrawing make-up water from a small river)	2	4.6	4.8.1.3/4-117
35. Groundwater use conflicts (Ranney wells)	2	Identified as NA in Section 4.7	Issue applies to a plant feature, Ranney wells, which STP Units 1 & 2 do not have.
36. Groundwater quality degradation (Ranney wells)	1	NA	Issue applies to a feature, Ranney wells, that STP Units 1 & 2 do not have.
37. Groundwater quality degradation (saltwater intrusion)	1	4.0	4.8.2/4-118
38. Groundwater quality degradation (cooling ponds in salt marshes)	1	4.0	4.8.3/4-121
39. Groundwater quality degradation (cooling ponds at inland sites)	2	4.8	4.8.3/4-121

Table A-1. STP Units 1 & 2 Environmental Report Cross-Reference of License Renewal NEPA Issues (continued)

Issue[a]	Category	Section of this Environmental Report	GEIS Cross Reference (Section/Page)[b]
Terrestrial Resources			
40. Refurbishment impacts to terrestrial resources	2	Identified as NA in Section 4.9	Issue applies to an activity, refurbishment, which STP Units 1 & 2 do not plan to undertake.
41. Cooling tower impacts on crops and ornamental vegetation	1	NA	Issue applies to a feature, mechanical draft cooling towers, which STP Units 1 & 2 do not have.
42. Cooling tower impacts on native plants	1	NA	Issue applies to a feature, mechanical draft cooling towers, which STP Units 1 & 2 do not have.
43. Bird collisions with cooling towers	1	NA	Issue applies to a feature, natural draft cooling towers, which STP Units 1 & 2 do not have.
44. Cooling pond impacts on terrestrial resources	1	4.0	4.4.4/4-58
45. Power line right-of-way management (cutting and herbicide application)	1	4.0	4.5.6.1/4-71
46. Bird collisions with power lines	1	4.0	4.5.6.2/4-74
47. Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	1	4.0	4.5.6.3/4-77
48. Floodplains and wetlands on power line right-of-way	1	4.0	4.5.7./4-81
Threatened or Endangered Species (for all plants)			
49. Threatened or endangered species	2	4.10	4.1/4-1
Air Quality			
50. Air quality during refurbishment (non-attainment and maintenance areas)	2	Identified as NA in Section 4.11	Issue applies to an activity, refurbishment, which STP Units 1 & 2 do not plan to undertake.
51. Air quality effects of transmission lines	1	4.0	4.5.2/4-62

Table A-1. STP Units 1 & 2 Environmental Report Cross-Reference of License Renewal NEPA Issues (continued)

Issue[a]	Category	Section of this Environmental Report	GEIS Cross Reference (Section/Page)[b]
Land Use			
52. Onsite land use	1	4.0	3.2/3-1
53. Power line right-of-way land use impacts	1	4.0	4.5.3/4-62
Human Health			
54. Radiation exposures to the public during refurbishment	1	NA	Issue applies to an activity, refurbishment, which STP Units 1 & 2 do not plan to undertake.
55. Occupational radiation exposures during refurbishment	1	NA	Issue applies to an activity, refurbishment, which STP Units 1 & 2 do not plan to undertake.
56. Microbiological organisms (occupational health)	1	NA	Issue applies to a plant feature, cooling towers, which STP Units 1 & 2 do not have.
57. Microbiological organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	2	4.12	4.3.6/4-48
58. Noise	1	4.0	4.3.7/4-49
59. Electromagnetic fields, acute effects	2	4.13	4.5.4.1/4-66
60. Electromagnetic fields, chronic effects	NA	4.0	4.5.4.2/4-67
61. Radiation exposures to public (license renewal term)	1	4.0	4.6.2/4-87
62. Occupational radiation exposures (license renewal term)	1	4.0	4.6.3/4-95
Socioeconomics			
63. Housing impacts	2	4.14	3.7.2/3-10 (refurbishment - not applicable to STP Units 1 & 2) 4.7.1/4-101 (renewable term)

Table A-1. STP Units 1 & 2 Environmental Report Cross-Reference of License Renewal NEPA Issues (continued)

Issue[a]	Category	Section of this Environmental Report	GEIS Cross Reference (Section/Page)[b]
64. Public services: public safety, social services, and tourism and recreation	1	4.0	Refurbishment (not applicable to STP Units 1 & 2) 3.7.4/3-14 (public service) 3.7.4.3/3-18 (safety) 3.7.4.4/3-19 (social) 3.7.4.6/3-20 (tour, rec) Renewal Term 4.7.3/4-104 (public safety) 4.7.3.3/4-106 (safety) 4.7.3.44-107 (social) 4.7.3.6/4-107 (tour, rec)
65. Public services: public utilities	2	4.15	3.7.4.5/3-19 (refurbishment - not applicable to STP Units 1 & 2) 4.7.3.5/4-107 (renewable term)
66. Public services: education (refurbishment)	2	Identified as NA in Section 4.16	Issue applies to an activity, refurbishment, which STP Units 1 & 2 do not plan to undertake.
67. Public services: education (license renewal term)	1	4.0	4.7.3.1/4-106
68. Offsite land use (refurbishment)	2	Identified as NA in Section 4.17.1	Issue applies to an activity, refurbishment, which STP Units 1 & 2 do not plan to undertake.
69. Offsite land use (license renewal term)	2	4.17.2	4.7.4/4-107
70. Public services: transportation	2	4.18	3.7.4.2/3-17 (refurbishment - not applicable to STP Units 1 & 2) 4.7.3.2/4-106 (renewal term)
71. Historic and archaeological resources	2	4.19	3.7.7/3-23 (refurbishment - not applicable to STP Units 1 & 2) 4.7.7/4-114 (renewal term)
72. Aesthetic impacts (refurbishment)	1	NA	Issue applies to an activity, refurbishment, which STP Units 1 & 2 do not plan to undertake.
73. Aesthetic impacts (license renewal term)	1	4.0	4.7.6/4-111
74. Aesthetic impacts of transmission lines (license renewal term)	1	4.0	4.5.8/4-83
Postulated Accidents			
75. Design basis accidents	1	4.0	5.3.2/5-11 (design basis) 5.5.1/5-114 (summary)

Table A-1. STP Units 1 & 2 Environmental Report Cross-Reference of License Renewal NEPA Issues (continued)

Issue[a]	Category	Section of this Environmental Report	GEIS Cross Reference (Section/Page)[b]
76. Severe accidents	2	4.20	5.3.3/5-12 (probabilistic analysis) 5.3.3.2/5-19 (air dose) 5.3.3.3/5-49 (water) 5.3.3.4/5-65 (groundwater) 5.3.3.5/5-95 (economic) 5.4/5-106 (mitigation) 5.5.2/5-114 (summary)
Uranium Fuel Cycle and Waste Management			
77. Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high-level waste)	1	4.0	6.2/6-8
78. Offsite radiological impacts (collective effects)	1	4.0	Not in GEIS.
79. Offsite radiological impacts (spent fuel and high-level waste disposal)	1	4.0	Not in GEIS.
80. Nonradiological impacts of the uranium fuel cycle	1	4.0	6.2.2.6/6-20 (land use) 6.2.2.7/6-20 (water use) 6.2.2.8/6-21 (fossil fuel) 6.2.2.9/6-21 (chemical)
81. Low-level waste storage and disposal	1	4.0	6.4.2/6-36 (low-level def) 6.4.3/6-37 (low-level volume) 6.4.4/6-48 (renewal effects)
82. Mixed waste storage and disposal	1	4.0	6.4.5/6-63
83. Onsite spent fuel	1	4.0	6.4.6/6-70
84. Nonradiological waste	1	4.0	6.5/6-86
85. Transportation	1	4.0	6.3/6-31, as revised by Addendum 1, August 1999
Decommissioning			
86. Radiation doses (decommissioning)	1	4.0	7.3.1/7-15
87. Waste management (decommissioning)	1	4.0	7.3.2/7-19 (impacts) 7.4/7-25 (conclusions)
88. Air quality (decommissioning)	1	4.0	7.3.3/7-21 (air) 7.4/7-25 (conclusions)
89. Water quality (decommissioning)	1	4.0	7.3.4/7-21 (water) 7.4/7-25 (conclusions)

Table A-1. STP Units 1 & 2 Environmental Report Cross-Reference of License Renewal NEPA Issues (continued)

Issue[a]	Category	Section of this Environmental Report	GEIS Cross Reference (Section/Page)[b]
90. Ecological resources (decommissioning)	1	4.0	7.3.5/7-21 (ecological) 7.4/7-25 (conclusions)
91. Socioeconomic impacts (decommissioning)	1	4.0	7.3.7/7-19 (socioeconomic) 7.4/7-24 (conclusions)
Environmental Justice			
92. Environmental justice	NA	2.6.2	not in GEIS

[a] 10 CFR 51, Subpart A, Appendix A, Table B-1. (Issue numbers added to facilitate discussion.)
[b] Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NUREG-1437).
NA = not applicable
NEPA = National Environmental Policy Act

ATTACHMENT B

NPDES PERMIT

5.2-9 TCEQ 2005

TPDES PERMIT NO. WQ0001908000
[For TCEQ office use only -
EPA I.D. No. TX0064947]

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
P. O. Box 13087
Austin, Texas 78711-3087

This is a renewal of TPDES Permit No. WQ0001908000, issued on November 2, 2000.

PERMIT TO DISCHARGE WASTES
under provisions of
Section 402 of the Clean Water Act
and Chapter 26 of the Texas Water Code

STP Nuclear Operating Company

whose mailing address is

P. O. Box 289
Wadsworth, Texas 77483-0289

is authorized to treat and discharge wastes from the South Texas Project Electric Generating Station (SIC 4911)

located on Farm-to-Market Road 521, approximately 10 miles north of Matagorda Bay and 12 miles south-southwest of the City of Bay City, Matagorda County, Texas

to Colorado River Tidal in Segment No. 1401 of the Colorado River Basin

only according to effluent limitations, monitoring requirements and other conditions set forth in this permit, as well as the rules of the Texas Commission on Environmental Quality (TCEQ), the laws of the State of Texas, and other orders of the TCEQ. The issuance of this permit does not grant to the permittee the right to use private or public property for conveyance of wastewater along the discharge route described in this permit. This includes, but is not limited to, property belonging to any individual, partnership, corporation or other entity. Neither does this permit authorize any invasion of personal rights nor any violation of federal, state, or local laws or regulations. It is the responsibility of the permittee to acquire property rights as may be necessary to use the discharge route.

This permit shall expire at midnight on December 1, 2009.

ISSUED DATE: JUL 21 2005

For the Commission

ATTACHMENT C

SPECIAL STATUS SPECIES CORRESPONDENCE

STP Nuclear Operating Company
South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

March 17, 2009
NOC-FD-09019472
File No. W12.01
STI No. 32447132

Mr. David Bernhart
Asst. Regional Administrator for Protected Resources
NOAA Fisheries Service
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701

SUBJECT: South Texas Project Units 1 & 2 License Renewal
Request for Information on Threatened or Endangered Species

Dear Mr. Bernhart:

In 2010, STP Nuclear Operating Company (STPNOC) plans to apply to the U.S. Nuclear Regulatory Commission (NRC) for renewal of the operating licenses for STP Units 1 & 2 on its approximately 12,220-acre site in Matagorda County, Texas. The existing operating licenses for STP Units 1 & 2 were initially issued for 40-year terms that expire in 2027 and 2028, respectively. License renewal would extend the operating period for the reactors by 20 years beyond the expiration of their existing licenses. Please note that this application is distinct from STPNOC's current application to construct two new reactors (STP Units 3 & 4) at this facility.

The NRC requires that the license renewal application for STP Units 1 & 2 include an environmental report describing potential environmental impacts from license renewal and from operation during the renewal term. One of these potential environmental impacts would be the potential effect caused by activities specifically related to license renewal on threatened or endangered species located on the STP site and its immediate environs, regardless of ownership or control of the land. Accordingly, the NRC requires that the environmental report for each license renewal application assess impacts to those species in accordance with the Endangered Species Act (10 CFR 51.53). The NRC will use this assessment in its review of the project pursuant to the National Environmental Policy Act (NEPA) and to determine the appropriate level of consultation (informal or formal) under Section 7 of the Endangered Species Act.

We are contacting you now in order to obtain input regarding issues of concern to your office and to identify any information your staff believes would be helpful to expedite the Section 7 consultation.

STP Units 1 & 2 are located in Matagorda County adjacent to the Colorado River (Figures 1 and 2), approximately eight miles north of Matagorda Bay. The site is bounded on the north, east and south by estuarine marshlands, veined with man-made ditches and tidal creeks. Approximately 7,000 acres of the site consists of the Main Cooling Reservoir (MCR) and the majority of the remaining upland consists of maintained grasses/disturbed land (approximately 1,800 acres), bottomland forest (approximately 1,200 acres), and scrub-shrub habitat (approximately 1,000 acres). The maintained/disturbed and scrub-shrub components are generally low quality for wildlife and are not important natural resource areas.

The Circulating Water System for each unit consists of the MCR, a main condenser, circulating water pumps, and a chemical injection system. Heated effluent from the STP Units 1 and 2 is discharged to the MCR. The MCR, shown in Figure 2, has a surface area of approximately 7,000 acres and a normal operating level of El. 47 ft MSL. The MCR was created as a cooling pond solely for the purpose of dissipating waste heat from the STP nuclear units. A series of dikes inside the MCR lengthen the flow path, providing extended circulation and cooling of the water. STPNOC diverts water from the Colorado River to the MCR to replace water lost to evaporation and designed seepage. Colorado River water is withdrawn at the Reservoir Makeup Pumping Facility (RMPF) and piped to the MCR by means of four large makeup pumps with a total capacity of approximately 269,000 gallons per minute (600 cubic feet per second). The makeup pumps at the RMPF operate intermittently, as dictated by weather (patterns of rainfall in the river basin), Colorado River flows, and operational considerations.

The MCR includes a blowdown structure (discharge) to allow the release of reservoir water to the Colorado River. The blowdown facility has been used (tested) only once, in 1997. Acceptable water quality has been maintained in the MCR by selective diversion of fresh water from the Colorado River during periods of high flow.

The transmission corridors/lines built to connect STP Units 1 & 2 to the grid are approximately 438 miles in length and occupy three main corridors: identified here as Eastern (toward Galveston), Western (to San Antonio), and Northwestern (toward Austin) (Figure 3). These primarily pass through agricultural lands and pasture/rangeland, however one of the Western lines reaches the Texas "Hill Country" with different habitats such as karst areas and Edwards Aquifer springs. No lands designated by the USFWS as "critical habitat" for endangered or threatened species are crossed by these corridors, nor do they cross any state or federal parks, wildlife refuges or preserves, or wildlife management areas.

Based on a review of information available on the state and federal websites (county listings of threatened and endangered species, etc.) and previous on-site surveys, STPNOC believes that only three federally-protected terrestrial animal species occur on or near the STP site: bald eagle, American alligator, and brown pelican. State-listed species observed on-site include reddish egrets, white-faced ibis, white-tailed hawk, and wood stork. Many other federal and state-protected plants and animals are listed for the counties containing STP and its associated transmission corridors (see Table 1). STPNOC is corresponding with the USFWS and Texas Parks and Wildlife Department (TPWD) regarding these terrestrial species.

With regard to species under the jurisdiction of NOAA-NMFS, five species of federally-listed sea turtles and at least one marine mammal, the manatee, may occur in Matagorda Bay and offshore in the Gulf of Mexico. However, none have been reported in the Colorado River near STP or its intake/discharge structures (approximately 8 miles upstream) nor are they likely to be entrapped at the intake. Other marine mammals, such as whales and porpoises, which are found in the Gulf of Mexico are unlikely to be affected by STP operations. STPNOC does not expect operations during the STP Units 1 & 2 license renewal terms (an additional 20 years) to adversely affect threatened or endangered species at the station site, the immediate environs, or the transmission line corridors because license renewal will not alter existing operations. No expansion of existing facilities is planned, and no structural modifications or other refurbishments have been identified that are necessary to support license renewal. Maintenance activities during the license renewal term would be restricted to previously disturbed areas. No additional land-disturbance or activities that would impact local habitats are anticipated in support of license renewal. The four companies associated with transmission corridor maintenance have established maintenance procedures for transmission lines that involve minimal disturbance of land, wetlands, and streams and are unlikely to adversely affect any threatened or endangered species.

After your review of the information provided in this letter, we would appreciate your sending a response by April 16, 2009 detailing any concerns you may have about any listed species or critical habitat in the area of the STP Units 1 & 2 site and the associated transmission corridors, or alternatively, confirming our conclusion that operation of STP Units 1 & 2 over the license renewal terms would have no effect on any threatened or endangered species. STPNOC will include copies of this letter and your response in the environmental reports that will be submitted to the NRC as part of the STP Units 1 & 2 license renewal application.

Please do not hesitate to call me at 361-972-8328 if there are questions or you need additional information to complete a review of the proposed action. Thank you in advance for your assistance.

Sincerely,

S. L. Dannhardt
Manager, Environmental

Attachment: Table 1, Figures 1, 2 and 3

Bcc: R. A. Gangluff
M. J. Berg
K. J. Taplett
Correspondence, N2002

Attachment

Table 1. Protected Species in Texas Counties Containing STP Units 1 & 2 Project Facilities and Transmission Lines

Common Name	Scientific Name	Federal Status[1]	State Status[1]	Plant Site[2]	T-Line Counties[2]
	Birds				
White-tailed hawk	*Buteo albicaudatus*	-	T	Y	Y
Zone-tailed hawk	*Buteo albonotatus*	-	T	-	Y
Piping plover	*Charadrius melodus*	LT	T	Y	Y
Golden-cheeked warbler	*Dendroica chrysoparia*	LE	E	-	Y
Reddish egret	*Egretta rufescens*	-	T	Y	Y
Peregrine falcon	*Falco peregrinus anatum*	DL	T	Y	Y
Arctic peregrine falcon	*Falco peregrinus tundrius*	DL	T	Y	Y
Whooping crane	*Grus americana*	LE	E	Y	Y
Bald eagle	*Haliaeetus leucocephalus*	DL	T	Y	Y
Wood stork	*Mycteria americana*	-	T	Y	Y
Eskimo curlew	*Numenius borealis*	LE	E	Y	Y
Brown pelican	*Pelecanus occidentalis*	LT	E	Y	Y
White-faced ibis	*Plegadis chihi*	-	T	Y	Y
Interior least tern	*Sterna antillarum anthalassos*	LE	E	-	Y
Sooty tern	*Sterna fuscata*	-	T	Y	Y
Attwater's prairie chicken	*Tympanuchus cupido attwateri*	LE	E	-	Y
Black-capped vireo	*Vireo atricapilla*	LE	E	-	Y
	Mammals				
Gray wolf	*Canis lupus*	LE	E	-	Y
Red wolf	*Canis rufus*	LE	E	Y	Y
Gulf coast jaguarundi	*Herpailurus yaguarondi cacomitli*	LE	E	-	Y
Ocelot	*Leopardus pardalis*	LE	E	Y	Y
White-nosed coati	*Nasura narica*	-	T	-	Y
Manatee	*Trichechus manatus*	LE	E	Y	Y
Black bear	*Ursus americanus*	SAT	T	-	Y
Louisiana black bear	*Ursus americanus luteolus*	T	T	Y	Y
	Reptiles				
American alligator	*Alligator mississippiensis*	SAT	-	Y	Y

Attachment

Table 1. Protected Species in Texas Counties Containing STP Units 1 & 2 Project Facilities and Transmission Lines (continued)

Common Name	Scientific Name	Federal Status[1]	State Status[1]	Plant Site[2]	T-Line Counties[2]
Loggerhead sea turtle	*Caretta caretta*	LT	T	Y	Y
Texas scarlet snake	*Cemaphora coccinea linerii*	-	T	Y	Y
Green sea turtle	*Chelonia mydas*	E	T	Y	Y
Timber/canebrake rattlesnake	*Crotalus horridus*	-	T	Y	Y
Leatherback sea turtle	*Dermochelys coriacea*	E	E	Y	Y
Indigo snake	*Drymarchon corais*	-	T	-	Y
Hawksbill sea turtle	*Eretmochelys imbricata*	E	E	Y	Y
Texas tortoise	*Gopherus berlandieri*	-	T	Y	Y
Cagle's map turtle	*Graptemys caglei*	-	T	-	Y
Kemp's ridley sea turtle	*Lepidochelys kempii*	E	E	Y	Y
Smooth green snake	*Liochlorophis vernalis*	-	T	Y	-
Texas horned lizard	*Phrynosoma cornutum*	-	T	Y	Y
Alligator snapping turtle	*Macrochelys temmenckii*	-	T	-	Y
Amphibians					
Houston toad	*Bufo houstonensis*	LE	E	-	Y
Cascade Caverns salamander	*Eurycea latitans complex*	-	T	-	Y
Comal blind salamander	*Eurycea tridentifera*	-	T	-	Y
Sheep frog	*Hypopachus variolosus*	-	T	-	Y
Black-spotted newt	*Notophthalmus meridionalis*	-	T	-	Y
Fish					
Blue sucker	*Cycleptus elongatus*	-	T	-	Y
Fountain darter	*Etheostoma fonticola*	LE	E	-	Y
Sharpnose shiner	*Notropis oxyrhynchus*	C	-	-	Y
Widemouth blindcat	*Satan eurystomus*	-	T	-	Y
Toothless blindcat	*Trogloglanis pattersoni*	-	T	-	Y

Attachment

Table 1. Protected Species in Texas Counties Containing STP Units 1 & 2 Project Facilities and Transmission Lines (continued)

Common Name	Scientific Name	Federal Status[1]	State Status[1]	Plant Site[2]	T-Line Counties[2]
		Crustaceans			
Peck's Cave amphipod	*Stygobromus pecki*	LE	E	-	Y
		Insects			
Helotes mold beetle	*Batrisodes venyivi*	LE	-	-	Y
Comal Springs riffle beetle	*Heterelmis comalensis*	LE	-	-	Y
A ground beetle	*Rhadine exilis*	LE	-	-	Y
A ground beetle	*Rhadine infernalis*	LE	-	-	Y
Comal Springs dryopid beetle	*Stygoparnus comalensis*	LE	-	-	Y
		Arachnids			
Robber Baron Cave meshweaver	*Circurina baronia*	LE	-	-	Y
Madla Cave meshweaver	*Cicurina madla*	LE	-	-	Y
Braken Bat Cave meshweaver	*Cicurina venii*	LE	-	-	Y
Government Canyon Bat Cave meshweaver	*Cicurina vespera*	LE	-	-	Y
Government Canyon Bat Cave spider	*Neoleptoneta microps*	LE	-	-	Y
Cokendolpher Cave harvestweaver	*Texella cokendolpheri*	LE	-	-	Y
		Plants			
Navasota ladies'-tresses	*Spiranthes parkseii*	LE	E	-	Y

[1]LE/E = Endangered; LT/T = Threatened; C = Candidate; - = Not listed; DL = delisted taxon, recovered, being monitored for first five years post delisting; SAE/T = listed due to similarity to endangered/threatened species.

[2]Listed in the county containing the plant site (Matagorda County) and/or the counties containing the existing transmission lines (Y=Yes, - = no reported occurrence) [Bexar, Brazoria, Colorado, Comal, DeWitt, Fayette, Gonzales, Guadalupe, Jackson, Karnes, Lavaca, Victoria, Wharton and Wilson Counties].

Attachment

Figure 1: 50-Miles Radius Surrounding the South Texas Project

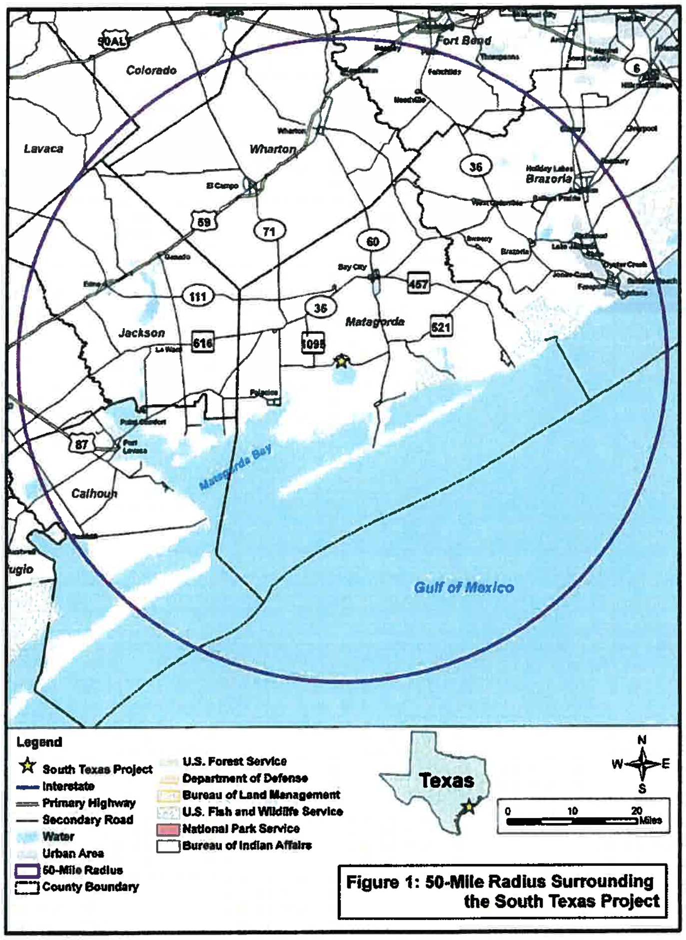


Figure 1: 50-Mile Radius Surrounding the South Texas Project

Attachment

Figure 2: South Texas Project Site Boundary

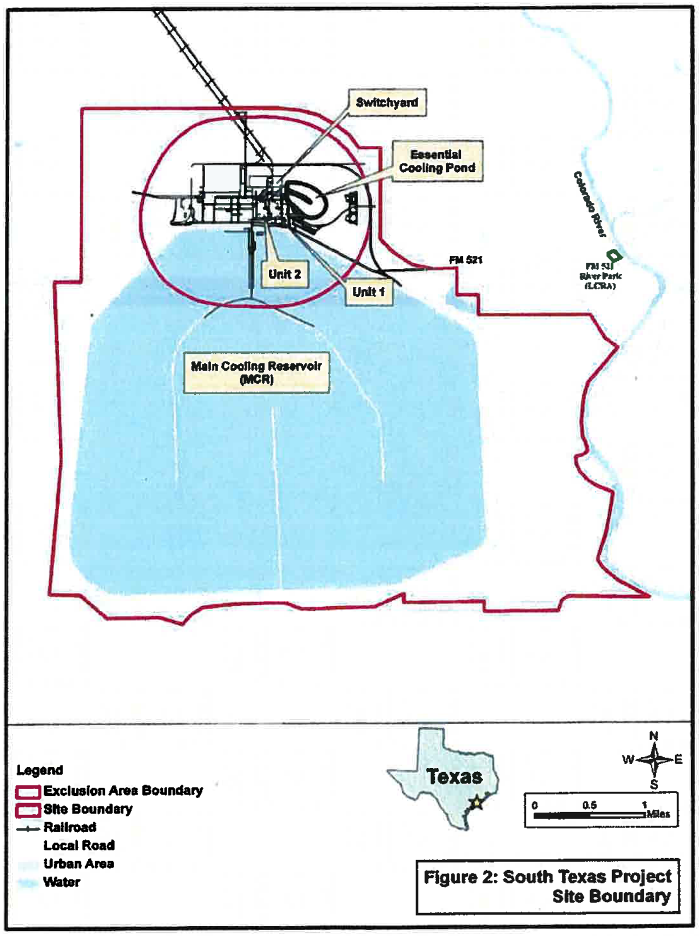
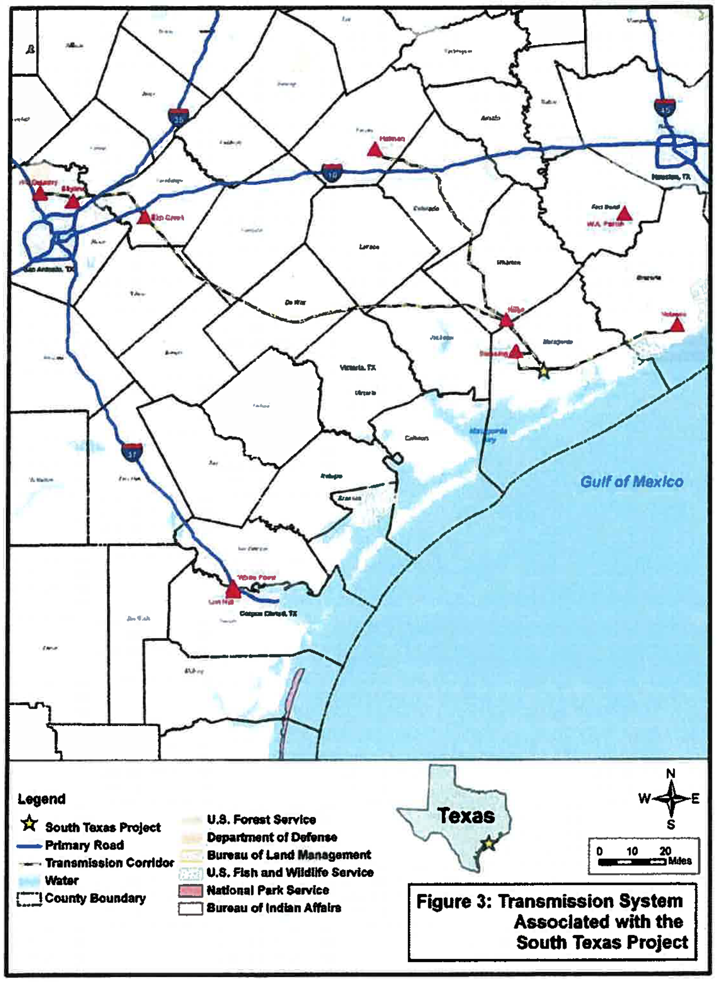


Figure 2: South Texas Project Site Boundary

Attachment

Figure 3: Transmission System Associated with the South Texas Project



STP Nuclear Operating Company

South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

March 17, 2009
NOC-TX-09019471
File No. W12.02
STI No. 32447110

Ms. Celeste Brancel
Environmental Review Coordinator
Texas Parks and Wildlife Department
4200 Smith School Road
Austin, TX 78744-3291

SUBJECT: South Texas Project Units 1 & 2 License Renewal
Request for Information on Threatened or Endangered Species

Dear Ms. Brancel:

In 2010, STP Nuclear Operating Company (STPNOC) plans to apply to the U.S. Nuclear Regulatory Commission (NRC) for renewal of the operating licenses for Units 1 & 2 on its approximately 12,220-acre site in Matagorda County, Texas. The existing operating licenses for STP Units 1 & 2 were initially issued for 40-year terms that expire in 2027 and 2028, respectively. License renewal would extend the operating period for the reactors by 20 years beyond the expiration of their existing licenses. Please note that this application is distinct from STP's current application to construct two new reactors (STP Units 3 & 4) at this facility.

The NRC requires that the license renewal application for STP Units 1 & 2 include an environmental report describing potential environmental impacts from license renewal and from operation during the renewal term. One of these potential environmental impacts would be the potential effect caused by activities specifically related to license renewal on threatened or endangered species located on the STP site and its immediate environs, regardless of ownership or control of the land. Accordingly, the NRC requires that the environmental report for each license renewal application assess impacts to these species in accordance with the Endangered Species Act (10 CFR 51.53). The NRC will use this assessment in its review of the project pursuant to the National Environmental Policy Act (NEPA) and to determine the appropriate level of consultation (informal or formal) under Section 7 of the Endangered Species act.

We are contacting you now in order to obtain input regarding issues of concern to your office and to identify any information your staff believes would be helpful to expedite the Section 7 consultation.

STP Units 1 & 2 are located in Matagorda County adjacent to the Colorado River (Figures 1 and 2), approximately eight miles north of Matagorda Bay. The site is bounded on the north, east and south by estuarine marshlands, veined with man-made ditches and tidal creeks. Approximately

7,000 acres of the site property consists of the Main Cooling Reservoir (MCR) and the majority of the remaining upland consists of maintained grasses/disturbed land (approximately 1,800 acres), bottomland forest (approximately 1,200 acres), and scrub-shrub habitat (approximately 1,000 acres). The maintained/disturbed and scrub-shrub components are generally low quality for wildlife and are not important natural resource areas.

The Circulating Water System for each unit consists of the MCR, a main condenser, circulating water pumps, and a chemical injection system. Heated effluent from the STP Units 1 and 2 is discharged to the MCR. The MCR, shown in Figure 1, has a surface area of approximately 7,000 acres and a normal operating level of El. 47 ft MSL. The MCR was created as a cooling pond solely for the purpose of dissipating waste heat from the STP nuclear units. A series of dikes inside the MCR lengthen the flow path, providing extended circulation and cooling of the water. STPNOC diverts water from the Colorado River to the MCR to replace water lost to evaporation and designed seepage. Colorado River water is withdrawn at the Reservoir Makeup Pumping Facility (RMPF) and piped to the MCR by means of four large makeup pumps with a total capacity of approximately 269,000 gallons per minute (600 cubic feet per second). The makeup pumps at the RMPF operate intermittently, as dictated by weather (patterns of rainfall in the river basin), Colorado River flows, and operational considerations.

The MCR includes a blowdown structure (discharge) to allow the release of reservoir water to the Colorado River. The blowdown facility has been used (tested) only once, in 1997. Acceptable water quality has been maintained in the MCR by selective diversion of fresh water from the Colorado River during periods of high flow.

The transmission corridors/lines built to connect STP Units 1 & 2 to the grid are approximately 438 miles in length and occupy three main corridors: identified here as Eastern (toward Galveston), Western (to San Antonio), and Northwestern (toward Austin) (Figure 3). For the most part they pass through agricultural lands and pasture/rangeland; however one of the Western lines reaches the Texas "Hill Country" with different habitats such as karst areas and Edwards Aquifer springs. No lands designated by the USFWS as "critical habitat" for endangered or threatened species are crossed by these corridors, nor do they cross any state or federal parks, wildlife refuges or preserves, or wildlife management areas.

Based on a review of information on the Texas Parks and Wildlife Department (TPWD) and U.S. Fish and Wildlife Service (USFWS) websites (county listings of threatened and endangered species) and previous on-site surveys, STPNOC believes that only three federally-protected animal species occur on the STP site. The bald eagle is occasionally observed on the STP site and nesting has been documented near the Colorado River. American alligators are found in many of the on-site wetlands/water bodies. Brown pelicans are occasional visitors to the MCR. Many other federal and state-protected plants and animals are listed for the counties containing STP and its associated transmission corridors (see Table 1). Also, five species of federally-listed sea turtles and manatees may occur in Matagorda Bay and offshore in the Gulf of Mexico. STPNOC is contacting NOAA-NMFS regarding these marine species. Although five sea turtle species and manatees could occur in Matagorda Bay and the Gulf of Mexico, none have been reported in the Colorado River near STP or its intake/discharge structures nor are they likely to be entrapped at the intake.

STPNOC does not expect STP Units 1 & 2 operations during the license renewal term (an additional 20 years) to adversely affect threatened or endangered species at the station sites, the immediate environs, or the transmission line corridors because license renewal will not alter existing operations. No expansion of existing facilities is planned, and no structural modifications or other refurbishments have been identified that are necessary to support license renewal. Maintenance activities during the license renewal term would be restricted to previously disturbed areas. No additional land-disturbance or activities that would impact local habitats are anticipated in support of license renewal. The four companies associated with transmission corridor maintenance have established maintenance procedures for transmission lines that involve minimal disturbance of land, wetlands, and streams and are unlikely to adversely affect any threatened or endangered species.

After your review of the information provided in this letter, we would appreciate your sending a response by April 16, 2009 detailing any concerns you may have about any listed species or critical habitat in the area of the STP Units 1 & 2 site and the associated transmission corridors, or alternatively, confirming our conclusion that operation of STP Units 1 & 2 over the license renewal term would have no effect on any threatened or endangered species. STPNOC will include copies of this letter and your response in the environmental report that will be submitted to the NRC as part of the STP Units 1 & 2 license renewal application.

Please do not hesitate to call me at 361-972-8328, if there are questions or you need additional information to complete a review of the proposed action. Thank you in advance for your assistance.

Sincerely,

S. L. Dannhardt

S. L. Dannhardt
Manager, Environmental

Attachment: Table 1, Figures 1, 2 and 3

Bcc: R. A. Gangluff
M. J. Berg
K. J. Taplett
Correspondence, N2002

Attachment

Table 1. Protected Species in Texas Counties Containing STP Units 1 & 2 Project Facilities and Transmission Lines

Common Name	Scientific Name	Federal Status[1]	State Status[1]	Plant Site[2]	T-Line Counties[2]
Birds					
White-tailed hawk	*Buteo albicaudatus*	-	T	Y	Y
Zone-tailed hawk	*Buteo albonotatus*	-	T	-	Y
Piping plover	*Charadrius melodus*	LT	T	Y	Y
Golden-cheeked warbler	*Dendroica chrysoparia*	LE	E	-	Y
Reddish egret	*Egretta rufescens*	-	T	Y	Y
Peregrine falcon	*Falco peregrinus anatum*	DL	T	Y	Y
Arctic peregrine falcon	*Falco peregrinus tundrius*	DL	T	Y	Y
Whooping crane	*Grus americana*	LE	E	Y	Y
Bald eagle	*Haliaeetus leucocephalus*	DL	T	Y	Y
Wood stork	*Mycteria americana*	-	T	Y	Y
Eskimo curlew	*Numenius borealis*	LE	E	Y	Y
Brown pelican	*Pelecanus occidentalis*	LT	E	Y	Y
White-faced ibis	*Plegadis chihi*	-	T	Y	Y
Interior least tern	*Sterna antillarum anthalassos*	LE	E	-	Y
Sooty tern	*Sterna fuscata*	-	T	Y	Y
Attwater's prairie chicken	*Tympanuchus cupido attwateri*	LE	E	-	Y
Black-capped vireo	*Vireo atricapilla*	LE	E	-	Y
Mammals					
Gray wolf	*Canis lupus*	LE	E	-	Y
Red wolf	*Canis rufus*	LE	E	Y	Y
Gulf coast jaguarundi	*Herpailurus yaguarondi cacominth*	LE	E	-	Y
Ocelot	*Leopardus pardalis*	LE	E	Y	Y
White-nosed coati	*Nasura narica*	-	T	-	Y
Manatee	*Trichechus manatus*	LE	E	Y	Y
Black bear	*Ursus americanus*	SAT	T	-	Y
Louisiana black bear	*Ursus americanus luteolus*	T	T	Y	Y
Reptiles					
American alligator	*Alligator mississippiensis*	SAT	-	Y	Y

Attachment

Table 1. Protected Species in Texas Counties Containing STP Units 1 & 2 Project Facilities and Transmission Lines (continued)

Common Name	Scientific Name	Federal Status[1]	State Status[1]	Plant Site[2]	T-Line Counties[2]
Loggerhead sea turtle	*Caretta caretta*	LT	T	Y	Y
Texas scarlett snake	*Cemaphora coccinea linerii*	-	T	Y	Y
Green sea turtle	*Chelonia mydas*	E	T	Y	Y
Timber/canebrake rattlesnake	*Crotalus horridus*	-	T	Y	Y
Leatherback sea turtle	*Dermochelys coriacea*	E	E	Y	Y
Indigo snake	*Drymarchon corais*	-	T	-	Y
Hawksbill sea turtle	*Eretmochelys imbricata*	E	E	Y	Y
Texas tortoise	*Gopherus berlandieri*	-	T	Y	Y
Cagle's map turtle	*Graptemys caglei*	-	T	-	Y
Kemp's ridley sea turtle	*Lepidochelys kempii*	E	E	Y	Y
Smooth green snake	*Liochlorophis vernalis*	-	T	Y	-
Texas horned lizard	*Phrynosoma cornutum*	-	T	Y	Y
Alligator snapping turtle	*Macrochelys temmenckii*	-	T	-	Y
Amphibians					
Houston toad	*Bufo houstonensis*	LE	E	-	Y
Cascade Caverns salamander	*Eurycea latitans complex*	-	T	-	Y
Comal blind salamander	*Eurycea tridentifera*	-	T	-	Y
Sheep frog	*Hypopachus variolosus*	-	T	-	Y
Black-spotted newt	*Notophthalmus meridionalis*	-	T	-	Y
Fish					
Blue sucker	*Cycleptus elongatus*	-	T	-	Y
Fountain darter	*Etheostoma fonticola*	LE	E	-	Y
Sharpnose shiner	*Notropis oxyrhynchus*	C	-	-	Y
Widemouth blindcat	*Satan eurystomus*	-	T	-	Y
Toothless blindcat	*Trogloglanis pattersoni*	-	T	-	Y

Table 1. Protected Species in Texas Counties Containing STP Units 1 & 2 Project Facilities and Transmission Lines (continued)

Common Name	Scientific Name	Federal Status[1]	State Status[1]	Plant Site[2]	T-Line Counties[2]
Crustaceans					
Peck's Cave amphipod	*Stygobromus pecki*	LE	E	-	Y
Insects					
Helotes mold beetle	*Batrisodes venyivi*	LE	-	-	Y
Comal Springs riffle beetle	*Heterelmis comalensis*	LE	-	-	Y
A ground beetle	*Rhadine exilis*	LE	-	-	Y
A ground beetle	*Rhadine infernalis*	LE	-	-	Y
Comal Springs dryopid beetle	*Stygoparnus comalensis*	LE	-	-	Y
Arachnids					
Robber Baron Cave meshweaver	*Circurina baronia*	LE	-	-	Y
Madla Cave meshweaver	*Cicurina madla*	LE	-	-	Y
Braken Bat Cave meshweaver	*Cicurina venii*	LE	-	-	Y
Government Canyon Bat Cave meshweaver	*Cicurina vespera*	LE	-	-	Y
Government Canyon Bat Cave spider	*Neoleptoneta microps*	LE	-	-	Y
Cokendolpher Cave harvestweaver	*Texella cokendolpheri*	LE	-	-	Y
Plants					
Navasota ladies'-tresses	*Spiranthes parkseii*	LE	E	-	Y

[1]LE/E = Endangered; LT/T = Threatened; C = Candidate; - = Not listed; DL = delisted taxon, recovered, being monitored for first five years post delisting; SAE/T = listed due to similarity to endangered/threatened species.

[2]Listed in the county containing the plant site (Matagorda County) and/or the counties containing the existing transmission lines (Y=Yes, - = no reported occurrence) [Bexar, Brazoria, Colorado, Comal, DeWitt, Fayette, Gonzales, Guadalupe, Jackson, Karnes, Lavaca, Victoria, Wharton and Wilson Counties].

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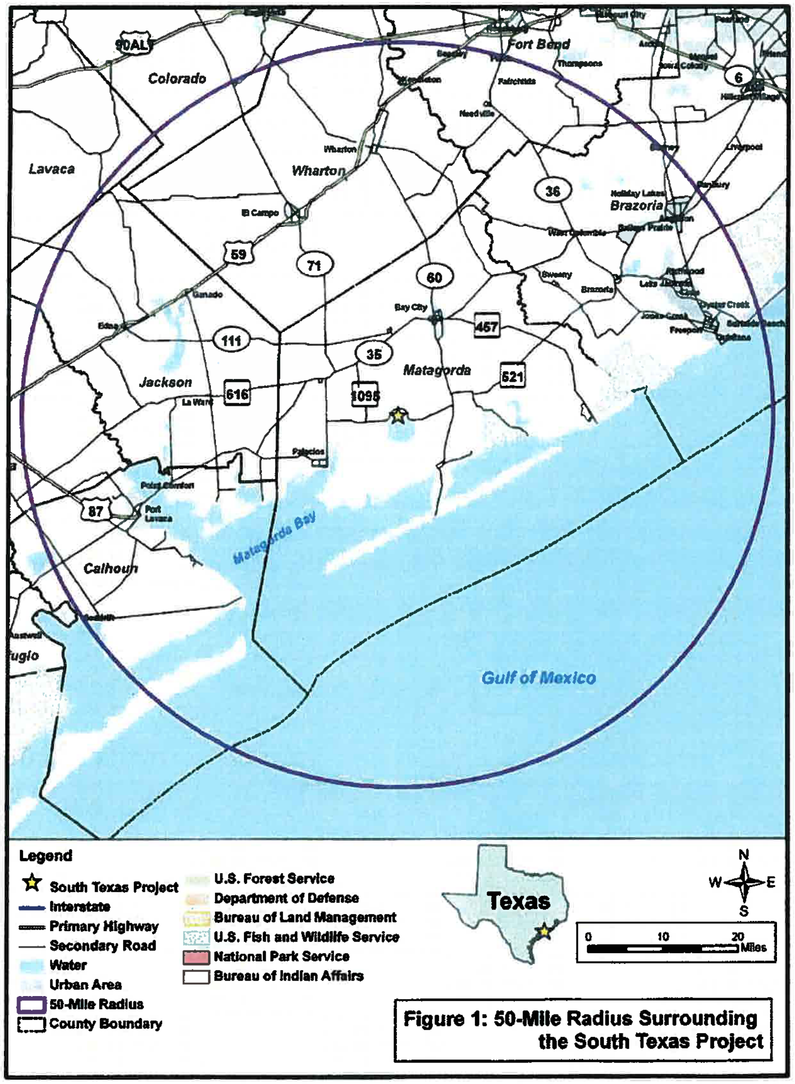

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Attachment

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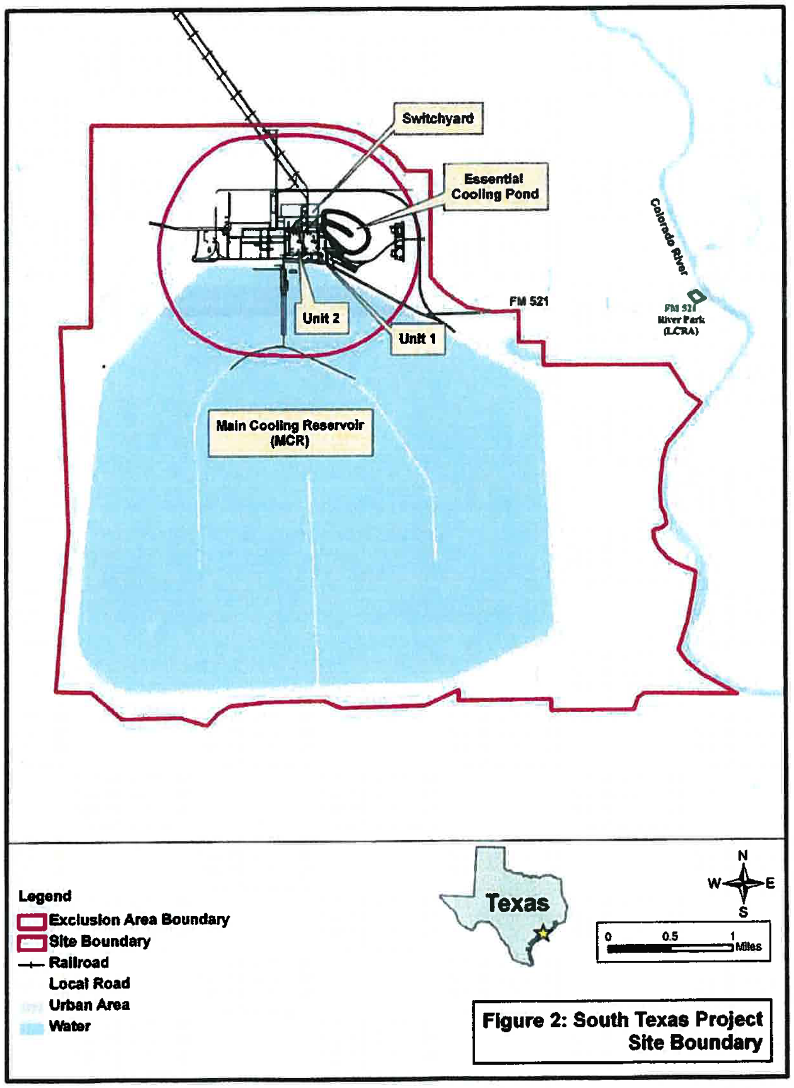
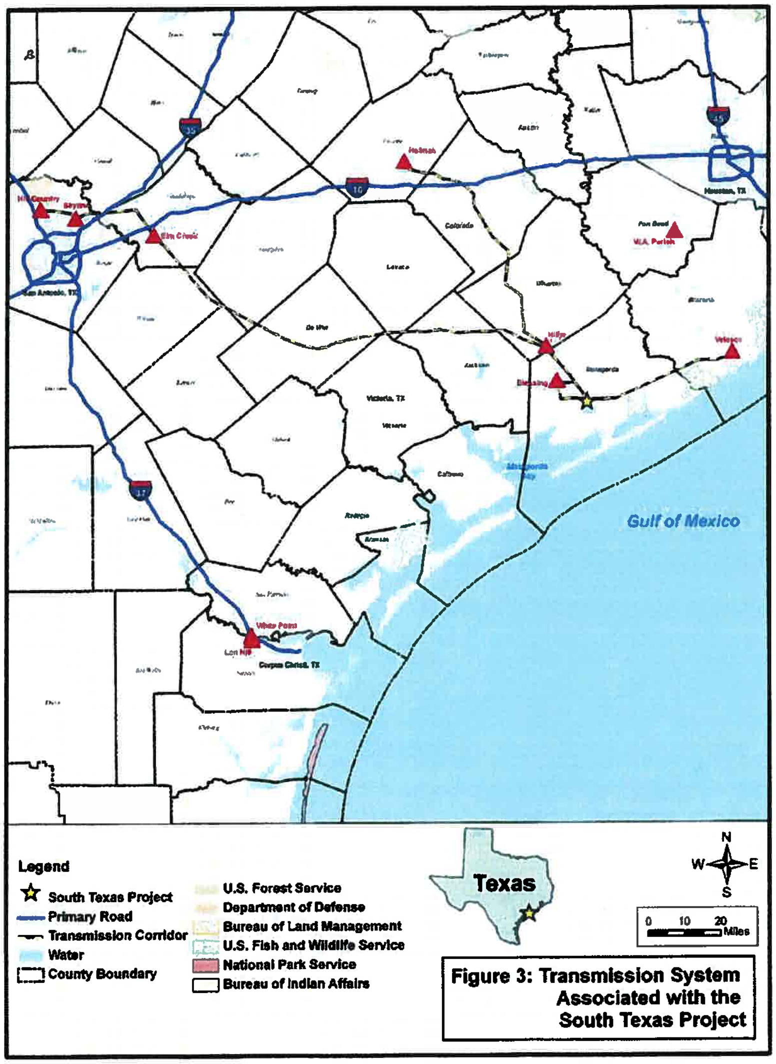


Attachment

Figure 3: Transmission System Associated with the South Texas Project



Nuclear Operating Company

South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

March 17, 2009
NOC-FD-09019473
File No. W12.01
STI No. 32447154

Ms. Mary Orms
U.S. Fish and Wildlife Service
c/o TAMU - Corpus Christi
6300 Ocean Drive
Corpus Christi, TX 78412

SUBJECT: South Texas Project Units 1 & 2 License Renewal
Request for Information on Threatened or Endangered Species

Dear Ms. Orms:

In 2010, STP Nuclear Operating Company (STPNOC) plans to apply to the U.S. Nuclear Regulatory Commission (NRC) for renewal of the operating licenses for STP Units 1 & 2 on its approximately 12,220-acre site in Matagorda County, Texas. The existing operating licenses for STP Units 1 & 2 were initially issued for 40-year terms that expire in 2027 and 2028, respectively. License renewal would extend the operating period for the reactors by 20 years beyond the expiration of their existing licenses. Please note that this application is distinct from STP's current application to construct two new reactors (STP Units 3 & 4) at this facility.

The NRC requires that the license renewal application for STP Units 1 & 2 include an environmental report describing potential environmental impacts from license renewal and from operation during the renewal term. One of these potential environmental impacts would be the potential effect caused by activities specifically related to license renewal on threatened or endangered species located on the STP site and its immediate environs, regardless of ownership or control of the land. Accordingly, the NRC requires that the environmental report for each license renewal application assess impacts to these species in accordance with the Endangered Species Act (10 CFR 51.53). The NRC will use this assessment in its review of the project pursuant to the National Environmental Policy Act (NEPA) and to determine the appropriate level of consultation (informal or formal) under Section 7 of the Endangered Species Act.

We are contacting you now in order to obtain input regarding issues of concern to your office and to identify any information your staff believes would be helpful to expedite the Section 7 consultation.

STP Units 1 & 2 are located in Matagorda County adjacent to the Colorado River (Figures 1 and 2), approximately eight miles north of Matagorda Bay. The site is bounded on the north, east and south by estuarine marshlands, veined with man-made ditches and tidal creeks. Approximately

7,000 acres of the site property consists of the Main Cooling Reservoir (MCR) and the majority of the remaining upland consists of maintained grasses/disturbed land (approximately 1,800 acres), bottomland forest (approximately 1,200 acres), and scrub-shrub habitat (approximately 1,000 acres). The maintained/disturbed and scrub-shrub components are generally low quality for wildlife and are not important natural resource areas.

The Circulating Water System for each unit consists of the MCR, a main condenser, circulating water pumps, and a chemical injection system. Heated effluent from the STP Units 1 and 2 is discharged to the MCR. The MCR, shown in Figure 1, has a surface area of approximately 7,000 acres and a normal operating level of El. 47 ft MSL. The MCR was created as a cooling pond solely for the purpose of dissipating waste heat from the STP nuclear units. A series of dikes inside the MCR lengthen the flow path, providing extended circulation and cooling of the water. STPNOC diverts water from the Colorado River to the MCR to replace water lost to evaporation and designed seepage. Colorado River water is withdrawn at the Reservoir Makeup Pumping Facility (RMPF) and piped to the MCR by means of four large makeup pumps with a total capacity of approximately 269,000 gallons per minute (600 cubic feet per second). The makeup pumps at the RMPF operate intermittently, as dictated by weather (patterns of rainfall in the river basin), Colorado River flows, and operational considerations.

The MCR includes a blowdown structure (discharge) to allow the release of reservoir water to the Colorado River. The blowdown facility has been used (tested) only once, in 1997. Acceptable water quality has been maintained in the MCR by selective diversion of fresh water from the Colorado River during periods of high flow.

The transmission corridors/lines built to connect STP Units 1 & 2 to the grid are approximately 438 miles in length and occupy three main corridors: identified here as Eastern (toward Galveston), Western (to San Antonio), and Northwestern (toward Austin) (Figure 3). For the most part they pass through agricultural lands and pasture/rangeland; however one of the Western lines reaches the Texas "Hill Country" with different habitats such as karst areas and Edwards Aquifer springs. No lands designated by the USFWS as "critical habitat" for endangered or threatened species are crossed by these corridors, nor do they cross any state or federal parks, wildlife refuges or preserves, or wildlife management areas.

Based on a review of information on the Texas Parks and Wildlife Department (TPWD) and U.S. Fish and Wildlife Service (USFWS) websites (county listings of threatened and endangered species) and previous on-site surveys, STPNOC believes that only three federally-protected animal species occur on the STP site. The bald eagle is occasionally observed on the STP site and nesting has been documented near the Colorado River. American alligators are found in many of the on-site wetlands/water bodies. Brown pelicans are occasional visitors to the MCR. Many other federal and state-protected plants and animals are listed for the counties containing STP and its associated transmission corridors (see Table 1). Also, five species of federally-listed sea turtles and manatees may occur in Matagorda Bay and offshore in the Gulf of Mexico. STPNOC is contacting NOAA-NMFS regarding these marine species. Although five sea turtle species and manatees could occur in Matagorda Bay and the Gulf of Mexico, none have been reported in the Colorado River near STP or its intake/discharge structures nor are they likely to be entrapped at the intake.

STPNOC does not expect STP Units 1 & 2 operations during the license renewal term (an additional 20 years) to adversely affect threatened or endangered species at the station sites, the immediate environs, or the transmission line corridors because license renewal will not alter existing operations. No expansion of existing facilities is planned, and no structural modifications or other refurbishments have been identified that are necessary to support license renewal. Maintenance activities during the license renewal term would be restricted to previously disturbed areas. No additional land-disturbance or activities that would impact local habitats are anticipated in support of license renewal. The four companies associated with transmission corridor maintenance have established maintenance procedures for transmission lines that involve minimal disturbance of land, wetlands, and streams and are unlikely to adversely affect any threatened or endangered species.

After your review of the information provided in this letter, we would appreciate your sending a response by April 16, 2009 detailing any concerns you may have about any listed species or critical habitat in the area of the STP Units 1 & 2 site and the associated transmission corridors, or alternatively, confirming our conclusion that operation of STP Units 1 & 2 over the license renewal term would have no effect on any threatened or endangered species. STPNOC will include copies of this letter and your response in the environmental report that will be submitted to the NRC as part of the STP Units 1 & 2 license renewal application.

Please do not hesitate to call me at 361-972-8328, if there are questions or you need additional information to complete a review of the proposed action. Thank you in advance for your assistance.

Sincerely,

S. L. Dannhardt

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Manager, Environmental

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		Birds			
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Zone-tailed hawk	*Buteo albonotatus*	-	T	-	Y
Piping plover	*Charadrius melodus*	LT	T	Y	Y
Golden-cheeked warbler	*Dendroica chrysoparia*	LE	E	-	Y
Reddish egret	*Egretta rufescens*	-	T	Y	Y
Peregrine falcon	*Falco peregrinus anatum*	DL	T	Y	Y
Arctic peregrine falcon	*Falco peregrinus tundrius*	DL	T	Y	Y
Whooping crane	*Grus americana*	LE	E	Y	Y
Bald eagle	*Haliaeetus leucocephalus*	DL	T	Y	Y
Wood stork	*Mycteria americana*	-	T	Y	Y
Eskimo curlew	*Numenius borealis*	LE	E	Y	Y
Brown pelican	*Pelecanus occidentalis*	LT	E	Y	Y
White-faced ibis	*Plegadis chihi*	-	T	Y	Y
Interior least tern	*Sterna antillarum anthalassos*	LE	E	-	Y
Sooty tern	*Sterna fuscata*	-	T	Y	Y
Attwater's prairie chicken	*Tympanuchus cupido attwateri*	LE	E	-	Y
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Gray wolf	*Canis lupus*	LE	E	-	Y
Red wolf	*Canis rufus*	LE	E	Y	Y
Gulf coast jaguarundi	*Herpailurus yaguarondi cacominth*	LE	E	-	Y
Ocelot	*Leopardus pardalis*	LE	E	Y	Y
White-nosed coati	*Nasura narica*	-	T	-	Y
Manatee	*Trichechus manatus*	LE	E	Y	Y
Black bear	*Ursus americanus*	SAT	T	-	Y
Louisiana black bear	*Ursus americanus luteolus*	T	T	Y	Y
		Reptiles			
American alligator	*Alligator mississippiensis*	SAT	-	Y	Y

Attachment

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Common Name	Scientific Name	Federal Status[1]	State Status[1]	Plant Site[2]	T-Line Counties[2]
Loggerhead sea turtle	*Caretta caretta*	LT	T	Y	Y
Texas scarlet snake	*Cemaphora coccinea linerii*	-	T	Y	Y
Green sea turtle	*Chelonia mydas*	E	T	Y	Y
Timber/canebrake rattlesnake	*Crotalus horridus*	-	T	Y	Y
Leatherback sea turtle	*Dermochelys coriacea*	E	E	Y	Y
Indigo snake	*Drymarchon corais*	-	T	-	Y
Hawksbill sea turtle	*Eretmochelys imbricata*	E	E	Y	Y
Texas tortoise	*Gopherus berlandieri*	-	T	Y	Y
Cagle's map turtle	*Graptemys caglei*	-	T	-	Y
Kemp's ridley sea turtle	*Lepidochelys kempii*	E	E	Y	Y
Smooth green snake	*Liochlorophis vernalis*	-	T	Y	-
Texas horned lizard	*Phrynosoma cornutum*	-	T	Y	Y
Alligator snapping turtle	*Macrochelys temmenckii*	-	T	-	Y
Amphibians					
Houston toad	*Bufo houstonensis*	LE	E	-	Y
Cascade Caverns salamander	*Eurycea latitans complex*	-	T	-	Y
Comal blind salamander	*Eurycea tridentifera*	-	T	-	Y
Sheep frog	*Hypopachus variolosus*	-	T	-	Y
Black-spotted newt	*Notophthalmus meridionalis*	-	T	-	Y
Fish					
Blue sucker	*Cycleptus elongatus*	-	T	-	Y
Fountain darter	*Etheostoma fonticola*	LE	E	-	Y
Sharpnose shiner	*Notropis oxyrhynchus*	C	-	-	Y
Widemouth blindcat	*Satan eurystomus*	-	T	-	Y
Toothless blindcat	*Trogloglanis pattersoni*	-	T	-	Y

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Common Name	Scientific Name	Federal Status[1]	State Status[1]	Plant Site[2]	T-Line Counties[2]
		Crustaceans			
Peck's Cave amphipod	*Stygobromus pecki*	LE	E	-	Y
		Insects			
Helotes mold beetle	*Batrisodes venyivi*	LE	-	-	Y
Comal Springs riffle beetle	*Heterelmis comalensis*	LE	-	-	Y
A ground beetle	*Rhadine exilis*	LE	-	-	Y
A ground beetle	*Rhadine infernalis*	LE	-	-	Y
Comal Springs dryopid beetle	*Stygoparnus comalensis*	LE	-	-	Y
		Arachnids			
Robber Baron Cave meshweaver	*Circurina baronia*	LE	-	-	Y
Madla Cave meshweaver	*Cicurina madla*	LE	-	-	Y
Braken Bat Cave meshweaver	*Cicurina venii*	LE	-	-	Y
Government Canyon Bat Cave meshweaver	*Cicurina vespera*	LE	-	-	Y
Government Canyon Bat Cave spider	*Neoleptoneta microps*	LE	-	-	Y
Cokendolpher Cave harvestweaver	*Texella cokendolpheri*	LE	-	-	Y
		Plants			
Navasota ladies'-tresses	*Spiranthes parkseii*	LE	E	-	Y

[1]LE/E = Endangered; LT/T = Threatened; C = Candidate; - = Not listed; DL = delisted taxon, recovered, being monitored for first five years post delisting; SAE/T = listed due to similarity to endangered/threatened species.

[2]Listed in the county containing the plant site (Matagorda County) and/or the counties containing the existing transmission lines (Y=Yes, - = no reported occurrence) [Bexar, Brazoria, Colorado, Comal, DeWitt, Fayette, Gonzales, Guadalupe, Jackson, Karnes, Lavaca, Victoria, Wharton and Wilson Counties].

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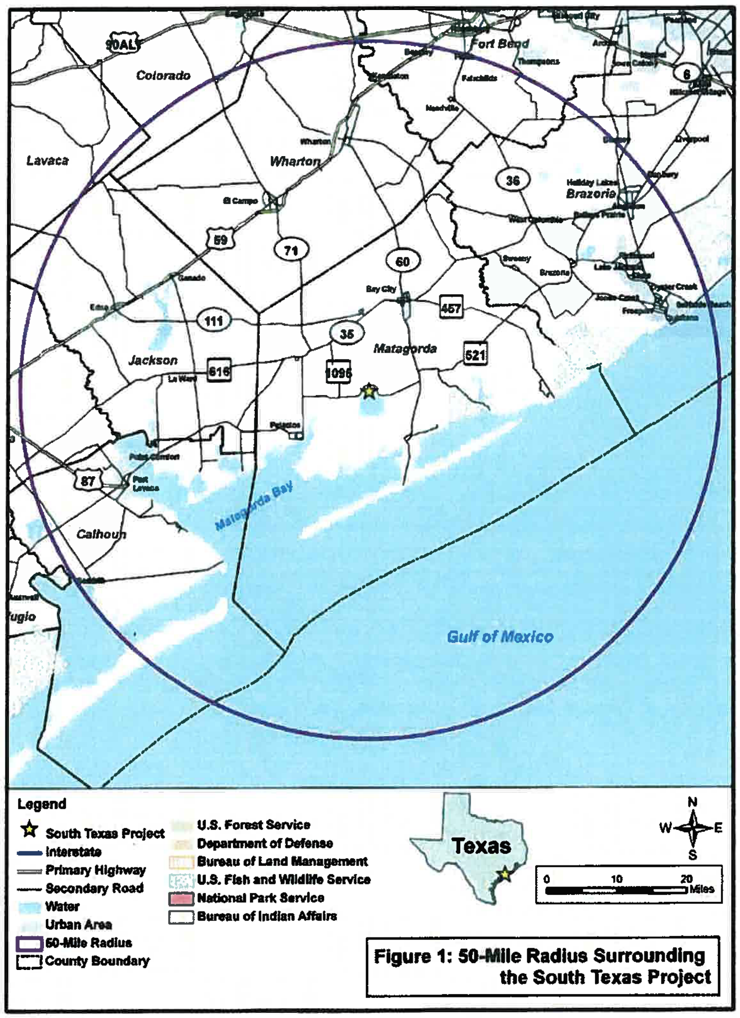

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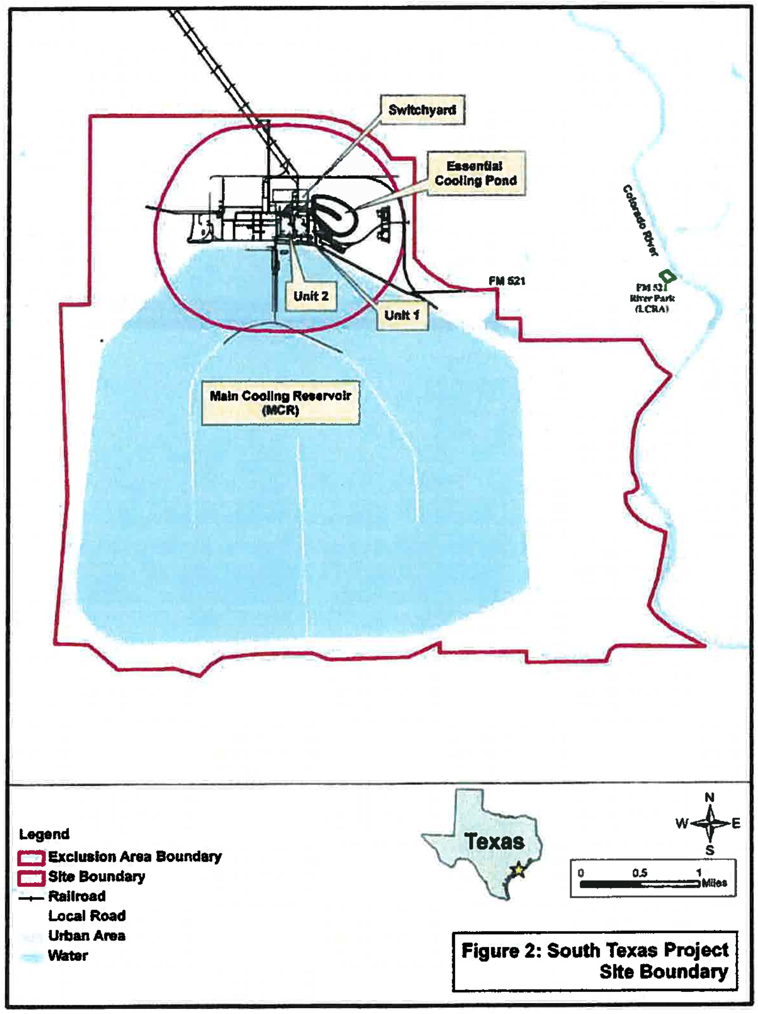

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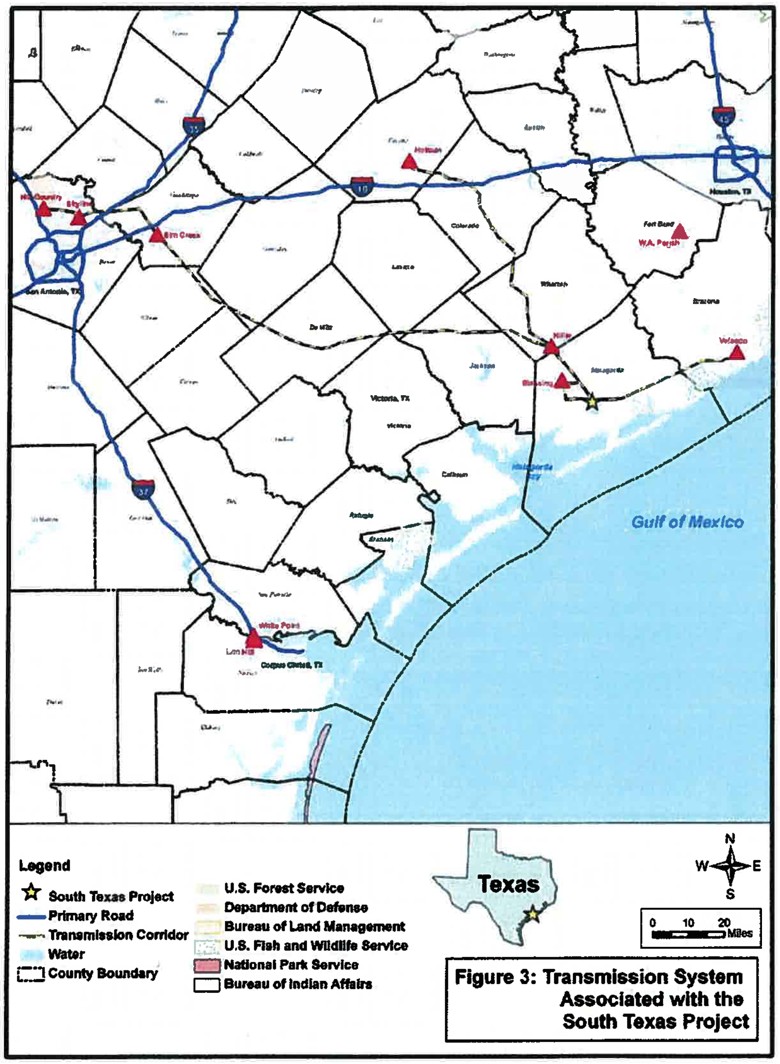


ATTACHMENT D

CULTURAL RESOURCES CORRESPONDENCE

Nuclear Operating Company

South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

March 17, 2009
NOC-TX-09019435
File No. W12.02
STI No. 32444421

Dr. James Bruseth
Director, Archeology Division
Texas Historical Commission
P.O. Box 12276
Austin, Texas 78711-2276

SUBJECT: South Texas Project (STP) Electric Generating Station, Units 1 & 2
Request for Review for Historic and Archaeological Resources

Dear Dr. Bruseth:

STP Nuclear Operating Company (STPNOC) is initiating the steps required to file an application with the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for STP Units 1 & 2. The current operating licenses expire on August 20, 2027, for Unit 1 and on December 15, 2028, for Unit 2. The renewal terms would be for an additional 20 years beyond each original license expiration date. The NRC review schedule dictates limited windows of opportunity to submit an application for license renewal and based on their schedule, the application will be submitted in the fourth quarter of 2010.

As part of the license renewal process, NRC requires license applicants to "assess whether any historic or archaeological properties will be affected by the proposed project". The NRC may request formal consultation with your office at a later date under Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470), and under Advisory Council on Historic Preservation regulations (36 CFR Part 800). By contacting you early in the application process, STPNOC hopes to identify any issues that need to be addressed or provide any information your office may need to expedite the NRC consultation.

Description of STP Units 1 & 2

STP Units 1 & 2 are located in Matagorda County, Texas, on Farm to Market Road 521 approximately 8 miles north of Matagorda Bay and 80 miles south-southwest of Houston. The nearest population center, Bay City, is approximately 15 miles north-northeast of the site (Figure 1). The western bank of the Colorado River forms the eastern STP property boundary. The STP site boundary encloses approximately 12,220 acres and includes a 7,000-acre Main Cooling Reservoir (Figure 2). The Units 1 & 2 site buildings, operations area, and support facilities occupy approximately 65 acres. The Essential Cooling Pond occupies approximately 46 acres. The remaining portion of the STP site is a combination of maintained and undeveloped land, with approximately 1,700 acres maintained as natural lowland habitat and some leased for cattle grazing and other agriculture.

Existing offsite infrastructure associated with the operation of STP Units 1 & 2 is comprised of transmission lines (Figure 3). In total, the corridors carrying circuits from STP extend a distance of approximately 438 miles. The transmission corridors/lines built to connect STP to the grid occupy three main corridors: identified here as Eastern (toward Galveston), Western (to San Antonio), and Northwestern (toward Austin). The corridors pass through land that is primarily agricultural and rangeland, with some forest land and lesser land use categories. The areas are mostly remote, with low population densities. Corridors that pass through farmlands generally continue to be used as farmland. The following 345-kilovolt transmission lines are considered in scope for the license renewal analysis:

- Velasco – This double-circuit line on double-circuit towers runs from STP to the Velasco substation south of Houston in Brazoria County. The 100-foot wide corridor is 45 miles long.
- Hillje – The Hillje substation is in the southwestern corner of Wharton County, just across the border from Matagorda County. The corridor is 400 feet wide and 20 miles long and contains six transmission lines from STP (another 138 kilovolt line brings emergency power in to STP). However, only two of the six transmission lines that run from STP towards Hillje terminate at Hillje. The other lines are described further below.
- Holman – This single circuit line exits STP and proceeds first to the Hillje substation on a double-circuit tower shared with an Elm Creek line. From Hillje, the line continues to Holman for an additional 70 miles.
- Hill Country and Skyline – The Hill Country and Skyline lines exit STP and run on separate double-circuit towers, each one shared with a W. A. Parrish line for 20 miles in the Hillje corridor. At that point, these lines diverge from the W. A. Parrish lines and continue on double-circuit towers to the Elm Creek substation. From Elm Creek, the Hill Country line continues to the Hill Country substation. From Elm Creek, the Skyline line continues to the Skyline substation.
- Lon Hill (White Point) loops 1 and 2 – The pre-existing Lon Hill line was looped into the STP substation. The 20-mile loop is subject to analysis as it was constructed originally to connect the plant to the grid. The loop resides in the Hillje corridor. Also, the Lon Hill line was looped into the White Point substation.

- Blessing – This single-circuit line heads west from STP for approximately eight miles then takes a turn to the north for another approximately seven miles, and terminates at Blessing Substation in Matagorda County. The corridor to Blessing is 100 feet wide.

Previous Cultural Resource Assessments

Cultural resource investigations of approximately 12,350 acres were conducted in 1973 by the Texas Archaeological Society for the proposed construction of STP Units 1 & 2. The investigations included a pedestrian surface survey with limited subsurface testing and a historic records search. Those investigations determined that the study area did not include any resources there were listed on, or eligible for listing on, the National Register of Historic Places (NRHP). It also concluded that no resources of local, regional, or state significance were in the study area. The findings of the survey were included in the analysis conducted for the NRC's Final Environmental Statement (FES) for construction of STP Units 1 & 2. The 1975 FES found that, based on the findings of the study, there were no archaeological resources in the site area. The 1986 FES for operation of STP Units 1 & 2 reports that consultation with the Texas Historical Commission (THC) on the operation of the STP site and transmission lines was conducted, and the THC concluded that no effect upon any properties listed on or eligible for listing on the NRHP would occur.

There are no known historic or archaeological resources on the STP Units 1 & 2 site. STPNOC is not aware of any historic or archaeological resources that have been affected by STP Units 1 & 2 operations, including operation and maintenance of transmission lines. However, STPNOC is aware that the site vicinity and the surrounding environs have the potential for containing cultural resources. STPNOC has an environmental review and evaluation procedure to ensure the protection and consideration of any cultural resources or human remains discovered during operations and maintenance activities on the site.

Designated Cultural Resources Near STP Units 1 & 2

A search of records maintained by the National Park Service, the THC, and the Texas Archaeological Research Laboratory was conducted in January 2009 to identify designated cultural properties and recorded archaeological resources within six miles of STP Units 1 & 2. There are no National Historic Landmarks and no properties listed on the NRHP located within six miles of STP Units 1 & 2. There are no Historic Texas Cemeteries and only one Recorded Texas Historical Landmark within six miles (THC 2009a). The Landmark is the St. Francis Catholic Church, a late Victorian church dating to 1896, which is located near Wadsworth approximately six miles to the east of STP Units 1 & 2 (THC 2009b). There are three previously recorded archaeological sites located within six miles of the STP Units 1 & 2, none of which are State Archaeological Landmarks (THC 2009c). One site is the wreck of a small boat, and one site is an historic farmstead with structural foundation remains and a widespread scatter of 20^{th} century machine parts and structural debris. The site form for the third site is missing from the records. The three archaeological sites are located to the northeast of STP Units 1 & 2, between 3.85 and 4.40 miles away.

Assessment of Effect

STPNOC is proposing that the NRC renew the operating licenses for Units 1 & 2 for an additional 20 years. Continued operation and maintenance of STP Units 1 & 2 and its associated transmission infrastructure would not involve any license-related construction, demolition, or refurbishment activities. Routine operation and maintenance activities would continue to occur as they have since the plant started operations in 1987. All such activities would occur in areas previously disturbed through construction activities. Therefore, STPNOC concludes that there would be no effect to historic properties from license renewal and associated operation and maintenance activities.

Please do not hesitate to contact me at 361-972-8328 if you have any questions or require any additional information. After your review, we would appreciate your response by April 16, 2009 detailing any concerns you may have for impacts to cultural resources or confirming STPNOC's conclusion that continued operation of STP Units 1 & 2 over the license term would have no effect on any historic properties. This will enable us to meet our application preparation schedule. STPNOC will include a copy of this letter and your response in the Environmental Report that will be submitted to the NRC as part of the license renewal application.

Sincerely,

S. L. Dannhardt
Manager, Environmental
sidannhardtf@stpees.com

Attachment: Figures 1, 2, and 3

NO HISTORIC
PROPERTIES AFFECTED
PROJECT MAY PROCEED
by
for Mark Wolfe
State Historic Preservation Officer
Date 10/26/09
Track#

- 4 -

Bcc: R. A. Gangluff
M. J. Berg
K. J. Taplett
Correspondence, N2002

Attachment

Figure 1: 50 Mile Radius Surrounding the South Texas Project

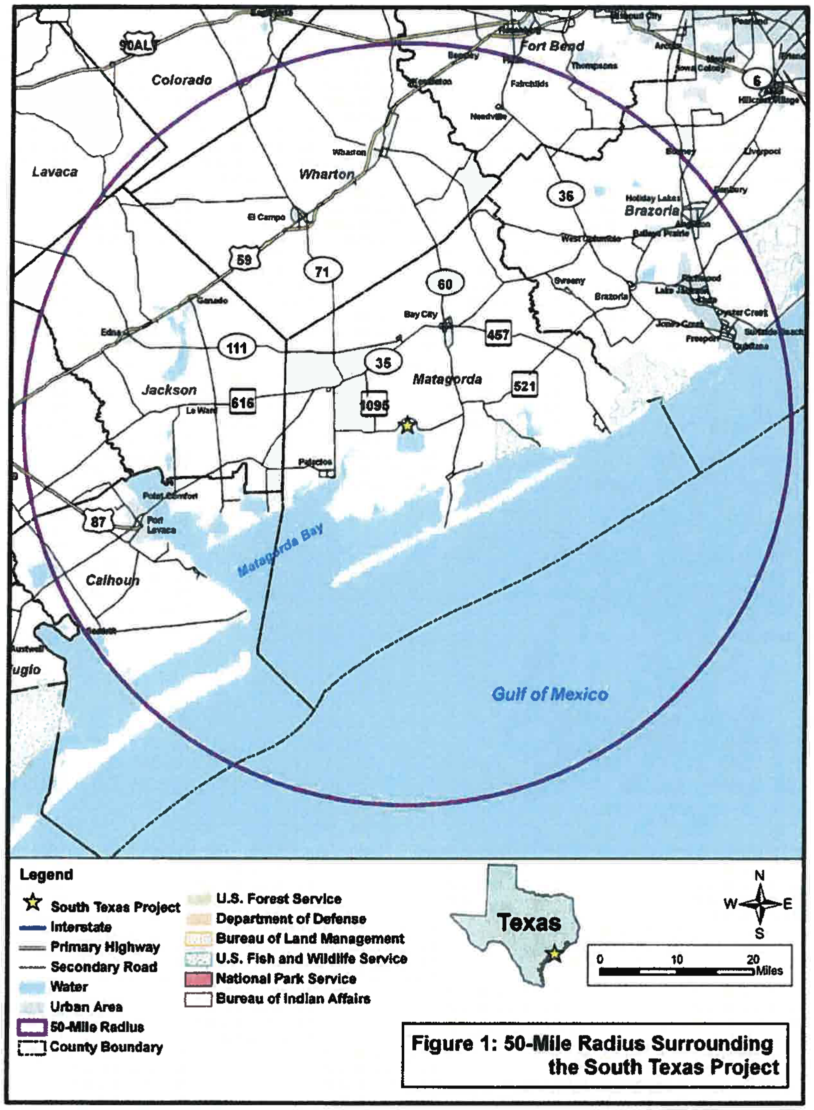
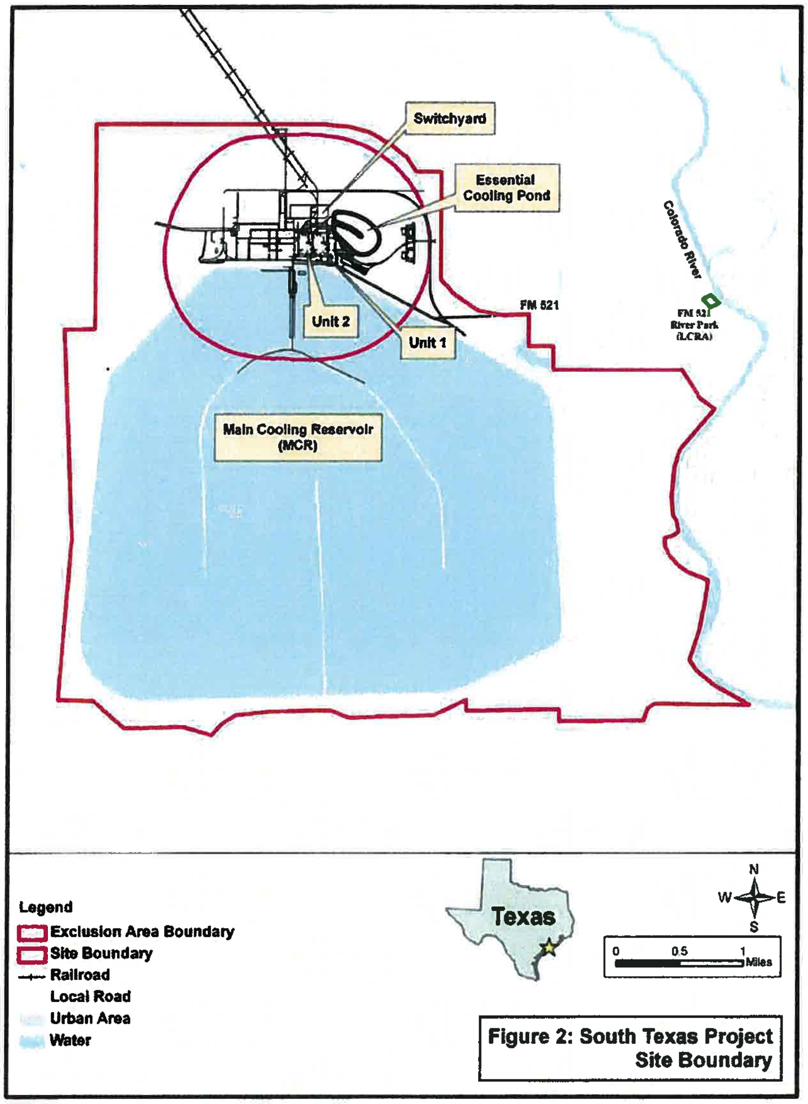


Figure 1: 50-Mile Radius Surrounding the South Texas Project

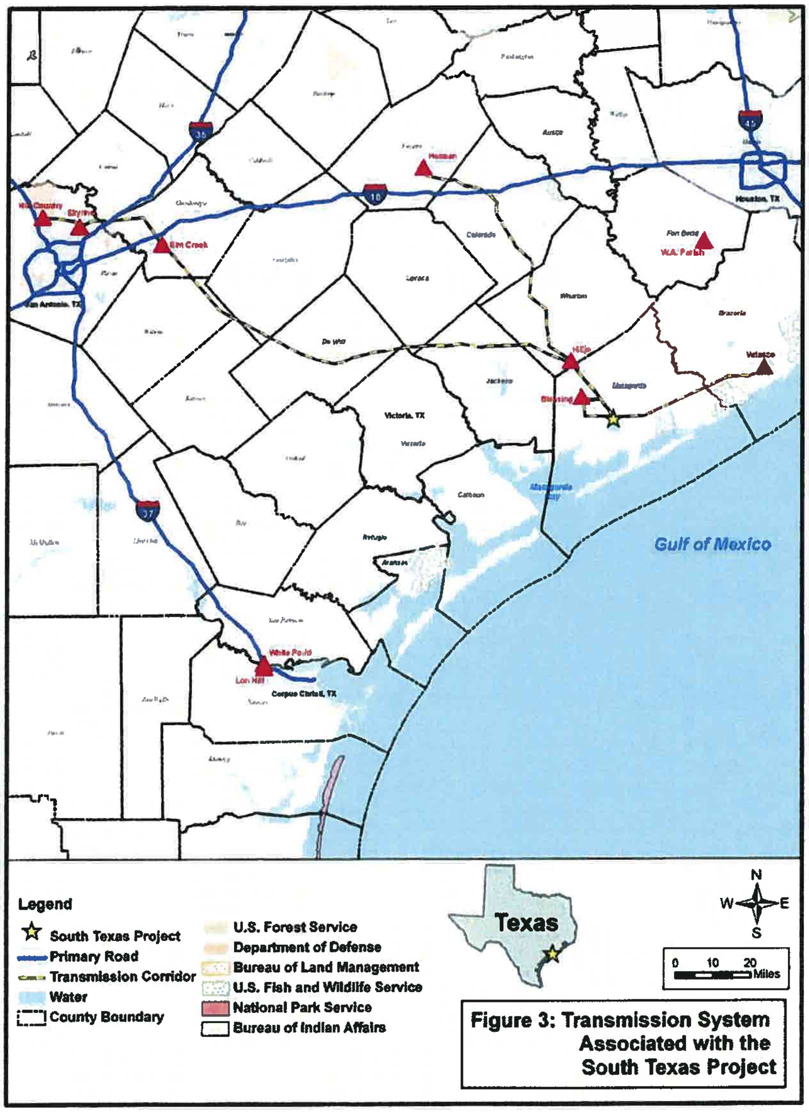
Attachment

Figure 2: South Texas Project Site Boundary



Attachment

Figure 3: Transmission System Associated with the South Texas Project



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National Park Service. 2009a. National Historic Landmarks within a 6-mile Radius of STP Units 1 & 2. National Historic Landmarks Program database, accessed on January 16, 2009. http://www.nps.gov/history/nhl/designations/listsofNHLs.htm.

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THC (Texas Historical Commission). 2009b. St. Francis Catholic Church. Texas Historic Sites Atlas database, accessed on January 16, 2009. http://atlas.thc.state.us/common/viewform.asp.

THC (Texas Historical Commission). 2009c. Archaeological Sites Located within 6 Miles of STP Units 1 & 2. Texas Archaeological Sites Atlas database, accessed on January 16, 2009. http://nueces.thc.state.tx.us/maps/ims.

ATTACHMENT E

MICROBIOLOGICAL CORRESPONDENCE

STP Nuclear Operating Company

South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

March 10, 2009
NOC-TX-09019432
File No. W12.02
STI No. 32444289

Mr. Neil Pascoe
Infectious Disease Control Unit
Texas Department of State Health Services
P. O. Box 149347
Austin, Texas 78714-9347

SUBJECT: South Texas Project Units 1 & 2 License Renewal
Request for Information on Thermophilic Microorganisms

Dear Mr. Pascoe:

STP Nuclear Operating Company (STPNOC) is preparing to file an application with the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for South Texas Project (STP) Units 1 & 2. The current operating licenses expire on August 20, 2027, for Unit 1 and on December 15, 2028, for Unit 2. The renewal terms would be for an additional 20 years beyond the original license expiration dates. The NRC regulation at 10 CFR 51.53 requires each applicant for a license to submit an Environmental Report assessing the impact of the proposed action (license renewal) that includes "an assessment of the impact of the proposed action {license renewal} on public health from thermophilic organisms in the affected water." Organisms of concern include the enteric pathogens *Salmonella* and *Shigella*, the *Pseudomonas aeruginosa* bacterium, thermophilic Actinomycetes ("fungi"), the many species of *Legionella* bacteria, and pathogenic strains of the free-living *Naegleria* amoeba.

STPNOC is consulting with your office to determine whether there is any concern about the potential occurrence of these organisms in the Main Cooling Reservoir (MCR) at STP or in the Colorado River downstream of STP. By contacting you, we hope to identify any issues that need to be addressed or any information your office may need to expedite the NRC consultation.

STP Units 1 & 2 are located in Matagorda County (Figures 1 and 2), approximately eight miles north of Matagorda Bay. Heated effluent from the STP reactors is discharged to the MCR, an approximately 3.0-mile-long by 3.75-mile-wide perched, off-channel impoundment built adjacent to the Colorado River (Figure 2). The MCR has a surface area of approximately 7,000 acres and a normal operating level of El. 47 ft MSL. The MCR was created as a cooling pond solely for the purpose of dissipating waste heat from the STP nuclear units. A series of dikes inside the MCR lengthen the flow path, providing extended circulation and cooling of the water.

The MCR is not a publicly managed water body and has no recreational uses. The general public has never had access to the MCR nor is any planned in the foreseeable future. The MCR is on private property and is located within the fenced site boundary.

STPNOC diverts water from the Colorado River to the MCR to replace water lost to evaporation and designed seepage. Colorado River water is withdrawn at the Reservoir Makeup Pumping Facility (RMPF) and piped to the MCR by means of four large makeup pumps with a total capacity of approximately 269,000 gallons per minute (600 cubic feet per second). The makeup pumps at the RMPF operate intermittently, as dictated by weather (patterns of rainfall in the river basin), Colorado River flows, and operational considerations.

When STP Units 1 & 2 were built, it was anticipated that it would be necessary to periodically discharge water from (or "blowdown") the MCR to prevent the buildup of salts and dissolved solids in the reservoir. This discharge was authorized under TPDES permit (No. WQ0001908000) and designated Outfall 001. Water discharged from the MCR via this outfall flows to the Colorado River by way of a blowdown facility approximately two miles downstream of the RMPF (Figure 2). The blowdown facility is equipped with seven discharge ports that allow water to be released at rates ranging from 80 cfs (35,906 gpm) to 308 cfs (138,240 gpm) depending on Colorado River flow. The discharge may not exceed 12.5 percent of the river flow and may not exceed 200 million gallons per day. The blowdown facility has been used (tested) only once, in 1997; the MCR is considered a closed cycle recirculating system. Acceptable water quality has been maintained in the MCR by selective diversion of fresh water from the Colorado River during periods of high flow.

The TPDES permit for STP 1 & 2 also contains limits on daily average (95°F) and daily maximum (97°F) discharge temperatures at Outfall 001. Thermophilic microorganisms grow at 55°C (131°F) and show optimal growth at 55-65°C (131-140°F). Given that the maximum temperature of the discharge at Outfall 001 would be 97°F, which is well below the temperature at which thermophilic microorganisms grow (131°F) and thrive (131-140°F), the potential for residents of riverside houses or recreational users of the Colorado River to be exposed to thermophilic pathogens appears to be remote if STPNOC were to discharge via Outfall 001.

The capability for blowdown is to be retained, however, should it be necessary to discharge MCR water in the future. Any such blowdown would comply with limits and conditions established in the TPDES wastewater discharge permit. TPDES discharge temperature limits would result in effluent temperatures between 95° and 97°F. Blowdown would occur during high river flow periods (normally during the winter and spring) when river temperatures are significantly lower than the discharge temperature and not conducive to survival and growth of *Naegleria*. We believe the risk to public health from thermophilic microorganisms associated with the potential discharge of MCR water via blowdown system operation is small.

We would appreciate your relating any concerns you may have about these organisms and potential public health effects over the license renewal term by April 9, 2009 or your confirmation of STPNOC's conclusion that operation of STP Units 1 & 2 over the license renewal term would not stimulate growth of thermophilic pathogens. This will enable us to meet our application preparation schedule. STPNOC will include a copy of this letter and your response in the Environmental Report that will be submitted to the NRC as part of the STP Units 1 & 2 license renewal application. Please do not hesitate to call me at 361-972-8328 if you have any questions or require any additional information.

Sincerely,

S. L. Dannhardt
Manager, Environmental

Attachments: Figures 1 and 2

Bcc: R. A. Gangluff
M. J. Berg
K. J. Taplett
Correspondence, N2002

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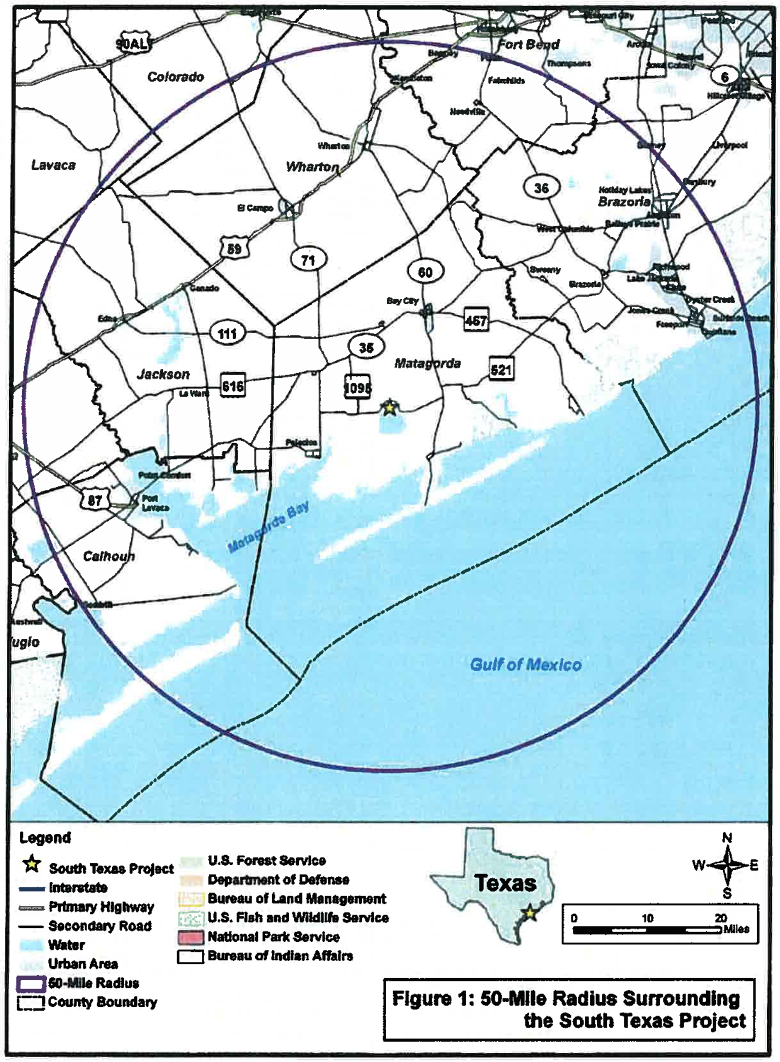
Attachment

Figure 1: 50-Miles Radius Surrounding the South Texas Project



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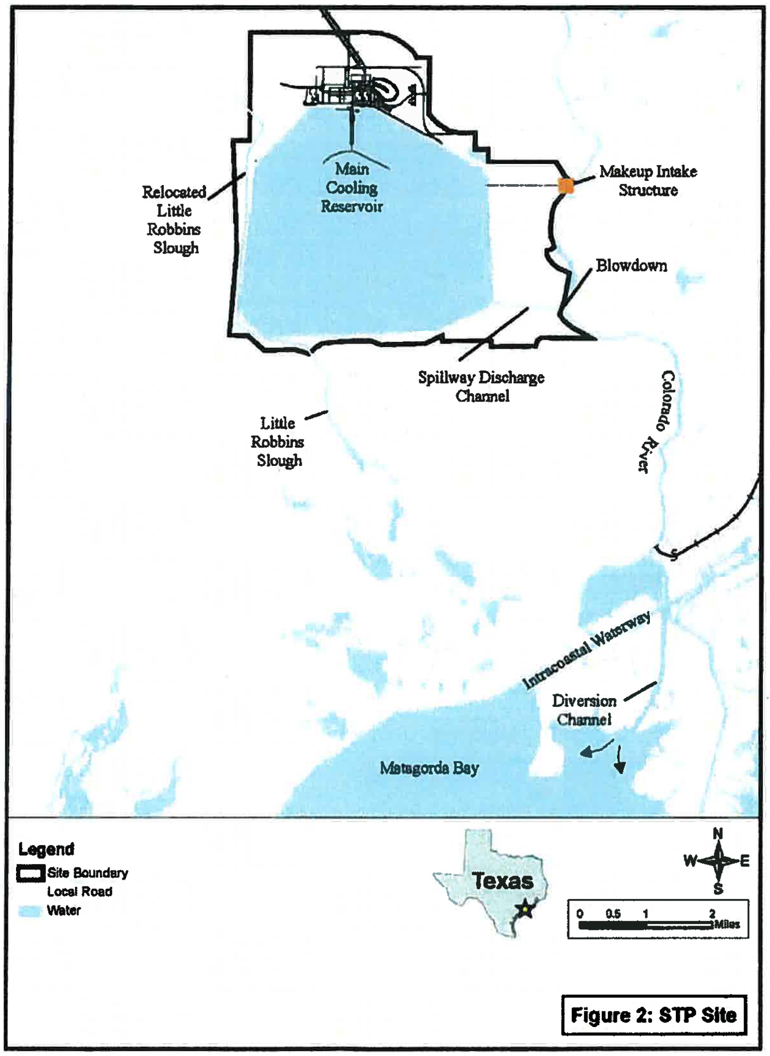
Attachment

Figure 2: South Texas Project Site



Nuclear Operating Company

South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

March 10, 2009
NOC-TX09019433
File No. W12.02
STI No. 32444297

Dr. Vincent P. Fonseca
State Epidemiologist
Texas Department of State Health Services
PO Box 149347
Austin, Texas 78714-9347

SUBJECT: South Texas Project Units 1 & 2 License Renewal
Request for Information on Thermophilic Microorganisms

Dear Dr. Fonseca:

STP Nuclear Operating Company (STPNOC) is preparing to file an application with the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for South Texas Project (STP) Units 1 & 2. The current operating licenses expire on August 20, 2027, for Unit 1 and on December 15, 2028, for Unit 2. The renewal terms would be for an additional 20 years beyond the original license expiration dates. The NRC regulation at 10 CFR 51.53 requires each applicant for a license to submit an Environmental Report assessing the impact of the proposed action (license renewal) that includes "an assessment of the impact of the proposed action {license renewal} on public health from thermophilic organisms in the affected water." Organisms of concern include the enteric pathogens *Salmonella* and *Shigella*, the *Pseudomonas aeruginosa* bacterium, thermophilic Actinomycetes ("fungi"), the many species of *Legionella* bacteria, and pathogenic strains of the free-living *Naegleria* amoeba.

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We would appreciate your relating any concerns you may have about these organisms and potential public health effects over the license renewal term by April 9, 2009 or your confirmation of STPNOC's conclusion that operation of STP Units 1 & 2 over the license

- 2 -

renewal term would not stimulate growth of thermophilic pathogens. This will enable us to meet our application preparation schedule. STPNOC will include a copy of this letter and your response in the Environmental Report that will be submitted to the NRC as part of the STP Units 1 & 2 license renewal application. Please do not hesitate to call me at 361-972-8328 if you have any questions or require any additional information.

Sincerely,

S. L. Dannhardt
Manager, Environmental

Attachment: Figures 1 and 2

- 3 -

Bcc: R. A. Gangluff
M. J. Berg
K. J. Taplett
Correspondence, N2002

Attachment

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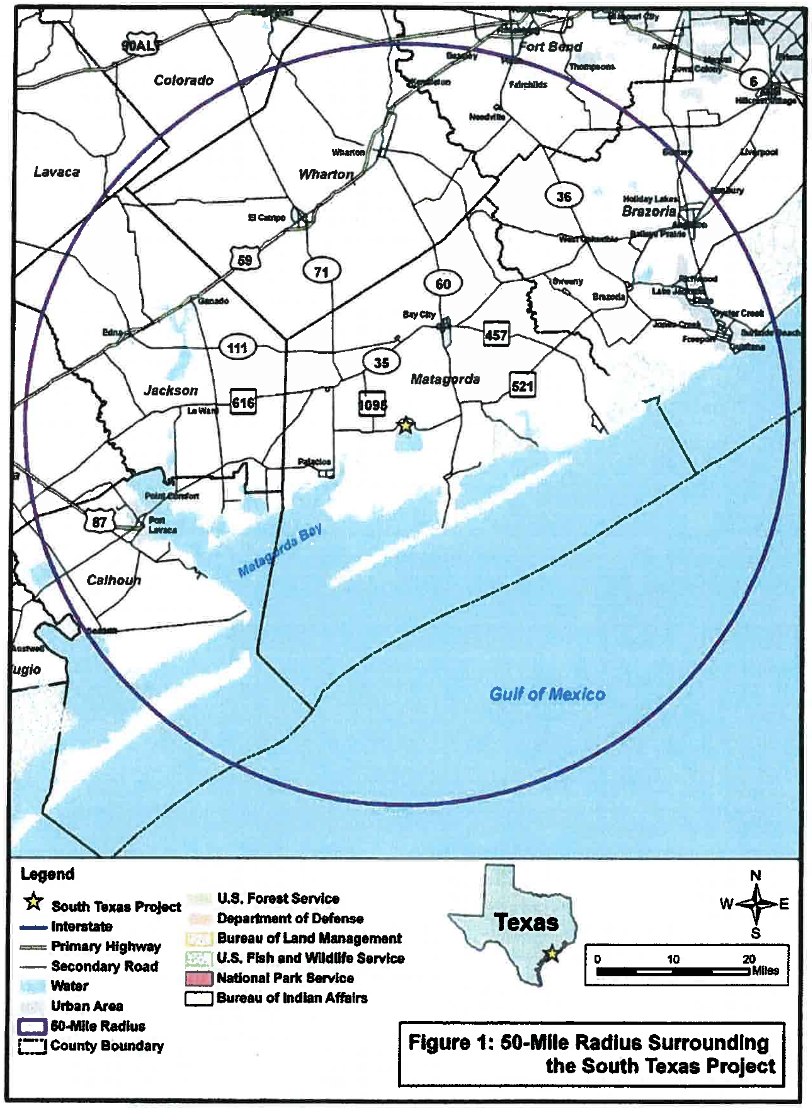

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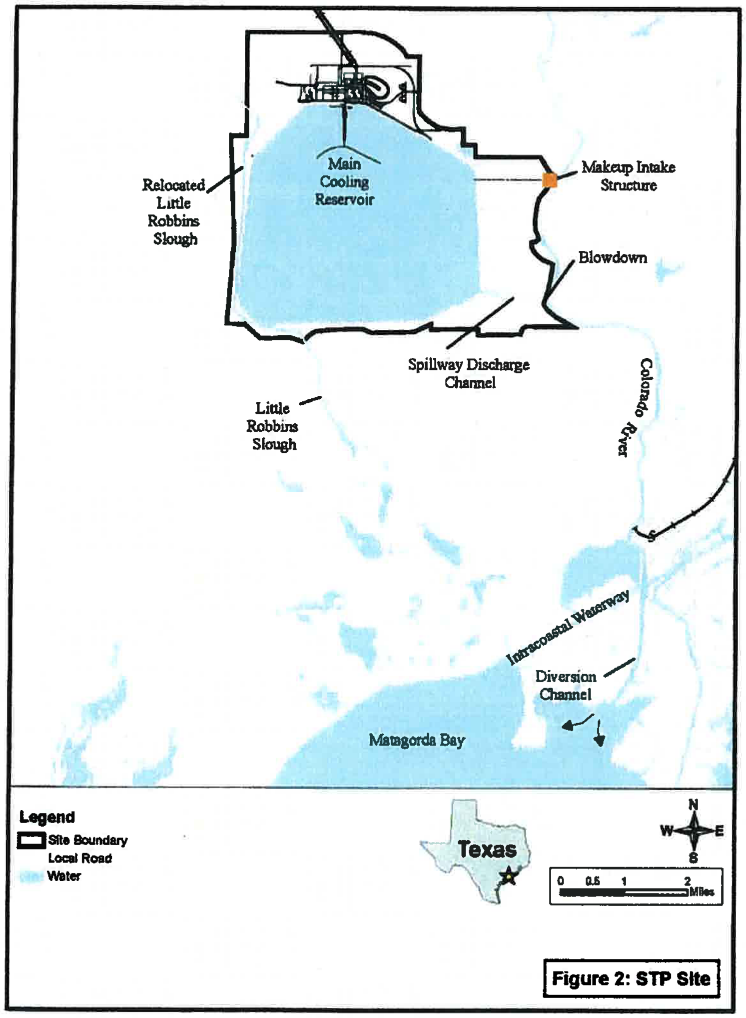
Figure 2: South Texas Project Site



ATTACHMENT F

SEVERE ACCIDENT MITIGATION ALTERNATIVES ANALYSIS

TABLE OF CONTENTS

Section — Page

TABLE OF CONTENTS (CONTINUED)

List of Tables

ACRONYMS USED IN ATTACHMENT F

AFW	auxiliary feedwater
AMSAC	Anticipated Transient Without Scram (ATWS) Mitigating System Actuation Circuitry
ATWS	anticipated transient without scram
BWR	boiling water reactor
CCF	common cause failure
CCW	component cooling water
CDF	core damage frequency
CRE	control room envelope
Cs	cesium
CST	condensate storage tank
CVCS	chemical and volume control system
DC	direct current
DG	diesel generator
EAB	electrical auxiliary building
ECW	essential cooling water
ECWIS	essential cooling water intake structure
EDG	emergency diesel generator
EPZ	emergency planning zone
ESF	engineered safeguard feature
ESFAS	engineered safety features activation system
EW	essential cooling water
FP	fire protection
F-V	Fussell-Vesely
HEP	human error probability
HRA	human reliability analysis
HVAC	heating ventilation and air-conditioning
Hx	heat exchanger
HNP	Shearon Harris Nuclear Plant
IA	instrument air
IPE	individual plant examination
IPEC	Indian Point Energy Center

ACRONYMS USED IN ATTACHMENT F

IPEEE	individual plant examination – external events
ISLOCA	interfacing systems LOCA
kV	kilovolt
LERF	large early release frequency
LOCA	loss-of-coolant accident
LOOP	loss of off-site power
LHSI	low head safety injection
MAAP	modular accident analysis program
MACCS	MELCOR accident consequences code system
MACCS2	MELCOR accident consequences code system, version 2
MACR	maximum averted cost-risk
MCR	main cooling reservoir
MFW	main feedwater
MOV	motor operated valve
MSIV	main steam isolation valve
MWt	megawatts thermal
NRC	U.S. Nuclear Regulatory Commission
OECR	off-site economic cost-risk
PACR	potential averted cost-risk
PDP	positive displacement pump
PORV	power operated relief valve
PRA	probabilistic risk assessment
STP	South Texas Project
PWR	pressurized water reactor
RCP	reactor coolant pump
RCS	reactor coolant system
RDR	real discount rate
RHR	residual heat removal
RMTS	risk managed technical specifications
RRW	risk reduction worth
SAMA	severe accident mitigation alternative
SBDG	standby diesel generator
SBO	station blackout

ACRONYMS USED IN ATTACHMENT F

SG	steam generator
SGTR	steam generator tube rupture
SI	safety injection
SSES	Susquehanna Steam Electric Station
STPNOC	STP Nuclear Operating Company
Te	tellurium
TD AFW	turbine driven auxiliary feedwater
TSC	technical support center
VEGP	Vogtle Electric Generating Plant
WCGS	Wolf Creek Generating Station

ATTACHMENT F – SEVERE ACCIDENT MITIGATION ALTERNATIVES

The severe accident mitigation alternatives (SAMA) analysis discussed in Section 4.20 of the Environmental Report is presented below.

F.1 METHODOLOGY

The methodology selected for this analysis, which is based on the NEI 05-01 (NEI 2005) guidance, involves identifying SAMA candidates that have the highest potential for reducing plant risk and determining whether or not the implementation of those candidates is beneficial on a cost-risk reduction basis. The metrics chosen to represent plant risk include the core damage frequency (CDF), the dose-risk, and the off-site economic cost-risk (OECR). These values provide a measure of both the likelihood and consequences of a core damage event. The SAMA process consists of the following steps:

- Baseline Risk Monetization – Use U.S. Nuclear Regulatory Commission (NRC) regulatory analysis techniques to calculate the monetary value of the unmitigated South Texas Project (STP) severe accident risk. This becomes the maximum averted cost-risk (MACR) that is possible (Section F.4). The following plant specific risk analyses are used to support this process:

  - The STP Level 1 and 2 Probabilistic Risk Assessment (PRA) models (Section F.2) provide estimates of the risk related to core melt scenarios. These models evaluate the likelihood of a core melt and the performance of the containment structures after core melt has occurred. The external events contributions, which have historically been evaluated separately from the internal events contributors, are integrated with the internal events contributors and are evaluated in conjunction with them.

  - The Level 1 and 2 PRA output, site-specific meteorology, demographic, land use, and emergency response data are used as input in performing a Level 3 PRA using the MELCOR Accident Consequences Code System Version 2 (MACCS2) (Section F.3). The results of the Level 3 PRA provide estimates of the consequences of core melt scenarios.

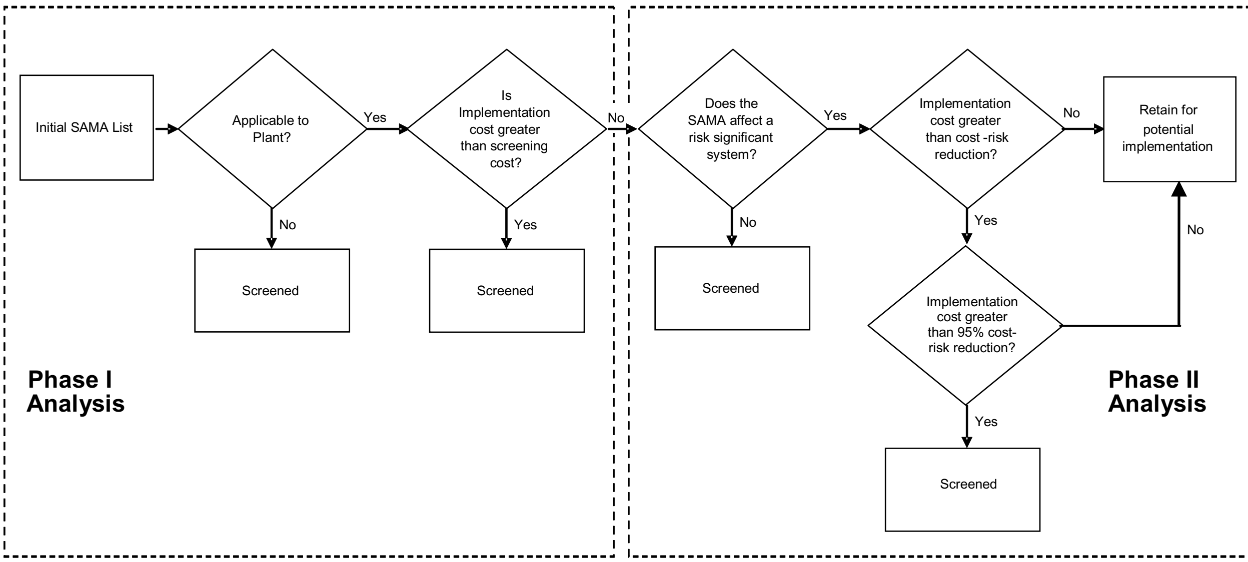
- Develop an initial plant specific SAMA list based on the STP PRA, Individual Plant Examination (IPE), Individual Plant Examination – External Events (IPEEE), and documentation from the industry and NRC. This process is defined in more detail in Section F.5 and the resulting 21 candidate Phase I SAMA list is provided as Table F.5-3.

- Phase I SAMA Analysis – Screen out SAMA candidates that are not applicable to the STP design (includes those candidates that are known to be of low benefit in pressurized water reactors (PWRs) such as STP, candidates that have already been implemented at STP, or candidates for which the potential benefits have been achieved at STP using other means), and candidates whose estimated cost exceeds the possible MACR (Section F.5). The result of this process is the Phase II SAMA list, which is provided as Table F.5-4.

- Phase II SAMA Analysis – Calculate the monetary value of the risk reduction attributable to each remaining SAMA candidate and compare it to the SAMA's implementation cost to identify the net cost-benefit. PRA insights are also used to screen SAMA candidates in this phase (Section F.6).

- Uncertainty Analysis – Evaluate how changes in the SAMA analysis assumptions might affect the cost-benefit evaluation (Section F.7).
- Conclusions – Summarize results and identify conclusions (Section F.8).

The steps outlined above are described in more detail in the subsections of this attachment. The graphic below summarizes the high-level steps of the SAMA process.



F.2 STP PRA MODEL

By application dated August 2, 2004, as supplemented by letters dated October 26, 2004, February 10, 2006, April 26, 2006, STP Nuclear Operating Company (STPNOC), licensee for South Texas Project (STP), Units 1 and 2, requested amendments to revise the Technical Specifications for STP, Units 1 and 2, in accordance with Part 50.90 of Title 10 of the Code of federal regulations (10 CFR). By letter dated June 6, 2006, as supplemented by letters dated December 28, 2007, February 28, 2007, May 9, 2007, and May 17, 2007, the licensee resubmitted its application in its entirety. The amendments provided a new action for selected Technical Specifications limiting conditions for operation to permit extending the completion times of action requirements subject to the requirement that the risk is assessed and managed. A new Configuration Risk Management Program was added to the Technical Specifications under Administrative Controls, as a risk assessment tool.

The amendments support the risk-informed Technical Specifications initiative 4b for which STP, Units 1 and 2, are pilot plants. As part of its approval process of these broad based risk informed Technical Specifications, the Nuclear Regulatory Commission (NRC) reviewed STP PRA models 4, 4.1, 4.2 and 5. The risk managed Technical Specifications (RMTS) were approved on July 13, 2007. Hence the STP PRA has been extensively reviewed by the NRC through revision 5.

Revision 5.1 was a minor revision that added RMTS macros and associated split fraction logic rules. The CDF and large early release frequency (LERF) were unchanged from Revision 5.

Revision 6 to the PRA was approved in 2009. The table below shows the recent history of the PRA models and the associated CDF.

STP Historical Core Damage Frequency and Truncation

PRA Revision	CDF	Truncation
STP_REV4	9.08E-06	1E-12
STP_RV41	9.19E-06	1E-12
STP_RV42	9.28E-06	1E-12
STP_REV5	1.04E-05	1E-12
STP_RV51 (added RMTS macros only)	1.04E-05 (no quantification change from STP_REV5)	1E-12
STP_REV6	6.39E-06	1E-12

The current model (STP_REV6) reflects the plant design configuration as of December 31, 2007 and plant data from January 1, 1998 through December 31, 2007 for component failure data and equipment unavailability. Internal initiating events frequencies are based on data from 6 months after commercial operation through December 31, 2007. The major changes to the STP_REV6 reference PRA model that affect CDF are the plant specific data update which reflects improved equipment reliability, reduction in initiating event frequency, reduction in planned maintenance unavailability, and interfacing systems loss of coolant accident (ISLOCA) (VSEQ) model changes. These changes have the following effect on the overall CDF value:

- Updating of equipment reliability resulted in the majority of the decrease in CDF, approximately 3E-06.
- Initiating event update resulted in decrease in CDF of approximately 4E-07.
- Planned maintenance unavailability update resulted in an overall decrease in CDF, approximately 2E-07.
- Treatment of operator action in the ISLOCA (VSEQ) initiator increased CDF by approximately 1E-07.

The STP CDF is calculated to be 6.39E-06 /year. The event tree quantification was calculated using a truncation cutoff frequency of 1.0E-12, or more than 6 orders of magnitude below the baseline CDF. The results of the CDF quantification of risk from internal events is summarized in Table F.2-1 (Initiating Event Contribution to core damage), Table F.2-2 (Initiator Group Contributor to CDF), Table F.2-3 (Basic Event Importance) and Table F.2-4 (Top Core Damage Sequences).

F.3 LEVEL 3 PRA ANALYSIS

The MACCS2 code (Chanin and Young 1997) was used to perform the level 3 PRA for STP Units 1 and 2. The input parameters given with the MACCS2 "Sample Problem A," which included the COMIDA2 food ingestion exposure model, formed the basis for the present analysis. These generic values were supplemented with parameters specific to STP and the surrounding area. Site-specific data included population distribution, economic parameters, and agricultural production. Parameters describing the costs of evacuation, relocation and decontamination were escalated from the time of their formulation (1986) to present (January 2009) costs. Plant-specific release data included the time-activity distribution of nuclide releases and release frequencies. The behavior of the population during a release (evacuation parameters) was based on plant and site-specific set points (i.e., declaration of a General Emergency) and evacuation time estimates (KLD 2007). These data were used in combination with site and region-specific meteorology to simulate the probability distribution of impact risks (exposure and economic) to the surrounding (within 50 miles) population from the 9 evaluated accident sequence releases at STP.

F.3.1 Population

The population distribution projections were taken from an analogous study for the potential construction and operation of two new units at the STP site (STPNOC 2009b). The study of the population distribution was based on the 2000 census, as accessed by SECPOP2000 (NRC 2003). The baseline population was determined for each of the sixteen directions and each of ten concentric distance rings with outer radii at 1, 2, 3, 4, 5, 10, 20, 30, 40 and 50 miles surrounding the site. The transient population within ten miles of the site, based on Earth Tech (1994), was included; that transient population, when projected to the time of the later evacuation study (KDL 2007), was within one percent of that found in the later study. County growth rates (TX State Data Center 2006) were applied to project this total population distribution to the year 2050.

F.3.2 Economy and Agriculture

MACCS2 requires certain agriculture and economic data (fraction of land devoted to farming, annual farm sales, fraction of farm sales resulting from dairy production, and property value of farm and non-farm land) spatially distributed in the same manner as the population. This was again done by applying the SECPOP2000 program, changing the regional economic data format to comply with MACCS2 input requirements. SECPOP2000 was used to access data from the 1997 National Census of Agriculture. The version 3.12.01 data file accessed by SECPOP2000 for that information, County97.dat, was modified to correct two errors (generally known as the missing notes parameter error and the missing county numbers error) in the issued version. The program's specification of crop production parameters for the 50-mile region (e.g, fraction of farmland devoted to grains, vegetables, etc.) was also applied.

Generic economic data that is applied to the region as a whole were revised from the MACCS2 sample problem input in order to account for cost escalation since 1986, the year that input was first specified. A factor of 1.94, representing cost escalation from 1986 to January 2009 was applied to parameters describing cost of evacuating and relocating people, land decontamination, and property condemnation.

F.3.3 Nuclide Release

The core inventory corresponds to the end-of-cycle values for projected future 4100 megawatts thermal (MWt) STP Units 1 and 2 operations, as determined by the ORIGEN2.1 code (STPNOC 2007). Table F.3-1 gives the estimated STP core inventory.

Release frequencies (STPNOC 2006a), nuclide release fractions (of the core inventory, (STPNOC 2006b), shown in Table F.3-2, and the time distribution of the release (described in Table F.3-2 for noble gases and cesium (Cs), STPNOC 2006b) were analyzed to determine the sum of the exposure (50-mile dose) and economic (50-mile economic costs) risks from 9 potentially representative accident sequences (also given in Table F.3-2). STP nuclide release categories, as determined by the modular accident analysis program (MAAP) computer code, were related to the MACCS categories as shown in Table F.3-3. Release duration periods were defined which represented the time distribution of each category's releases. Release inventories of each of the two chemical forms of the Cs and tellurium (Te) releases, as given by the MAAP code output, were incorporated into the nuclide release fractions.

The containment building has an outer diameter of 164 feet. The top of containment is 198 feet above grade. All releases were modeled as occurring at top of containment. The thermal content of each of the releases was assumed to be the same as ambient, i.e., buoyant plume rise was not modeled. Each of these assumptions was considered in sensitivity analyses, presented as the last subheading in this section.

F.3.4 Evacuation

Reactor trip for each sequence was taken as time zero relative to the core containment response times. A General Emergency is declared when plant conditions degrade to the point where it is judged that there is a credible risk to the public; it was assumed here that the declaration would coincide with the onset of core damage. Table F.3-4 shows the resulting declaration times.

The MACCS2 User's Guide input parameters of 95 percent of the population within 10 miles of the plant (Emergency Planning Zone (EPZ)) evacuating and 5 percent not evacuating were employed. These values are conservative relative to the NUREG-1150 study, which assumed evacuation of 99.5 percent of the population within the EPZ (NRC 1989).

The evacuees are assumed to begin evacuation 60 minutes (KDL 2007, 50% of population begins evacuating) after a general emergency has been declared at an evacuation radial speed of 1.34 m/sec. This speed is derived from the projected time to evacuate the entire EPZ under adverse weather conditions during the year 2007, the year of the evacuation study. The evacuation speed was projected to year 2050 conditions by conservatively assuming that all of the roads in 2007 transported traffic at their maximum throughput and that no new roads would be constructed (although the roads would be maintained at 2007 conditions). The 2050 evacuation speed was then the 2007 speed multiplied by the ratio of 2007 to projected 2050 EPZ (10-mile) populations. That estimated 2050 evacuation speed, 1.03 m/sec, was used in the risk analysis. Both the evacuation speed and the time from emergency declaration to the start of evacuation was considered further in the sensitivity analyses presented in the last subheading in this section.

F.3.5 Meteorology

Annual sequential-hourly onsite meteorology data sets from 2006 through 2008 were investigated for use in MACCS2. The data for the parameters of interest in those sets (10-meter wind speed, 10-meter wind direction, multi-level temperatures used to simulate stability class, and precipitation) were from the primary onsite tower. The percentage of data requiring editing for the years 2006 through 2008 were 13%, 5.6% and 3.3%. Missing or bad wind speeds and wind directions were first filled in with the corresponding data from the onsite backup tower. Vertical temperature differences were filled in with the temperature difference corresponding (i.e., same stability class) to the primary tower's measured sigma-theta. Gaps in onsite hourly precipitation data were filled in with the corresponding hourly rainfall from National Weather Service measurements at nearby Palacios Municipal Airport. Subsequent to these steps, 0.009%, 0.2%, and 0.003% of the hourly data points of interest were missing for 2006-2008, respectively. Remaining data gaps were to be filled in by (in order of preference): using corresponding data from the primary tower 60-meter level (taking the relationship between the levels as determined from immediately preceding hours), interpolation (if the data gap was less than 4 hours), or using data from the same hour and a nearby day of a previous year. In practice, only the former two methods were necessary.

The 2006 data set was found to result (see subsequent discussion of sensitivity analysis) in the maximum economic cost and dose risks. The 2006 hourly sequential meteorology was used to create the one-year sequential hourly data set used in the baseline MACCS2 runs. 10-meter wind speed and direction were combined with precipitation and atmospheric stability (specified according to the vertical temperature gradient as measured between the 60- and 10-meters levels) to create the hourly data used in the simulation. Hourly stability was classified according to the scheme used by the NRC (NRC 1983).

Atmospheric mixing heights were specified for morning and evening hours for each season of the year. These values ranged from 430 meters for winter morning hours to 1600 meters for summer evening (USEPA 1972).

F.3.6 Selection of the Representative Source Terms ans MACCS2 Results

The STP Level 2 model includes fifteen accident sequences (or "end states") that are categorized into four major release category groups, as shown in Table F.3-5[1].

For the STP SAMA analysis, the cost benefit calculations were performed at the major release cateogry level, that is, the impact of SAMA implementation was measured by the changes in the major release category frequencies. In order to correlate changes in the major release category frequencies to changes in the mean exposure and economic impacts, and subsequently to cost, it was necessary to assign a representative source term to each of the four major release categories.

For each of the major release categories, the relevant accident sequence frequencies and release characteristics provided in Table F.3-2 were reviewed. The representative accident sequence/source term was considered to be the one that best approximated how a change in the major release category frequency would be reflected in terms of consequences. For example, an accident sequence with a moderate frequencey and severe release characteristics

[1] It should be noted that the sum of the release category frequencies (6.24E-06/yr) is less than the reported CDF of 6.39E-06/yr due to truncation.

would be selected over an accident sequence with a relativley high frequencey and a minor radionuclide release. The following summarizes the source term selection for the major release categories:

- Group I: ISGTR
- Group II: R05SU
- Group III: R13U
- Group IV: Intact

Table F.3-6 provides the 0-50 mile dose-risk and 0-50 mile offsite economic cost-risk (OECR) for each of these major release categories.

F.3.6.1 Validation of Representative Source Terms

In order to validate the choice of the “representative source terms”, the dose-risk and OECR from Table F.3-6 can be compared to the results based on the use of all 9 available source terms. It should be noted, however, that even when all nine available source terms are used for the corresponding accident sequences, there are still six accident sequences from Table F.3-5 for which accident sequence specific source terms are not available. Table F.3-7 summarizes how the frequencies for these six sequences were binned to the analyzed sequences for the validation process:

Table F.3-8 provides the 0-50 mile dose-risk and OECR for each of the nine analyzed accident sequences given the accident sequence binning described in Table F.3-7:

The dose-risk within 50 miles of STP was determined to be 1.74 person-rem for both the case in which the four representative source terms were used and when the larger set of nine source terms were used. For the economic cost-risk within 50 miles of STP (the OECR), the use of the four “representative source terms” is slightly non-conservative, but the difference of $295 would only change the plant’s MACR by $8000, which is a very minor change. Therefore, the representative source terms assigned to the four major release category groups are considered to be appropriate.

F.4 BASELINE RISK MONETIZATION

This section explains how STP calculated the monetized value of the status quo (i.e., accident consequences without SAMA implementation). STP also used this analysis to establish the maximum benefit that could be achieved if all risk for reactor operation were eliminated.

F.4.1 Off-Site Exposure Cost

The baseline annual off-site exposure risk was converted to dollars using NRC's conversion factor of $2,000 per person-rem, and discounted to present value using NRC standard formula in NUREG/BR-0184 (NRC 1997):

$$Wpha = C \times Zpha$$

Where:

W_{pha}	=	monetary value of public health risk after discounting
C	=	$[1-\exp(-rt_f)]/r$
t_f	=	years remaining until end of facility life = 20 years
r	=	real discount rate (RDR) (as fraction) = 0.03 per year
Z_{pha}	=	monetary value of public health (accident) risk per year before discounting ($ per year)

The Level 3 analysis showed an annual off-site population dose risk of 1.74 person-rem, as documented in Table F.3-6. The calculated value for C using 20 years and a 3% discount rate is 15.0396. Therefore, calculating the discounted monetary equivalent of accident dose-risk involves multiplying the dose (person-rem per year) by $2,000 and by the C value (15.0396). The calculated off-site exposure cost is estimated to be $52,338 (1.74 * 15.0396 * $2000 = $52,338).

F.4.2 Off-Site Economic Cost Risk

The Level 3 analysis showed an annual Off-site Economic Cost Risk (OECR) of $1,624, as documented in Table 3-6. Calculated values for off-site economic costs caused by severe accidents must be discounted to present value as well. This is performed in the same manner as for public health risks and uses the same C value. The resulting value is $24,424 (15.0396 * $1,624 = $24,424).

F.4.3 On-Site Exposure Cost Risk

Occupational health was evaluated using NRC methodology that involves separately evaluating immediate and long-term doses (NRC 1997).

For immediate dose, NRC recommends using the following equation:

Equation 1:

$$W_{IO} = R\{(FD_{IO})_S - (FD_{IO})_A\}\{[1 - \exp(-rt_f)]/r\}$$

Where:

W_{IO}	=	monetary value of accident risk avoided due to immediate doses, after discounting
R	=	monetary equivalent of unit dose ($2,000 per person-rem)
F	=	accident frequency (6.39E-06 events per year)
D_{IO}	=	immediate occupational dose [3,300 person-rem per accident (NRC estimate)]
$_S$	=	subscript denoting status quo (current conditions)
$_A$	=	subscript denoting after implementation of proposed action
r	=	RDR (0.03 per year)
t_f	=	years remaining until end of facility life (20 years).

Assuming FA is zero, the best estimate of the immediate dose cost is:

$$W_{IO} = R\,(FD_{IO})_S\,\{[1 - \exp(-rt_f)]/r\}$$
$$= 2{,}000*6.39E\text{-}06*3{,}300*\{[1 - \exp(-0.03*20)]/0.03\}$$
$$= \$634$$

For long-term dose, NRC recommends using the following equation:

Equation 2:

$$W_{LTO} = R\{(FD_{LTO})_S - (FD_{LTO})_A\}\,\{[1 - \exp(-rt_f)]/r\}\{[1 - \exp(-rm)]/rm\}$$

Where:

W_{LTO}	=	monetary value of accident risk avoided long-term doses, after discounting, ($)
D_{LTO}	=	long-term dose [20,000 person-rem per accident (NRC estimate)]
m	=	years over which long-term doses accrue (as long as 10 years)

Using values defined for immediate dose and assuming F_A is zero, the best estimate of the long-term dose is:

$$W_{LTO} = R\,(FD_{LTO})_S\,\{[1 - \exp(-rt_f)]/r\}\,\{[1 - \exp(-rm)]/rm\}$$
$$= 2{,}000*6.39E\text{-}06*20{,}000*\{[1 - \exp(-0.03*20)]/0.03\}\,\{[1 - \exp(-0.03*10)]/0.03*10\}$$
$$= \$3{,}321$$

The total occupational exposure is then calculated by combining Equations 1 and 2 above. The total accident related on-site (occupational) exposure risk (W_O) is:

$$W_O = W_{IO} + W_{LTO} = (\$634 + \$3{,}321) = \$3{,}955$$

F.4.4 On-Site Cleanup and Decontamination Cost

The total undiscounted cost of a single event in constant year dollars (C_{CD}) that NRC provides for cleanup and decontamination is $1.5 billion (NRC 1997). The net present value of a single event is calculated as follows. NRC uses the following equation to integrate the net present value over the average number of remaining service years:

$$PV_{CD} = [C_{CD}/mr][1-\exp(-rm)]$$

Where:

PV_{CD} = net present value of a single event
C_{CD} = total undiscounted cost for a single accident in constant dollar years
r = RDR (0.03)
m = years required to return site to a pre-accident state

The resulting net present value of a single event is $1.3E+09. The NRC uses the following equation to integrate the net present value over the average number of remaining service years:

$$U_{CD} = [PV_{CD}/r][1-\exp(-rt_f)]$$

Where:

PV_{CD} = net present value of a single event ($1.3E+09)
r = RDR (0.03)
t_f = 20 years (license renewal period)

The resulting net present value of cleanup integrated over the license renewal term, $1.95E+10, must be multiplied by the total CDF (6.39E-06) to determine the expected value of cleanup and decontamination costs. The resulting monetary equivalent is $124,541.

F.4.5 Replacement Power Cost

Long-term replacement power costs were determined following NRC methodology in NUREG/BR-0184 (NRC 1997). The net present value of replacement power for a single event, PV_{RP}, was determined using the following equation:

$$PV_{RP} = [\$1.2\times10^8/r] * [1 - \exp(-rt_f)]^2$$

Where:

PV_{RP} = net present value of replacement power for a single event, ($)
r = RDR (0.03)
t_f = 20 years (license renewal period)

To attain a summation of the single-event costs over the entire license renewal period, the following equation is used:

$$U_{RP} = [PV_{RP}/r] * [1 - \exp(-rt_f)]^2$$

Where:

U_{RP} = net present value of replacement power over life of facility ($-year)

After applying a correction factor to account for STP size relative to the generic reactor described in NUREG/BR-0184 (i.e., 1365 megawatt electric/910 megawatt electric) the replacement power costs are determined to be 8.29E+09 ($-year). Multiplying this value by the CDF (6.39E-06) results in a replacement power cost of $52,962.

F.4.6 Maximum Averted Cost-Risk

The STP MACR is the total averted cost-risk if all internal and external events risk associated with on-line operation were eliminated. For STP, the external events contributors are quantified in conjunction with the internal events contributors, so the CDF used in the calculations performed in Sections F.4.1 through F.4.5 include the external events risk (Fire, Seismic, External Flooding, High Winds). The external events that are not quantified in the PRA model are addressed in Section F.5.1.5.

The maximum averted cost-risk is the sum of the contributors calculated in Sections F.4.1 through F.4.5:

Maximum Averted Cost-Risk

Off-site exposure cost	=	$52,338
Off-site economic cost	=	$24,424
On-site exposure cost	=	$3,955
On-site cleanup cost	=	$124,541
Replacement Power cost	=	$52,962
Total cost	=	$258,220

This total represents the monetary equivalent of the risk that could be eliminated if all on-line risk could be eliminated for a single STP unit. The MACR is rounded to next highest thousand ($259,000) for SAMA calculations. Finally, the single unit MACR is multiplied by two to obtain the site MACR of $518,000 ($259,000*2=$518,000). External events contributors are integrated with the internal events model and no multiplier is required to address the external events contributors.

It should be noted that the Phase II cost benefit calculations account for the difference between the rounded MACR and the actual MACR by adding the difference to the averted cost-risk calculated for each SAMA.

The MACR and implementation costs are considered on a site scale for consistency and to clearly account for any “economy of scale” that may exist in the implementation costs.

F.5 PHASE I SAMA ANALYSIS

The Phase I SAMA analysis, as discussed in Section F.1, includes the development of the initial SAMA list and a coarse screening process. This screening process eliminates those candidates that are not applicable to the plant's design or are too expensive to be cost beneficial even if the risk of on-line operations were completely eliminated. The following subsections provide additional details of the Phase I process.

F.5.1 SAMA Identification

The initial list of SAMA candidates for STP was developed from a combination of resources including:

- STP PRA results
- Industry Phase II SAMAs
- STP IPE/IPEEE (HL&P 1999)

These resources are judged to provide a list of potential plant changes that are most likely to reduce risk in a cost-effective manner for STP.

In addition to the "Industry Phase II SAMA" review identified above, an industry based SAMA list was used in a different way to aid in the development of the STP plant-specific SAMA list. While the industry SAMA review cited above was used to identify SAMAs that might have been overlooked in the development of the STP SAMA list due to PRA modeling issues, a generic SAMA list was used as an idea source to identify the types of changes that could be used to address the areas of concern identified through the STP importance list review. For example, if long term direct current (DC) power availability was determined to be an important issue for STP, the industry list would be reviewed to determine if a plant enhancement had already been conceived that would address STP's needs. If an appropriate SAMA was found to exist, it would be used in the STP list to address the DC power issue; otherwise, a new SAMA would be developed that would meet the site's needs. This generic list was compiled as part of the development of several industry SAMA analyses and is available in NEI 05-01 (NEI 2005).

F.5.1.1 Level 1 STP Importance List Review

The importance list review was performed to identify the failure scenarios most important to STP risk and to develop methods to mitigate those scenarios. For each event on the importance list, the reasons for the event's importance are determined through sequence and systems analysis. Strategies to mitigate the relevant failures are developed based on accident sequence review, plant knowledge, and industry insights. For STP, the external events models are integrated into the PRA and the importance review addresses both internal and external events (with limited exceptions).

The importance list itself is developed from the STP PRA results file and is comprised of the model's split fractions sorted according to their risk reduction worth (RRW) values. The events with the largest RRW values in this list are those events that would provide the greatest reduction in the CDF if the failure probability were set to zero. Because a PRA's importance list can be extensive, it is desirable to limit the review to only those contributors that could yield potentially cost beneficial results. One method that can be used to limit the scope of the importance list review is to correlate the RRW value threshold to the lowest expected cost of implementation for a SAMA. Usually, procedure changes are among the least expensive enhancements that can be made at a site, so they are often used as the representative "lowest cost SAMA". The cost of a procedure change varies depending on the type of procedure that is being changed and the scope of the changes that are proposed, but the lower end of the cost estimates range from $50,000 to $100,000 (CPL 2004). For STP, the upper end of this range ($100,000) is used as the lowest cost SAMA to account for engineering analysis, the update of procedure text and supporting documentation, and training for both units.

The RRW value corresponding to $100,000 at STP is 1.24. This can be demonstrated by reducing the CDF, dose-risk and OECR by a factor of 1.24, which corresponds to an event with Level 1- and Level 2-based RRW values of 1.24. The corresponding single unit averted cost-risk would be $49,978. Applying a factor of 2 to account for both units results in a cost-risk of $99,956. This is approximately equal to the assumed minimum expected cost of implementation of $100,000.

If the importance list review were limited to events with RRW values of 1.24 or greater, only 2 split fractions from the Level 1 importance list (and their associated sequences) would require review. Because a review of 2 split fractions would provide only limited insights into the STP risk profile, the review was expanded to include the top 40 split fractions (includes split fractions with RRW values as low as 1.022), which corresponds to an averted cost-risk of about $11,000 for the site.

Table F.5-1 documents the disposition of the top 40 split fractions in the Level 1 STP RRW list. Note that the review of each split fraction involves an evaluation of the sequences including the event to identify the factors that make the split fraction important.

F.5.1.2 Level 2 STP Importance List Review

A similar review was performed on the importance listings from the Level 2 results. In this case, a composite importance file based on the following release categories was used to identify potential SAMAs:

- Group 1(Large Early)
- Group 2 (Small Early)
- Group 3 (Late)

This method was chosen to prevent high frequency-low consequence events (i.e., the "Intact" release category) from biasing the importance listing. The "Intact" release category contributes only about 2.9 percent of the dose-risk while accounting for about 50 percent of the Level 2 frequency. Exclusion of the "Intact" results from the Level 2 review allows the contributors that are most important to dose-risk and cost-risk to rise to the top of the importance list.

The top 40 Level 2 RRW split fractions were also reviewed (includes split fractions with RRW values as low as 1.027). As described for the Level 1 RRW list, events below the 1.24 threshold RRW value are not expected to yield cost beneficial SAMAs and the review was expanded to include split fractions with RRW values as low as 1.027 to make the review more robust.

Table F.5-2 documents the disposition of the top 40 split fractions in the Level 2 STP RRW list.

F.5.1.3 Industry SAMA Analysis Review

The SAMA identification process for STP is primarily based on the PRA importance listings supplemented by a review of the plant improvements suggested in the IPE and the IPEEE. In addition to these plant-specific sources, selected industry SAMA submittals were reviewed to identify any Phase II SAMAs that were determined to be potentially cost beneficial at other plants. These SAMAs were further analyzed and included in the STP SAMA list if they were considered to address potential risks not identified by the STP importance list review.

While many of the industry SAMAs reviewed are ultimately shown not to be cost beneficial, some are close and a small number have been estimated to be cost beneficial at other plants. Use of the STP importance ranking should identify the types of changes that would most likely be cost beneficial for STP, but review of selected industry Phase II SAMAs may capture potentially important changes not identified for STP due to PRA modeling differences or SAMAs that represent alternate methods of addressing risk. Given this potential, it was considered prudent to include a review of selected industry Phase II SAMAs in the STP SAMA identification process.

Phase II SAMAs from the following United States nuclear power sites have been reviewed:

- Wolf Creek Generating Station (WCGS) (WCNOC 2006)
- Indian Point Energy Center (IPEC) Unit 2 (ENO 2007)
- Shearon Harris Nuclear Plant (HNP) (CPL 2006)
- Vogtle Electric Generating Station (VEGP) (SNC 2007)
- Prairie Island Nuclear Generating Plant (PINGP) (NMC 2008)
- Susquehanna Steam Electric Station (SSES) (PPL 2006)

One GE boiling water reactor (BWR) and Five Westinghouse PWR sites were chosen from available documentation to serve as the Phase II SAMA sources. Six of the Phase II SAMAs from these sources were included in the Phase I STP SAMA list. While more SAMAs were applicable to STP, many of the industry Phase II SAMAs were already represented by other SAMAs in the STP list, were known not to impact important plant systems, or were judged not to have the potential to be close contenders for STP. These SAMAs were not considered further. The following provides a summary of some of the issues considered during the review of the industry SAMAs.

F.5.1.3.1 Wolf Creek Generating Station

Review of WCGS Cost Beneficial SAMAs

Industry Site SAMA ID	SAMA Description	Discussion for STP	Disposition for STP SAMA List
2	Modify the Controls and Operating Procedures for Sharpe Station to Allow for Rapid Response	This is a site specific SAMA that was developed to allow the Wolf Creek operators to control a local diesel generating station from the Wolf Creek main control room. This SAMA is not applicable to STP.	Not included. Not applicable to STP.
4 (case 2)	Update emergency procedures to direct local, manual closure of the residual heat removal (RHR) EJHV8809A and EJHV8809B valves if they fail to close remotely	This SAMA was developed to address questions about the ability of MOVs to close against the differential pressure in a specific ISLOCA sequence for Wolf Creek. This has not been identified as a risk significant issue for STP.	This issue is not important to STP risk and is not required for inclusion on the SAMA list.
5	Enhance procedures to direct operators to open emergency diesel generator (EDG) Room doors for alternate room cooling	This SAMA was intended to provide a low cost means of addressing loss of EDG room cooling at WCGS. Loss of SBDG heating ventilation and air-conditioning (HVAC) accounts for only 10 percent of the common cause failure (CCF) of all three SBDGs and was not identified as an important contributor in the PRA results review, but this SAMA has been included on the SAMA list to evaluate its potential benefit.	Added to SAMA list (SAMA 13).
1	Permanent, Dedicated Generator for the NCP with Local Operation of turbine driven auxiliary feedwater (TD AFW) After 125V Battery Depletion	This was designed to assist in a station blackout (SBO) that included a seal loss of coolant accident (LOCA). The design includes a 4kV, 500kW EDG to power a charging pump and transformer to support the 125V battery chargers. The requirements for SBO mitigation at STP are different than at WCGS and are addressed by site specific SAMA 1, which requires an additional 480V AC generator to support long term AFW operation and makes use of the existing power supply from the technical support center (TSC) EDG to power the PDP for reactor coolant pump (RCP) Seal injection/makeup.	Already included as a site specific SAMA, no additional SAMA added.

Review of WCGS Cost Beneficial SAMAs

Industry Site SAMA ID	SAMA Description	Discussion for STP	Disposition for STP SAMA List
3	AC Cross-tie Capability	This SAMA is designed to improve AC crosstie capability. STP has an inter-unit 4KV cross-tie capability that is addressed in the plant procedures, but it is not credited in the PRA. A potential improvement may be to enhance the 4KV cross-tie capability so that it is available between divisions on a single unit, but the benefit of such a SAMA would be limited given that the inter-unit cross-tie already exists.	Added to SAMA list (SAMA 14).
13	Alternate Fuel Oil Tank with Gravity Feed Capability	For Wolf Creek, fuel oil failures contributed significantly to the CDF and an alternate method to transfer fuel to the EDG day tank was determined to be cost effective. STP already has an alternate diesel fuel oil fill capability. The auxiliary fuel oil filtration skid has a 200 gpm pump that can take fuel from the auxiliary fuel oil storage tank or a normal fill truck.	Similar item already implemented. Not added to the SAMA list.
14	Permanent, Dedicated Generator for the NCP, one Motor Driven AFW Pump, and a Battery Charger	This was designed to assist in an SBO that included a seal LOCA. The design includes a 4kV, 500kW EDG to power a charging pump, an AFW pump, and a transformer to support the 125V battery chargers. The requirements for SBO mitigation at STP are different than at WCGS and are addressed by site specific SAMA 1, which requires an additional 480V AC generator to support long term AFW operation and makes use of the existing power supply from the TSC EDG to power the PDP for RCP Seal injection/makeup.	Already included as a site specific SAMA, no additional SAMA added.

F.5.1.3.2 Indian Point Energy Center Unit 2

Review of IPEC U2 Cost Beneficial SAMAs

Industry Site Phase II SAMA ID	SAMA Description	Discussion for STP	Disposition for STP SAMA List
028	Provide a Portable Diesel Driven Battery Charger	This SAMA was designed to prolong AFW availability in an SBO by using a portable generator to provide alternate battery charging capability. No discussion is provided in the IPEC U2 SAMA analysis about primary side makeup requirements. The requirements for SBO mitigation at STP are different than at IPEC and are addressed by site specific SAMA 1, which requires an additional 480V AC generator to support long term AFW operation and makes use of the existing power supply from the TSC EDG to power the PDP for RCP Seal injection/makeup.	Already included as a site specific SAMA, no additional SAMA added.
044	Use Fire Water System as Backup for Steam Generator Inventory	This enhancement was intended to provide alternate steam generator (SG) makeup capability and relies on Fire Water as a suction source, but includes a new, electric, 800 gpm pump to provide flow. The Fire Water system is a low pressure system that does not address early losses of SG makeup. STP SAMA 3 makes use of a high pressure engine driven pump to provide makeup using the Fire Water system or condensate storage tank (CST) as potential suction sources, which is considered to meet the intent of the IPEC SAMA.	Already included as a site specific SAMA, no additional SAMA added.
054	Install Flood Alarm in the 480V AC Switchgear Room	Providing a water sensor in the 480V AC Switchgear room would provide early warning of flood conditions and improve the probability isolation could occur before equipment damage. Internal flooding is not a large contributor for STP and it is below the review threshold for SAMA identification.	This issue is not important to STP risk and is not required for inclusion on the SAMA list.
056	Keep RHR Heat Exchanger Discharge MOVs Normally Open	The intent of this SAMA is to reduce the contribution of failures of the RHR heat exchanger (HX) valves to open on demand. The STP RHR HX outlet valves are normally open/fail open valves.	Already implemented, no additional SAMA added.

Review of IPEC U2 Cost Beneficial SAMAs

Industry Site Phase II SAMA ID	SAMA Description	Discussion for STP	Disposition for STP SAMA List
060	Provide Added Protection Against Flood Propagation from Stairwell 4 into the 480V AC Switchgear Room	This change addresses a plant specific internal flooding issue and includes changes to the swing direction of a door, addition of ductwork, and a check valve. Internal flooding is not a large contributor for STP and it is below the review threshold for SAMA identification.	This issue is not important to STP risk and is not required for inclusion on the SAMA list.
061	Provide Added Protection Against Flood Propagation from the Deluge Room into the 480V AC Switchgear Room	This change addresses a plant specific internal flooding issue and includes upgrading the deluge room to close off flood paths. Internal flooding is not a large contributor for STP and it is below the review threshold for SAMA identification.	This issue is not important to STP risk and is not required for inclusion on the SAMA list.
065	Upgrade the Alternate Safe Shutdown System to Allow Timely Restoration of Seal Injection and Cooling	This SAMA involves providing a hardwired connection from the Alternate Safe Shutdown System power supply to a safety injection (SI) pump to improve the probability that the operators can restore RCP seal cooling in a timely manner. The STP PDP can be supported by the TSC EDG and aligned in time to support RCP seal cooling in SBO conditions.	Already implemented, no additional SAMA added.

F.5.1.3.3 Shearon Harris Nuclear Plant

Review of HNP Cost Beneficial SAMAs

Industry Site SAMA ID	SAMA Description	Discussion for STP	Disposition for STP SAMA List
9	Proceduralize Actions to Open EDG Room Doors on Loss of HVAC and Implement Portable Fans	This SAMA was intended to provide a low cost means of addressing loss of EDG room cooling at HNP. Loss of SBDG HVAC accounts for only 10 percent of the CCF of all three SBDGs and was not identified as an important contributor in the PRA results review, but this SAMA has been included on the SAMA list to evaluate its potential benefit.	Added to SAMA list (SAMA 13).

Review of HNP Cost Beneficial SAMAs

Industry Site SAMA ID	SAMA Description	Discussion for STP	Disposition for STP SAMA List
6	Flood Mitigation for Scenarios 6 and 7	This is a plant specific internal flooding issue related to valve qualification in flooding conditions. Internal flooding is not a large contributor for STP and it is below the review threshold for SAMA identification.	This issue is not important to STP risk and is not required for inclusion on the SAMA list.
8	Alternate Seal Cooling and Direct Feed to Transformer 1B3-SB	This SAMA was developed to address loss of 4kV bus events where power is available to the opposite 4kV bus, but vital equipment has failed on the powered bus. The STP PDP can be supported by the TSC EDG and aligned in time to support RCP seal cooling in SBO conditions.	Already Implemented, no additional SAMA added.

F.5.1.3.4 Vogtle Electric Generating Plant

Review of VEGP Cost Beneficial SAMAs

Industry Site SAMA ID	SAMA Description	Discussion for STP	Disposition for STP SAMA List
2	Maintain Full-Time Black Start Capability of the Plant Wilson Combustion Turbines	Currently, a combustion turbine located near VEGP is only credited for black start support of VEGP during a 14 day allowed outage time for the VEGP EDGs. The intent is to maintain the black start capability on a full time basis to support VEGP. This enhancement is not applicable to the STP site.	Not included. Not applicable to STP.
4	Prepare Procedures and Operator Training for Cross-Tying an Opposite Unit Diesel Generator (DG)	VEGP has the required hardware to align power from one plant's emergency AC buses to the opposite unit's buses; however, procedures were not available to direct the use of the cross-tie in emergency situations. While not credited in the PRA, STP has procedures to cross-tie emergency 4KV busses to the busses on the opposite unit.	Already implemented.

Review of VEGP Cost Beneficial SAMAs

Industry Site SAMA ID	SAMA Description	Discussion for STP	Disposition for STP SAMA List
6	Implementation of a Bypass Line for the Cooling Tower Return Isolation Valves	This SAMA is designed primarily to prevent trip of the EDGs on loss of EDG cooling water flow caused by failure to re-open of the cooling water return isolation valves. The cooling water return valves are not significant contributors to SBDG failures at STP.	This issue is not important to STP risk and is not required for inclusion on the SAMA list.
16	Enhance Procedures for ISLOCA Response	This VEGP SAMA was derived from the Wolf Creek SAMA list and was originally intended to address a plant specific issue related to verifying that valves in an ISLOCA pathway can close against the anticipated pressure difference in the line. This has not been identified as a risk significant issue for STP.	This issue is not important to STP risk and is not required for inclusion on the SAMA list.

F.5.1.3.5 Prairie Island Nuclear Generating Plant

Review of PINGP Cost Beneficial SAMAs

Industry Site SAMA ID	SAMA Description	Discussion for STP	Disposition for STP SAMA List
9	Analyze Room Heat-up for Natural/Forced Circulation (Screenhouse Ventilation)	This SAMA was developed to support the use of alternate room cooling in the plant's screenhouse when normal cooling fails. Developing emergency procedures for opening Essential Cooling Water Intake Structure (ECWIS) doors to provide alternate cooling on loss of HVAC could provide some benefit to STP.	Added to SAMA list (SAMA 15)

Review of PINGP Cost Beneficial SAMAs

Industry Site SAMA ID	SAMA Description	Discussion for STP	Disposition for STP SAMA List
22	Provide Compressed Air Backup for Instrument Air to Containment	PINGP proposed an enhancement that would potentially tie into existing Instrument Air (IA) lines using nitrogen bottles to lengthen the time the pressurizer power operated relief valves (PORVs) could be operated for Feed and Bleed on loss of IA to containment. STP has the ability to power IA compressor 14 from the BOP diesel in loss of offsite power (LOOP) events, but the availability of IA could be further improved if a portable, engine driven IA compressor could be connected to the system as an alternate air source.	Added to SAMA list (SAMA 16)

F.5.1.3.6 Susquehanna Steam Electric Station

Review of SSES Cost Beneficial SAMAs

Industry Site SAMA ID	SAMA Description	Discussion for STP	Disposition for STP SAMA List
2a	Improve Cross-Tie Capability Between 4kV AC Emergency Buses (A-D, B-C)	SSES did not credit cross-tie between EDG trains and relied on the swing EDG to mitigate EDG failures. STP has an inter-unit 4KV cross-tie capability that is addressed in the plant procedures, but it is not credited in the PRA. A potential improvement may be to enhance the 4KV cross-tie capability so that it is available between divisions on a single unit, but the benefit of such a SAMA would be limited given that the inter-unit cross-tie already exists.	Added to SAMA list (SAMA 14)
6	Procure Spare 480V AC Portable Station Generator	This SAMA was developed to address the hardware failure contribution from their existing portable 480V generator. Given that STP does not currently have a portable 480V AC generator, this is not applicable to the site.	Not included. Not applicable to STP.

Review of SSES Cost Beneficial SAMAs

Industry Site SAMA ID	SAMA Description	Discussion for STP	Disposition for STP SAMA List
2b	Improve Cross-Tie Capability Between 4kV AC Emergency Buses (A-BC-D)	This SAMA is an enhancement over SSES SAMA 2a and allows cross-tie between any EDG division. STP has an inter-unit 4KV cross-tie capability that is addressed in the plant procedures, but it is not credited in the PRA. A potential improvement may be to enhance the 4KV cross-tie capability so that it is available between divisions on a single unit, but the benefit of such a SAMA would be limited given that the inter-unit cross-tie already exists.	Added to SAMA list (SAMA 14)
3	Proceduralize Staggered RPV Depressurization When Fire Protection (FP) System Injection is the Only Available Makeup Source	This SAMA is specific to the SSES site and is based on the need to split flow from a single injection system between units and to maintain level during RPV depressurization. It is not applicable to the STP design.	Not included. Not applicable to
5	Auto Align 480V AC Portable Station Generator	This SAMA was designed for a plant that already had a portable generator, but the impacts of auto generator alignment can be considered for STP. The PDP pump is supplied by the TSC EDG so that power for RCP seal cooling is potentially available in SBO cases; however, the time available to restore seal cooling is short (13 minutes for total loss of RCP seal cooling). Enhancing the TSC EDG so that it auto-starts and loads the PDP on loss of normal power could reduce the probability of an RCP seal LOCA (SAMA 17). Alternatively, the RCP seals could be replaced by the Westinghouse Shutdown Seals, which is a passive method of preventing RCP seal LOCAs (SAMA 17a).	Added to SAMA list (SAMA 17, SAMA 17a)

F.5.1.3.7 Industry SAMA Identification Summary

The most important issues for STP are considered to be addressed by the SAMAs developed through the PRA importance list review. Further, the plant changes suggested as part of that review were developed to meet the specific needs of the plant such that those SAMAs are more likely to provide effective means of risk reduction than SAMAs taken from other sites. However, effort was made to review other industry SAMA analyses to determine if other sites identified plant changes that could be cost beneficial for STP. As a result of this review, six additional industry SAMAs were added to the STP Phase I SAMA list:

- SAMA 13 - Develop Procedures to Open Doors and/or Use Portable Fans for Alternate SBDG Room Cooling

- SAMA 14 - Provide Capability to Cross-tie Emergency 4KV Divisions on a Single Unit
- SAMA 15 - Develop Emergency Procedures for Alternate ECWIS Room Cooling
- SAMA 16 - Portable, Engine Driven Instrument Air Compressor
- SAMA 17 - Completely Automate the Start and Load of the PDP on the TSC EDG
- SAMA 17a - Install Westinghouse RCP Shutdown Seals

F.5.1.4 STP IPE/IPEEE

The STP IPE (HL&P 1999), which addressed external events and served as the IPEEE as well as the IPE, generated a list of risk-based insights and potential plant improvements. Typically, changes identified in the IPE and IPEEE processes are implemented and closed out; however, there are some items that are not completed within the industry due to high projected costs or other criteria. Because the criteria for used to define a cost beneficial SAMA may be different than what was used in the post-IPE decision-making process, these recommended improvements are re-examined in this analysis.

As a result of the IPE, several potential plant improvements were identified and considered for implementation at the plant. The following table summarizes the status of these plant improvements.

Description of Potential Enhancement	Status of Implementation	Disposition
Install fail-closed, air operated valves in place of MOVs in the supplemental containment purge subsystem to improve isolation capability for loss of power cases.	Implemented.	No further review required.
Install fail-closed, air operated valves in place of MOVs in the chemical and volume control system (CVCS) letdown lines to improve isolation capability for loss of power cases.	Implemented.	No further review required.
Align the CVCS positive displacement pump to normally take power from the non-safety bus that is powered by the TSC EDG to address RCP seal cooling issues in an SBO.	Implemented.	No further review required.
Refine electrical auxiliary building (EAB) HVAC cooling success criteria and provide procedures for establishing alternate room cooling.	Implemented.	No further review required.

All of the plant changes suggested in the IPE, which includes external events considerations, have been implemented at STP and no further review of these items is required.

F.5.1.5 "Other" External Events and Internal Flooding

As identified in Section F.2, the STP PRA includes the following initiating events that are typically considered to be separate from internal events initiators:

- Seismic
- Internal Fire
- External Flooding (Breach of the Main Cooling Reservoir)
- High Wind (tornado)

Consequently, the SAMA identification task for these contributors is addressed by the STP PRA results review described in sections F.5.1.1 and F.5.1.2. However, the IPE screened several potentially relevant initiating event types from further review based on low risk. Because it is not clear that the external event contributors screened on "low risk" could not yield potentially cost beneficial SAMAs, the external events that were screened in the IPE have been reviewed as part of the SAMA analysis.

The review process is a multi-step evaluation. The first step is to develop a potential averted cost-risk (PACR) for each of the external events contributors. The PACR represents the cost-risk that could be averted if all risk for a given initiating event type could be eliminated (similar to a MACR, but for a specific initiating event). For example, the PACR for an aircraft strike is assumed to be the site MACR multiplied by the ratio of the aircraft strike frequency to the site CDF: $518,000 * 6.95E-07 / 6.39E-06 = $56,340.

Once the PACRs are developed for the initiating event categories, they can be compared to the minimum SAMA implementation cost for the STP site ($100,000, from Section F.5.1.1). If the PACR is less than the minimum SAMA implementation cost, then no SAMAs designed to specifically address the corresponding external event type would be cost beneficial and the event type can be screened from further consideration.

In order to develop the PACRs for STP, it has been assumed that CDF is directly proportional to the MACR and that it is appropriate to compare the CDFs that are developed in the PRA model to those event occurrence frequencies that are currently excluded from the PRA. Note that "event occurrence frequencies" are not CDFs; they are only frequencies of specific events that challenge the plant.

It is recognized that the public impact of a core damage event varies depending on the scenario, but because there are no Level 2 or Level 3 results for the "screened" external events, an alternate method of estimating the PACRs, such as the one described here, is required.

The following table summarizes the PACRs that were developed using the above process for each of the initiating event types that were screened in the IPE:

Review of External Events Screened in the STP IPE

Initiating Event Group	Surrogate CDF (per yr, site)	PACR (site)	Disposition
Accidental Aircraft Impact	6.95E-07[2]	$56,340	The PACR is below the minimum expected cost of implementation for a SAMA. Screened from further review.
Turbine Missile	3.19E-07[3]	$25,859	The PACR is below the minimum expected cost of implementation for a SAMA. Screened from further review.
Tornado Wind Damage	8.33E-09[4]	$675	The PACR is below the minimum expected cost of implementation for a SAMA. Screened from further review.
Tornado Missiles	3.24E-08[5]	$2,626	The PACR is below the minimum expected cost of implementation for a SAMA. Screened from further review.
Hazardous Chemicals	6.0E-08[6]	$4,864	The PACR is below the minimum expected cost of implementation for a SAMA. Screened from further review.
ECP/ECW Failures (non-tornado induced)	6.2E-07[7]	$50,260	The PACR is below the minimum expected cost of implementation for a SAMA. Screened from further review.
Internal Flooding	6.04E-07[8]	$48,995	The PACR is below the minimum expected cost of implementation for a SAMA. Screened from further review.

It is recognized that the types of credible threats to nuclear facilities by aircraft have changed since the time the IPEEE was published. While this is true, efforts are underway within the industry to address this issue in conjunction with other forms of sabotage. Based on the fact that this topic is currently being analyzed in another forum and due to the complexity of the issue, intentional aircraft impact events are considered to be out of the scope of the SAMA

[2] This is not a CDF, but an aircraft strike frequency for any structure at the plant, which is dominated by the 6.94E-7 per yr strike frequency from general aviation aircraft. Assuming a conditional core damage probability of 1.0, the 6.95E-07/yr frequency is used as the site CDF (for a given unit, the strike frequency would be about on half of this total to account for the smaller number of buildings associated with the given unit).
[3] This is not a CDF, but a frequency of damage to potentially important targets (does not mean the equipment in the target is necessarily damaged). The CDF would depend on the conditional core damage probability accounting for any critical equipment that is damaged. The damage frequency listed includes both failure mechanisms identified in the IPE.
[4] This is the frequency of a tornado strike on the site (a single unit would be about half) for which the wind speeds exceed the design basis of the plant (360 mph).
[5] This is the frequency of inside wall scabbing of the site's safety related structures due to tornado missile impact rather than a CDF.
[6] On-site releases were estimated to be only 3.0E-08 per year. The IPE identifies the Midland Nuclear Plant's hazardous chemical release analysis as a bounding estimate for STP (7.55E-06), but no site specific value was developed. However, Midland was located about 1 mile from the Dow chemical plant facilities compared with the 5 mile distance to the Celanese plant for STP, which would make the threat negligible. The site release CDF value of 3.0E-08 has been doubled to account for any offsite releases.
[7] Frequency of Main Cooling Reservoir failure with subsequent ECW intake screen clogging.
[8] The IPE provides occurrence frequencies for each of the unscreened flooding scenarios and indicates that the conditional core damage probabilities for each scenario is very small given that numerous redundant and diverse safety systems remain available for each scenario. Even if it is assumed that the conditional core damage probability is as high as 1E-02 for each scenario, the total CDF from the non-screened events would be 6.04E-07/yr.

analysis. Accidental aircraft impact was addressed in the IPE and dispositioned in the table above.

Given that the PACRs for the external events contributors that were screened in the IPE are estimated to be below the minimum expected SAMA implementation cost ($100,000 for the site), no additional review is required for these events.

F.5.2 Phase I Screening

The initial list of SAMA candidates is presented in Table F.5-3. The process used to develop the initial list is described in Section F.5.1.

The purpose of the Phase 1 analysis is to use high-level knowledge of the plant and SAMAs to preclude the need to perform detailed cost-benefit analyses on them. The following screening criteria were used:

- Applicability to the Plant: If a proposed SAMA does not apply to the STP design, it is not retained. Similarly, any SAMAs that have already been implemented by STP or achieve results that STP has achieved by other means can be screened as they are not applicable to the current plant design. The use of this criterion is not often explicitly used in the Phase I analysis because the SAMA methodology generally precludes inclusion of such SAMAs; however, this criterion is listed as a possible screening method given that there may be circumstances in which a SAMA would be included in the list even if it is not relevant to the site. An example may be the inclusion of a high profile SAMA that is well known in the industry, but not applicable to the specific site design. Such a SAMA may be included for documentation purposes. Another example may be an unimplemented SAMA from the IPE that has been superseded by another plant enhancement.

- Implementation Cost Greater than Screening Cost: If the estimated cost of implementation is greater than the MACR (refer to Section F.4.6), the SAMA cannot be cost beneficial and is screened from further analysis.

Table F.5-3 provides a description of how each SAMA was dispositioned in Phase 1. Those SAMAs that required a more detailed cost-benefit analysis are passed to the Phase 2 analysis and further evaluated in Section F.6.

F.6 PHASE II SAMA ANALYSIS

Not all of the Phase 2 SAMA candidates, which are summarized in Table F.6-1, necessarily require detailed analysis. The Phase 2 process allows for the screening of SAMAs known to be related to non-risk significant systems or to components/functions with low importance rankings. Due to the nature of the PRA-based process used to develop the STP SAMA list, there are limited avenues for SAMAs of this type to be included in the list. However, potential pathways do exist:

- Inclusion of unresolved proposed plant changes from previous STP risk analyses
- Inclusion of SAMAs based on the results of conservative modeling methods.

While only high level calculations related to importance values or other PRA insights may be required for eliminating a SAMA that is linked to a non-risk significant system or components, some more detailed quantitative efforts are usually required to screen SAMAs that are developed to address risk contributors based on conservative modeling techniques. For STP, no cases were identified in which a SAMA was derived due to conservative modeling techniques.

For the SAMAs requiring detailed analysis, a more detailed conceptual design was prepared. This information was then used to evaluate the effect of the candidates' changes upon the plant safety model. The final cost-risk based screening method is defined by the following equation:

Net Value = Averted cost-risk – Cost of implementation

Where:

Averted cost-risk = (baseline cost-risk of site operation (MACR) – cost-risk of site operation with SAMA implemented)

If the net value of the SAMA is negative, the cost of implementation is larger than the benefit associated with the SAMA and the SAMA is not considered beneficial. The baseline cost-risk of plant operation was derived using the methodology presented in Section F.4. The cost-risk of plant operation with the SAMA implemented is determined in the same manner with the exception that the revised PRA results reflect implementation of the SAMA. Given that the external events contributors are included in the PRA, the use of a multiplier is not required for the STP SAMA calculations.

The implementation costs used in the Phase 2 analysis include both STP-specific estimates developed by plant personnel and estimates taken from other SAMA submittals for those SAMAs that were determined to be similar. It should be noted that the STP-specific implementation costs include neither contingency costs nor replacement power costs that may be incurred due to consequential shutdown time.

Sections F.6.1 – F.6.5 describe the detailed cost-benefit analysis that was used for each of the remaining candidates.

F.6.1 SAMA Number 4: Develop Procedures to Isolate CCW Inside Containment

For STP, ISLOCA contributions are limited by the fact that RHR is placed inside containment. The dominant ISLOCA scenario in the current PRA model is based on failure of the tubes in the RHR/Component Cooling Water (CCW) heat exchanger, which would provide a pathway for primary side water to leave the containment. The ISLOCA scenario could be terminated by closing an in-containment valve in the CCW line, but currently, STP does not have procedures that direct this action. If procedures are developed to direct isolation of the CCW line for these Hx rupture scenarios, it would significantly reduce the ISLOCA contribution. However, it should be noted that that probability assigned to the Hx rupture is likely conservative and work is being performed by Westinghouse and STP to further analyze this failure mode. If the results of the analysis indicate that the failure mode is significantly lower than what is currently assumed, the ISLOCA contribution would be eliminated as an important contributor for STP and this SAMA would not be required.

The VSEQ (and VSEQL2) initiating events are based on the fault tree associated with Top Event VSEQS. This fault tree included a basic events (representing the operator action to isolate CCW inside containment given a path from the reactor coolant system (RCS) to the low head safety injection (LHSI) piping and the RHR HX tubes have failed. But in the STP_REV6 analysis, these operator action basic events were given a value of 1.0 (i.e., guaranteed failed).

The STP_REV6 VSEQ initiating event is dominated (> 99.9%) by scenarios involving failure to isolate the CCW system. In order to represent this SAMA in the PRA, the human error probability (HEP) for the isolation action was changed to 0.0 (isolation is 100 percent successful).

F.6.1.1 Averted Cost-Risk

The model changes identified above yielded a reduction in the CDF, Dose-risk, and OECR. The results were used to calculate the averted cost-risk for this SAMA using the process described in Section F.6. The following tables summarize the PRA results given implementation of the SAMA and the corresponding averted cost-risk calculations:

SAMA 4 Model PRA Results

	CDF	Dose-Risk	OECR
Base Value	6.39E-06	1.74	$1,624
SAMA Value	6.26E-06	1.57	$1,324
Percent Change	-2.0%	-9.8%	-18.5%

A further breakdown of this information is provided below according to release category for the internal events quantification:

SAMA 4 Internal Events Results By Release Category

Release Category	Group I (Large-Early)	Group II (Small-Early)	Group III (Late)	Group IV (Intact)	Total
$Frequency_{BASE}$	5.01E-07	1.16E-06	1.48E-06	3.10E-06	6.24E-06
$Frequency_{SAMA}$	3.76E-07	1.16E-06	1.48E-06	3.10E-06	6.12E-06
$Dose\text{-}Risk_{BASE}$	0.68	0.59	0.42	0.05	1.74
$Dose\text{-}Risk_{SAMA}$	0.51	0.59	0.42	0.05	1.57
$OECR_{BASE}$	$1,202	$399	$23	$0	$1,624
$OECR_{SAMA}$	$902	$399	$23	$0	$1,324

Using the methodology from Section F.4, these results were used to calculate the cost-risk for the site assuming implementation of the SAMA, which is $491,364 (accounts for both units). The total averted cost-risk is the difference between the MACR and this cost-risk value:

SAMA 4
Averted Cost Risk

Base Case Cost-Risk	SAMA Cost-Risk	Averted Cost-Risk
$518,000	$491,364	$26,636

F.6.1.2 Cost of implementation

The cost of a procedure change is estimated to be $100,000 (CPL 2004). This is considered to address engineering analysis, training, and update of materials.

F.6.1.3 Net value

The net value for this SAMA is the difference between the averted cost-risk and the cost of implementation:

SAMA 4
Net Value

Averted Cost-Risk	Cost of Implementation	Net Value
$26,636	$100,000	-$73,364

Given that the cost of implementation is greater than the averted cost-risk for this SAMA, the net value is negative.

F.6.2 SAMA Number 10: Enhance Procedures to Ensure the SGs are Filled or Maintained Filled In SGTR Events to Scrub Fission Products

This SAMA makes a procedure change that directs operators to fill or maintain filled the steam generators prior to core damage to provide mechanical scrubbing of fission products in steam generator tube rupture (SGTR) events.

In many cases, the operators may control SG level above the top of the tubes as a matter of course or the control band may extend above the top of the tubes, but without explicit guidance to maintain level above the top of the tubes in core damage evolutions, it is not certain that the action would be taken. This may be a particular problem in situations where primary side inventory has depleted to the point where the SGs are not providing an effective means of heat removal and the operators are concentrating on other actions to recover the core.

In order to represent this SAMA in the PRA, the SGTR contributions to STP's major release categories were reviewed and then re-assigned based on the assumption that the SAMA would reduce the magnitude of any unscrubbed SGTR releases. The following is a summary of the changes that were made to the binning of the SGTR releases:

- RELI: Re-bin the 7.48E-9 contribution from RELI to RELII. It is assumed that the water in the SG will reduce the magnitude of the release to the point where it would be classified as "small".
- RELII: The 7.48E-09 contribution from RELI is added to this release category. The existing contribution of 7.36E-8 is retained in RELII. These releases are already scrubbed and a further reduction is not considered to be warranted.
- RELIII: Re-bin the 1.35E-07 contribution from RELIII to RELIV. It is assumed the magnitude of the late release will be will reduced such that it could be represented by the "containment intact" source term.
- RELIV: The 1.35E-07 contribution from RELIII is added to this category. The existing contribution of 2.01E-07 is retained in RELIV. Those SGTR sequences binned to RELIV are already scrubbed and a further reduction is not considered to be warranted.

F.6.2.1 Averted Cost-Risk

The model changes identified above yielded a reduction in the Dose-risk and OECR, but the CDF is not impacted. The results were used to calculate the averted cost-risk for this SAMA using the process described in Section F.6. The following tables summarize the PRA results given implementation of the SAMA and the corresponding averted cost-risk calculations:

SAMA 10
Model PRA Results

	CDF	Dose-Risk	OECR
Base Value	6.39E-06	1.74	$1,624
SAMA Value	6.39E-06	1.70	$1,607
Percent Change	0.0%	-2.3%	-1.0%

A further breakdown of this information is provided below according to release category for the internal events quantification:

SAMA 10
Internal Events Results By Release Category

Release Category	Group I (Large-Early)	Group II (Small-Early)	Group III (Late)	Group IV (Intact)	Total
$Frequency_{BASE}$	5.01E-07	1.16E-06	1.48E-06	3.10E-06	6.24E-06
$Frequency_{SAMA}$	4.94E-07	1.17E-06	1.35E-06	3.24E-06	6.24E-06
$Dose\text{-}Risk_{BASE}$	0.68	0.59	0.42	0.05	1.74
$Dose\text{-}Risk_{SAMA}$	0.67	0.60	0.38	0.05	1.70
$OECR_{BASE}$	$1,202	$399	$23	$0	$1,624
$OECR_{SAMA}$	$1,184	$402	$21	$0	$1,607

Using the methodology from Section F.4, these results were used to calculate the cost-risk for the site assuming implementation of the SAMA, which is $2,916 (accounts for both units). The total averted cost-risk is the difference between the MACR and this cost-risk value:

SAMA 10
Averted Cost Risk

Base Case Cost-Risk	SAMA Cost-Risk	Averted Cost-Risk
$518,000	$515,084	$2,916

F.6.2.2 Cost of implementation

The cost of a procedure change is estimated to be $100,000 (CPL 2004). This is considered to address engineering analysis, training, and update of materials.

F.6.2.3 Net value

The net value for this SAMA is the difference between the averted cost-risk and the cost of implementation:

SAMA 10
Net Value

Averted Cost-Risk	Cost of Implementation	Net Value
$2,916	$100,000	-$97,084

Given that the cost of implementation is greater than the averted cost-risk for this SAMA, the net value is negative.

F.6.3 SAMA Number 12: Enhance Procedures to Prevent Clearing of RCS Cold Leg Water Seals

This SAMA models the procedure change that would preclude the operators from clearing the water seals in the RCS cold legs just prior to, or after core damage. If the loop seals are cleared there is an unobstructed flow path for hot gases to flow from the damaged core through the steam generator tubes increasing the likelihood of an induced steam generator tube rupture.

Currently, plant procedures instruct the operators to start an idle RCP if core exit thermocouples exceed 1200 °F and if the steam generator narrow range level is greater than 14% in the associated RCS loop. The concern is that once the RCPs are started, the RCS loop seal may be cleared and without subsequent recovery of core cooling this RCP start would increase convective flows from the hot core to the steam generators. This would therefore increase the potential for induced steam generator tube ruptures as the severe accident progresses.

The sequences in which the above procedure response is to be implemented must include the availability of offsite power to power the RCP and DC control power to initiate the RCP. The availability of RCP seal and motor cooling for normal conditions are not required, as described in the note preceding the step to start the RCP.

Conditions involving core exit temperatures greater than 1200°F together with steam generator levels greater than 14% NR, in the absence of non-condensable gases, must involve leakage from the RCS. If there was no leakage, natural circulation alone would limit core temperatures and therefore core uncovery, by transferring heat to the steam generators until levels in the steam generator are much less than 14%.

The presence of non-condensable gases such as hydrogen may occur, but is not typically modeled in nuclear plant PRA models. The use of discrete, success or failed events until explicitly recovered, which is the nature of PRA models, is not sufficient to resolve periods of system failure followed by periods of later successful system response. The generation of hydrogen within the RCS that occurred following a temporary interruption of steam generator cooling and high pressure injection at TMI-2 is not modeled in the STP PRA. It is instead conservatively represented by sequences in which high pressure injection and AFW are initially lost and not restored.

Leakages from the RCS that may also lead to the conditions allowing the RCP start are modeled in the STP PRA. To realize the conditions that would allow the RCP start and be of concern, the leak rates must be large enough to uncover the core prior to steam generator dryout, but also small enough that RCS pressure remains high so that induced steam generator tube rupture events remain a concern. Further, such sequences must be accompanied by a failure of high pressure injection, so that RCS inventory is not maintained. Only if the fuel is uncovered could core exit temperatures exceed 1200°F.

The STP PRA model contains many such sequences, which in some cases do lead to induced steam generator tube failures. However, these sequences nearly all involve station blackout conditions in which the RCPs have no power to operate. For such sequences the RCPs could not be started and so this issue is not of concern.

For sequences involving some RCP seal leakages with the RCS remaining at high pressure (i.e. 14% of those involving RCP seal leakage), this issue is also not of concern because the PRA model already assumes that the loop seals are cleared as a result of the seal leakage when computing the probability of induced steam generator tube rupture.

Others sequences of this type would require a small RCS leakage (e.g. pressurizer PORV leak, letdown isolation failure, or smaller RCP seal leakage sizes) coupled with the failure of AFW cooling to the steam generators, and loss of high pressure injection. For steam generator tube ruptures as an initiating event, the issue of starting an RCP is not of concern because the leak path into the secondary side is already present. Therefore, the additional sequences that are applicable are of very low frequency when you consider that offsite power must be available to allow the starting of the RCPs; i.e. station blackout sequences are excluded. Via review of the current baseline PRA, an estimate of the frequency of such scenarios is 2.4E-09 events per year. In this analysis, it is conservatively assumed that all this frequency is transferred from release category RELI to RELIV, to represent the optimistic case for this SAMA.

F.6.3.1 Averted Cost-Risk

The model changes identified above only yielded a measurable reduction in the OECR. The results were used to calculate the averted cost-risk for this SAMA using the process described in Section F.6. The following tables summarize the PRA results given implementation of the SAMA and the corresponding averted cost-risk calculations:

SAMA 12
Model PRA Results

	CDF	Dose-Risk	OECR
Base Value	6.39E-06	1.74	$1,624
SAMA Value	6.39E-06	1.74	$1,619
Percent Change	0.0%	0.0%	-0.3%

A further breakdown of this information is provided below according to release category for the internal events quantification:

SAMA 12
Internal Events Results By Release Category

Release Category	Group I (Large-Early)	Group II (Small-Early)	Group III (Late)	Group IV (Intact)	Total
Frequency_{BASE}	5.01E-07	1.16E-06	1.48E-06	3.10E-06	6.24E-06
Frequency_{SAMA}	4.99E-07	1.16E-06	1.48E-06	3.10E-06	6.24E-06
Dose-Risk_{BASE}	0.68	0.59	0.42	0.05	1.74
Dose-Risk_{SAMA}	0.68	0.59	0.42	0.05	1.74
OECR_{BASE}	$1,202	$399	$23	$0	$1,624
OECR_{SAMA}	$1,197	$399	$23	$0	$1,619

Using the methodology from Section F.4, these results were used to calculate the cost-risk for the site assuming implementation of the SAMA, which is $517,850 (accounts for both units). The total averted cost-risk is the difference between the MACR and this cost-risk value:

SAMA 12
Averted Cost Risk

Base Case Cost-Risk	SAMA Cost-Risk	Averted Cost-Risk
$518,000	$517,850	$150

F.6.3.2 Cost of implementation

The cost of a procedure change is estimated to be $100,000 (CPL 2004). This is considered to address engineering analysis, training, and update of materials.

F.6.3.3 Net value

The net value for this SAMA is the difference between the averted cost-risk and the cost of implementation:

SAMA 12
Net Value

Averted Cost-Risk	Cost of Implementation	Net Value
$150	$100,000	-$99,850

Given that the cost of implementation is greater than the averted cost-risk for this SAMA, the net value is negative.

F.6.4 SAMA Number 13: Develop Procedures to Open Doors and/or Use Portable Fans for Alternate SBDG Room Cooling

Loss of the SBDG HVAC system results in overheating of the SBDG rooms and is assumed to result in the subsequent failure of the equipment located in the rooms. Ensuring procedures are available to direct operators to open the doors to the SBDG rooms on loss of HVAC could allow the SBDGs to continue operating even after HVAC failure.

It is assumed that the operators would, at a minimum, be required to open the SBDG room doors to provide sufficient air circulation, but portable fans may be necessary to supplement air flow to provide adequate cooling. However, for this analysis, it is assumed that the procedure change to open the SBDG room doors alone will be sufficient to eliminate all failures of SBDG HVAC (lowest cost change).

In order to represent this SAMA in the PRA, the following changes were made to represent 100 percent reliability of the action to provide alternate SBDG room cooling:

1. Modified Top Event DGX as follows:
    a. Modified the DGX fault tree. Under the gate for each train (representing Trains A, B and C), the basic events representing HVAC failures were collected under a separate OR gate, and this gate was placed under an AND gate, where the other input to the AND gate is a basic event representing failure of the operators to recover

ventilation. The result is that ventilation failures will not fail the diesel unless the operator action also fails.

b. The ventilation basic events affected by the change are:

Train A	Train B	Train C
DG_RMFN_FTS_0001	DG_RMFN_FTS_0002	DG_RMFN_FTS_0003
DG_RMFN_FTR_0001	DG_RMFN_FTR_0002	DG_RMFN_FTR_0003
DG_BKDP_FTO_0024	DG_BKDP_FTO_0023	DG_BKDP_FTO_0022

2. The new basic event representing the operator action is SAMA_DG_HVAC_HRA (set to 0.0). The same human reliability analysis (HRA) basic event was used for HVAC recovery of all three trains (i.e., no credit for failure of operator on one train and success on another).

3. Common cause failures were added.

F.6.4.1 Averted Cost-Risk

The model changes identified above yielded a reduction in the CDF and OECR (the changes to dose-risk are not reportable due to roundoff). The results were used to calculate the averted cost-risk for this SAMA using the process described in Section F.6. The following tables summarize the PRA results given implementation of the SAMA and the corresponding averted cost-risk calculations:

SAMA 13
Model PRA Results

	CDF	Dose-Risk	OECR
Base Value	6.39E-06	1.74	$1,624
SAMA Value	6.37E-06	1.74	$1,622
Percent Change	-0.3%	0.0%	-0.1%

A further breakdown of this information is provided below according to release category for the internal events quantification:

SAMA 13
Internal Events Results By Release Category

Release Category	Group I (Large-Early)	Group II (Small-Early)	Group III (Late)	Group IV (Intact)	Total
Frequency_{BASE}	5.01E-07	1.16E-06	1.48E-06	3.10E-06	6.24E-06
Frequency_{SAMA}	5.00E-07	1.16E-06	1.47E-06	3.09E-06	6.22E-06
Dose-Risk_{BASE}	0.68	0.59	0.42	0.05	1.74
Dose-Risk_{SAMA}	0.68	0.59	0.42	0.05	1.74
OECR_{BASE}	$1,202	$399	$23	$0	$1,624
OECR_{SAMA}	$1,200	$399	$23	$0	$1,622

Using the methodology from Section F.4, these results were used to calculate the cost-risk for the site assuming implementation of the SAMA, which is $516,804 (accounts for both units). The total averted cost-risk is the difference between the MACR and this cost-risk value:

SAMA 13
Averted Cost Risk

Base Case Cost-Risk	SAMA Cost-Risk	Averted Cost-Risk
$518,000	$516,804	$1,196

F.6.4.2 Cost of implementation

The cost of a procedure change is estimated to be $100,000 (CPL 2004). This is considered to address engineering analysis, training, and update of materials.

F.6.4.3 Net value

The net value for this SAMA is the difference between the averted cost-risk and the cost of implementation:

SAMA 13
Net Value

Averted Cost-Risk	Cost of Implementation	Net Value
$1,196	$100,000	-$98,804

Given that the cost of implementation is greater than the averted cost-risk for this SAMA, the net value is negative.

F.6.5 SAMA Number 15: Develop Emergency Procedures for Alternate ECWIS Room Cooling

Loss of the ECWIS HVAC system will result in failure of the ECW pumps. Providing procedures that direct the operators to open the ECWIS doors could provide a mean alternate cooling and allow continued operation of the ECW pumps.

It is assumed that the operators would, at a minimum, be required to open the ECWIS room doors to provide sufficient air circulation, but portable fans may be necessary to supplement air flow to provide adequate cooling. However, for this analysis, it is assumed that the procedure change to open the ECWIS room doors alone will be sufficient to eliminate all failures of ECWIS HVAC (lowest cost change).

In order to represent this SAMA in the PRA, the following changes were made to represent 100 percent reliability of the action to provide alternate ECWIS room cooling:

1. Modified Top Event ECWS as follows.
    a. The basic events associated with fans and dampers were set to zero.

b. For failure of the fans (6) to run, the total failure rate in the common cause group FNR was multiplied by zero
c. For failure of the fans (6) to start, the total failure rate in the common cause group FNS was multiplied by zero.
d. For failure of the inlet dampers to open (3) to open, the total failure rate in the common cause group DPR was multiplied by zero.
e. For failure of the inlet dampers to remain open (3), the basic event equations for EW_AODP_XFC_9894, EW_AODP_XFC_9895 and EW_AODP_XFC_9896 were set to zero.

2. Common cause failures were added, after the common cause data was edited.

F.6.5.1 Averted Cost-Risk

The model changes identified above yielded a reduction in the CDF, Dose-risk, and OECR. The results were used to calculate the averted cost-risk for this SAMA using the process described in Section F.6. The following tables summarize the PRA results given implementation of the SAMA and the corresponding averted cost-risk calculations:

SAMA 15
Model PRA Results

	CDF	Dose-Risk	OECR
Base Value	6.39E-06	1.74	$1,624
SAMA Value	6.30E-06	1.71	$1,604
Percent Change	-1.4%	-1.7%	-1.2%

A further breakdown of this information is provided below according to release category for the internal events quantification:

SAMA 15
Internal Events Results By Release Category

Release Category	Group I (Large-Early)	Group II (Small-Early)	Group III (Late)	Group IV (Intact)	Total
$\text{Frequency}_{\text{BASE}}$	5.01E-07	1.16E-06	1.48E-06	3.10E-06	6.24E-06
$\text{Frequency}_{\text{SAMA}}$	5.00E-07	1.16E-06	1.47E-06	3.09E-06	6.22E-06
$\text{Dose-Risk}_{\text{BASE}}$	0.68	0.59	0.42	0.05	1.74
$\text{Dose-Risk}_{\text{SAMA}}$	0.68	0.59	0.42	0.05	1.74
$\text{OECR}_{\text{BASE}}$	$1,202	$399	$23	$0	$1,624
$\text{OECR}_{\text{SAMA}}$	$1,200	$399	$23	$0	$1,622

Using the methodology from Section F.4, these results were used to calculate the cost-risk for the site assuming implementation of the SAMA, which is $510,482 (accounts for both units). The total averted cost-risk is the difference between the MACR and this cost-risk value:

SAMA 15
Averted Cost Risk

Base Case Cost-Risk	SAMA Cost-Risk	Averted Cost-Risk
$518,000	$510,482	$7,518

F.6.5.2 Cost of implementation

The cost of a procedure change is estimated to be $100,000 (CPL 2004). This is considered to address engineering analysis, training, and update of materials.

F.6.5.3 Net value

The net value for this SAMA is the difference between the averted cost-risk and the cost of implementation:

SAMA 15
Net Value

Averted Cost-Risk	Cost of Implementation	Net Value
$7,518	$100,000	-$92,482

Given that the cost of implementation is greater than the averted cost-risk for this SAMA, the net value is negative.

F.7 UNCERTAINTY ANALYSIS

Sensitivity cases were run for the following conditions to assess their impact on the overall SAMA evaluation:

- Use the 95th percentile PRA results in place of the mean PRA results.
- Use alternate MACCS2 input variables for selected cases.
- Use of a 7 Percent Real Discount Rate

F.7.1 95th Percentile PRA Results

The results of the SAMA analysis can be impacted by implementing conservative values from the PRA's uncertainty distribution. If the best estimate failure probability values were consistently lower than the "actual" failure probabilities, the PRA model would underestimate plant risk and yield lower than "actual" averted cost-risk values for potential SAMAs. Re-assessing the cost benefit calculations using the high end of the failure probability distributions is a means of identifying the impact of having consistently underestimated failure probabilities for plant equipment and operator actions included in the PRA model. This sensitivity uses the 95th percentile results to examine the impact of uncertainty in the PRA model.

For STP, the RISKMAN software code was used to perform the Level 1 internal events model uncertainty analysis. The results of the CDF calculation are provided below:

Parameter	Value Per Year
Mean	6.39E-06
5%	3.29E-06
50%	5.34E-06
95%	1.02E-05

The PRA uncertainty calculation identifies the 95th percentile CDF as 1.02E-05 per year. This is a factor of 1.6 greater than the baseline STP CDF of 6.39E-06 (which is a mean value from the RISKMAN Monte Carlo quantification).

F.7.1.1 PHASE I Impact

For Phase I screening, use of the 95th percentile PRA results will increase the MACR and may prevent the screening of some of the higher cost modifications. However, the impact on the overall SAMA results due to the retention of the higher cost SAMAs for Phase II analysis is typically small. This is due to the fact that the benefit obtained from the implementation of those SAMAs must be extremely large in order to be cost beneficial.

The impact of uncertainty in the PRA results on the Phase I SAMA analysis has been examined. The MACR is the primary Phase I criteria affected by PRA uncertainty. Thus, this portion of this sensitivity is focused on recalculating the MACR using the 95th percentile PRA results and re-performing the Phase I screening process.

As discussed above, the 95th PRA results are approximately a factor of 1.6 greater than point estimate CDF. The uncertainty analyses that are available for the Level 1 models are not available for Level 2 and Level 3 PRA models. In order to simulate the use of the 95th percentile results for the Level 2 and Level 3 models, the same scaling factor calculated for the Level 1 results was assumed to apply to the Level 2 and Level 3 models. Because the MACR calculations scale linearly with the CDF, dose-risk, and off-site economic cost-risk, the 95th percentile MACR can be calculated by multiplying the base case MACR by 1.6. This results in a 95th percentile MACR of $826,854.

The initial SAMA list has been re-examined using the revised MACR to identify SAMAs that would be retained for the Phase 2 analysis. Those SAMAs that were previously screened due to costs of implementation that exceeded $518,000 are now retained if the costs of implementation are less than $826,854. Of the SAMAs screened in the baseline Phase 1 analysis, only SAMA 3b would be retained based on the use of the 95th percentile MACR.

In order to disposition SAMA 3b, a detailed Phase II analysis was performed. The following subsections provide the results in the same format used for the Phase II quantifications provided in section F.6. Note that the impact of using the 95th percentile results for this cases is estimated by multiplying the base case averted cost risk by a factor of 1.6, which is consistent with the process established for estimating the 95th percentile MACR above.

F.7.1.1.1 SAMA Number 3b: Install Fire Wrap on PDP Cables in Cable Spreading Room

For the cable spreading room fire scenario Z047X, the "A" power train is still available for some contributors and "A" AFW could be used for heat removal if primary side integrity is maintained. Protecting the positive displacement pump (PDP) cables in the cable spreading room is a potential means of maintaining primary side integrity.

This SAMA assumes that it is possible to identify and protect the cables required to support PDP operation such that the PDP would likely be available to provide seal injection to the RCPs given a fire in the cable spreading room (scenario Z047X). The availability of seal injection would effectively eliminate the potential of an RCP seal LOCA and primary side inventory would be maintained such that AFW “A” would be able to provide long term secondary side heat removal.

In order to represent this SAMA, the new cable fire wrap was assumed to be 100 percent effective at preventing PDP cable damage. This was addressed in the PRA model by deleting the following macros:

- IZ47BC
- IZ047X

F.7.1.1.1.1 Averted Cost-Risk

The model changes identified above yielded a reduction in the CDF, Dose-risk, and OECR. The results were used to calculate the averted cost-risk for this SAMA using the process described in Section F.6. The following tables summarize the PRA results given implementation of the SAMA and the corresponding averted cost-risk calculations:

SAMA 3b
Model PRA Results

	CDF	Dose-Risk	OECR
Base Value	6.39E-06	1.74	$1,624
SAMA Value	6.36E-06	1.73	$1,614
Percent Change	-0.5%	-0.6%	-0.6%

A further breakdown of this information is provided below according to release category for the internal events quantification:

SAMA 3b
Internal Events Results By Release Category

Release Category	Group I (Large-Early)	Group II (Small-Early)	Group III (Late)	Group IV (Intact)	Total
$Frequency_{BASE}$	5.01E-07	1.16E-06	1.48E-06	3.10E-06	6.24E-06
$Frequency_{SAMA}$	5.01E-07	1.13E-06	1.47E-06	3.10E-06	6.20E-06
$Dose\text{-}Risk_{BASE}$	0.68	0.59	0.42	0.05	1.74
$Dose\text{-}Risk_{SAMA}$	0.68	0.58	0.42	0.05	1.73
$OECR_{BASE}$	$1,202	$399	$23	$0	$1,624
$OECR_{SAMA}$	$1,202	$389	$23	$0	$1,614

Using the methodology from Section F.4, these results were used to calculate the cost-risk for the site assuming implementation of the SAMA, which is $515,392 (accounts for both units). The total averted cost-risk is the difference between the MACR and this cost-risk value:

SAMA 3b
Averted Cost Risk

Base Case Cost-Risk	SAMA Cost-Risk	Averted Cost-Risk
$518,000	$515,392	$2,608

F.7.1.1.1.2 Cost of implementation

STP estimated an implementation cost of $796,677 for the site (STPNOC 2009a).

F.7.1.1.1.3 Net value

The net value for this SAMA is the difference between the averted cost-risk and the cost of implementation:

SAMA 3b
Net Value (base case)

Averted Cost-Risk	Cost of Implementation	Net Value
$2,608	$796,677	-$794,069

Given that the cost of implementation is greater than the averted cost-risk for this SAMA, the net value is negative for the base case. If the averted cost-risk is multiplied by a factor of 1.6 to account for the impact of implementing the 95th percentile PRA results, the net value remains highly negative:

SAMA 3b
Net Value (95th percentile PRA results)

Averted Cost-Risk	Cost of Implementation	Net Value
$4,163	$796,677	-$792,514

F.7.1.1.2 PHASE I IMPACT SUMMARY

While SAMA 3b would be retained for Phase II quantification if the 95th percentile PRA results were used in place of the point estimate results, this SAMA would not be cost beneficial.

F.7.1.2 PHASE II Impact

As mentioned above, the 95th percentile PRA results are not available for the Level 2 and Level 3 models. In order to estimate the impact of using the 95th percentile PRA results in the Phase 2 SAMA analysis, the same process used to calculate the revised MACR was applied to each of the Phase 2 SAMAs (the averted cost-risk for each SAMA was increased by a factor of 1.6 over the base case).

The following table provides a summary of the impact of using the 95th percentile PRA results in the detailed cost-benefit calculations that have been performed.

Results Summary for the 95th Percentile PRA Results

SAMA ID	Cost of Implement-ation	Averted Cost- Risk (Base)	Net Value (Base)	Averted Cost- Risk (95th Percentile)	Net Value (95th Percentile)	Change in Cost Effective-ness?
SAMA 4	$100,000	$26,636	-$73,364	$42,518	-$57,482	No
SAMA 10	$100,000	$2,916	-$97,084	$4,655	-$95,345	No
SAMA 12	$100,000	$150	-$99,850	$239	-$99,761	No
SAMA 13	$100,000	$1,196	-$98,804	$1,909	-$98,091	No
SAMA 15	$100,000	$7,518	-$92,482	$12,001	-$87,999	No

Of the SAMAs classified as “not cost beneficial” in the baseline Phase 2 analysis, none were found to be cost beneficial when the 95th percentile PRA results were applied.

F.7.2 MACCS2 Input variations

Perturbations to some MACCS2 inputs were investigated to determine their effects on annual risk. Among the parameters analyzed, release height, release heat, evacuation speed, evacuation-preparation time, and meteorological data year have been discussed previously in Section F.3. The effect of building wake on the risk was determined because the proximity of other site buildings to the STP containment introduces uncertainty as to local air flow around these buildings.

Some of the level-2 nuclide release categories for four of the nine accident sequences that were analyzed exhibited releases still increasing at the concluding time of the level-2 analysis. Those sequences (and their level-2 analysis concluding time) are R05SU (24 hours), R07SU (24 hours), R15U (48 hours), and R13U (48 hours). The effect of these release cut-offs was examined by extrapolating the nuclide releases for each of these sequences to 72-hours from scram.

Severe meteorological conditions in the last spatial segment of the model domain (40-50 miles) were chosen to assure conservatively high impacts and risks. Most especially, perpetual rainfall was imposed on this segment so that a conservatively large quantity of the nuclides released in each scenario were deposited (via wet deposition) within the model domain.

Table F.7.2-1 gives the sensitivity of the risk to the choice of these parameters. The table also discusses the reason for considering that parameter and the result. Other than meteorology year (the maximum risk year was chosen for the level-3 risk analysis) and imposing the above described met condition on the 40-50 mile distance interval, the site risks to severe accidents vary ≤7% as a result of any of the considered parameter changes. The baseline modeling conservatism of specifying rainfall in the spatial ring from 40-50 miles is seen to more than balance any increases that might be due to alternative specification of release parameters.

The impact of all the MACCS2 parameter changes investigated here are bounded by the use of the 95th percentile PRA results, which correspond to a 60 percent increase in the CDF, dose-risk, and OECR.

F.7.3 Use of a 7 Percent Real Discount Rate

A sensitivity study has been performed in order to identify how the conclusions of the SAMA analysis might change based on the value assigned to the real discount rate (RDR). The original RDR of 3 percent, which could be viewed as conservative, has been changed to 7 percent and the maximum averted cost-risk was re-calculated using the methodology outlined in Section F.4. The Phase 1 screening against the MACR was re-examined using the revised MACR to identify any SAMA candidates that could be screened from further analysis based on the premise that their costs of implementation exceeded all possible benefit. In addition, the Phase 2 analysis was re-performed using the 7 percent RDR.

Implementation of the 7 percent RDR reduced the MACR by 19.7 percent compared with the case where a 3 percent RDR was used. This corresponds to a decrease in the MACR from $518,000 to $416,000. The Phase 1 SAMA list was reviewed to determine if such a decrease in the MACR would impact the disposition of any SAMAs. It was determined that no additional SAMAs could have been screened in the Phase 1 analysis if an RDR of 7 percent were used in place of the 3 percent value, although SAMA 3b would not have to be retained for a detailed analysis in the 95th percentile study.

The Phase 2 SAMAs were dispositioned based on the results of a SAMA specific cost-benefit analysis. This step has been re-performed using the 7 percent real discount rate to calculate the net values for the SAMAs.

As shown below, the determination of cost effectiveness did not change for any Phase 2 SAMA when the 7 percent RDR was used in lieu of 3 percent.

Phase 2
Results Summary for 7 Percent RDR Sensitivity

SAMA ID	Cost of Implement-ation	Averted Cost-Risk (3 percent RDR)	Net Value (3 percent RDR)	Averted Cost- Risk (7 percent RDR)	Net Value (7 percent RDR)	Change in Cost Effective-ness?
SAMA 3b	796,677	$2,608	-$794,069	$2,076	-$794,601	No
SAMA 4	$100,000	$26,636	-$73,364	$19,972	-$80,028	No
SAMA 10	$100,000	$2,916	-$97,084	$2,088	-$97,912	No
SAMA 12	$100,000	$150	-$99,850	$108	-$99,892	No
SAMA 13	$100,000	$1,196	-$98,804	$1,000	-$99,000	No
SAMA 15	$100,000	$7,518	-$92,482	$6,008	-$93,992	No

F.8 CONCLUSIONS

The benefits of revising the operational strategies in place at STP and/or implementing hardware modifications can be evaluated without the insight from a risk-based analysis. Use of the PRA in conjunction with cost-benefit analysis methodologies has, however, provided an enhanced understanding of the effects of the proposed changes relative to the cost of implementation and projected impact on off-site dose and economic factors. The results of this study indicate that of the identified potential improvements that can be made at STP, none are cost beneficial.

The baseline Phase II analysis indicates that none of the SAMAs have a positive net value. When the 95^{th} percentile PRA results are considered, the conclusions are not changed.

While these results are believed to accurately reflect the impact of addressing STP's most important areas of risk, STP notes that this analysis should not necessarily be considered a formal disposition of these proposed changes as other plant evaluations may be performed with acceptance criteria that are different than those identified in the SAMA analysis.

F.9 TABLES

Table F.2-1
Initiating Event Contribution to CDF

STP_Rev6 Initiator		IE_Freq	CDF	%CDF	CCDP
	External Events				
HWIND	Tornado Induced Failure of Switchyard and ECP	1.22E-06	1.11E-06	17.32	9.07E-01
Z047X	Fire Zone 047 Scenario X	1.46E-05	3.98E-07	6.23	2.72E-02
FLECW	ECW Failure Due to Breach of main cooling reservoir (MCR)	3.20E-07	2.90E-07	4.54	9.06E-01
Z071X	Fire Zone 071 Scenario X	2.34E-07	2.12E-07	3.32	9.06E-01
Z047B	Fire Zone 047 Scenario B	2.72E-03	1.83E-07	2.87	6.74E-05
FR18	Control Room Fire Scenario 18	2.12E-06	1.22E-07	1.91	5.77E-02
Z47BC	Fire Zone 047 Scenario BC	3.18E-06	6.40E-08	1.00	2.01E-02
SEIS3	Seismic Event, 0.4g Acceleration	7.74E-07	4.05E-08	0.63	5.24E-02
FR23	Control Room Fire Scenario 23	1.61E-06	2.61E-08	0.41	1.62E-02
SEIS4	Seismic Event, 0.6g Acceleration	6.14E-08	2.07E-08	0.32	3.37E-01
Z147O	Fire Zone 147 Scenario O	1.08E-03	1.10E-08	0.17	1.01E-05
SEIS2	Seismic Event, 0.2g Acceleration	2.89E-06	9.76E-09	0.15	3.38E-03
FL26	External Flooding Scenarios 2 Through 6	1.05E-08	9.48E-09	0.15	9.02E-01
FL1	Flood Induced LOOP - Scenario 1	3.20E-06	2.11E-09	0.03	6.58E-04
SEIS1	Seismic Event, 0.1g Acceleration	3.02E-05	2.09E-09	0.03	6.92E-05
FR10	Control Room Fire Scenario 10	3.43E-06	1.02E-09	0.02	2.98E-04
	Group Subtotal	**3.87E-03**	**2.50E-06**	**39.11**	
	Loss of Coolant Accidents				
ELOCA	Excessive LOCA	3.54E-07	3.20E-07	5.01	9.05E-01
RCPL	RCP Seal LOCA	2.38E-03	1.51E-07	2.36	6.32E-05
VSEQ	Interfacing Systems LOCA	1.38E-07	1.25E-07	1.96	9.06E-01
ILOCA	Isolable Small LOCA	1.00E-03	4.93E-08	0.77	4.92E-05
SLOCA	Non-Isolable Small LOCA	4.96E-04	2.61E-08	0.41	5.26E-05
MLOCA	Medium LOCA	2.66E-05	9.84E-09	0.15	3.71E-04
LLOCA	Large LOCA	2.67E-06	9.37E-09	0.15	3.52E-03
RCRV	One RCS SRV Opens	7.55E-06	2.84E-10	0.00	3.76E-05
RCR2	2 or More RCS SRVs Open	1.09E-06	4.07E-11	0.00	3.74E-05
	Group Subtotal	**3.92E-03**	**6.91E-07**	**10.82**	
	Loss of Offsite Power Events				
LOSPX	Loss of All Offsite Power	1.85E-02	9.57E-07	14.98	5.18E-05
LOSP	Loss of 345kV Offsite Power	3.12E-02	6.31E-07	9.87	2.02E-05
	Group Subtotal	**4.97E-02**	**1.59E-06**	**24.85**	
	Steam Generator Tube Rupture				
SGTR	Steam Generator Tube Rupture	6.61E-03	4.41E-07	6.91	6.68E-05
	Group Subtotal	**6.61E-03**	**4.41E-07**	**6.91**	

Table F.2-1
Initiating Event Contribution to CDF (Continued)

STP_Rev6 Initiator		IE_Freq	CDF	%CDF	CCDP
	Loss of Support Systems				
LOEAB3/6/9	Loss of EAB HVAC, BC/AB/ACRUN, All Support	3.67E-06	2.00E-07	3.13	5.44E-02
LOEAB2/5/8	Loss of EAB HVAC, BC/AB/ACRUN, HVAC A/C/B=F	5.80E-05	5.51E-08	0.86	9.51E-04
L1DCA	Loss of DC Bus E1A11	1.29E-02	4.90E-08	0.77	3.81E-06
L1DCB	Loss of DC Bus E1B11	1.29E-02	4.82E-08	0.75	3.75E-06
LOECW2/5/8	Loss of ECW, BC/AB/ACRUN, ECW A/C/B=F	2.40E-04	8.11E-09	0.13	3.38E-05
LOECW3/6/9	Loss of ECW, BC/AB/ACRUN, All Support	1.08E-05	7.53E-09	0.12	6.99E-04
LOCR3/6/9	Loss of CRE HVAC, BC/AB/ACRUN, All Support	3.67E-06	6.68E-09	0.10	1.82E-03
LOCR2/5/8	Loss of CRE HVAC, BC/AB/ACRUN, HVAC A/C/B=F	5.78E-05	2.06E-09	0.03	3.56E-05
LOCCW2/5/8	Loss of CCW, BC/AB/ACRUN, CCW A/C/B=F	1.03E-03	1.20E-10	0.00	1.17E-07
LOCCW3/6/9	Loss of CCW, BC/AB/ACRUN, All Support	3.10E-05	4.90E-11	0.00	1.58E-06
	Group Subtotal	**2.71E-02**	**3.77E-07**	**5.89**	
	General Transients				
SLBD	Steam Line Break Outside Containment	9.89E-03	2.80E-07	4.38	2.83E-05
TTRIP	Turbine Trip	6.78E-01	1.80E-07	2.81	2.65E-07
PLMFW	Partial Loss of Main Feedwater	5.71E-01	1.51E-07	2.36	2.64E-07
RTRIP	Reactor Trip	5.79E-01	6.50E-08	1.02	1.12E-07
LOPF	Loss of Primary Flow	1.59E-01	4.16E-08	0.65	2.61E-07
SLBI	Steam Line Break Inside Containment	1.00E-03	2.57E-08	0.40	2.56E-05
EXMFW	Excessive Feedwater Flow	5.34E-02	1.35E-08	0.21	2.54E-07
IMSIV	Closure of One main steam isolation valve (MSIV)	3.59E-02	9.02E-09	0.14	2.51E-07
TLMFW	Total Loss of Main Feedwater	3.55E-02	8.91E-09	0.14	2.51E-07
LCV	Loss of Condenser Vacuum	2.47E-02	6.09E-09	0.10	2.47E-07
LOMT	Loss of Main Transformer	4.90E-02	4.37E-09	0.07	8.92E-08
SI	Inadvertent Safety Injection	1.12E-02	3.25E-09	0.05	2.91E-07
AMSIV	Closure of All MSIV's	1.04E-02	2.48E-09	0.04	2.39E-07
LOIA	Loss of Instrument Air	5.42E-03	1.86E-09	0.03	3.44E-07
FLBO	Feed Line Break in the IVC	3.30E-03	1.02E-09	0.02	3.08E-07
MSV	MS Relief or Safety Valve Opening	3.38E-03	7.35E-10	0.01	2.18E-07
	Group Subtotal	**2.23E+00**	**7.94E-07**	**12.42**	
	Total Reported Frequencies of the Group:	2.32E+00	**6.39E-06**	100.00	

Table F.2-2
Initiator Group Contribution to CDF

STP_Rev6		
Initiator Group	**Value**	**Percent**
External Events	2.50E-06	39.1
LOOP	1.59E-06	24.8
General Transients	7.94E-07	12.4
LOCA	6.91E-07	10.8
SGTR	4.41E-07	6.9
Support System Faults	3.77E-07	5.9
Total CDF	6.39E-06	

Table F.2-3
Basic Events with Significant FV Importance

	Basic Event	Description	F-V
1	EP_138KV_UNAV	138kV Unavailable After Plant Initiating Event	4.40E-02
2	RT_OPER_OTA	Operator Fails To Trip Reactor	3.96E-02
3	[RT_RTBK_FOD_000R RT_RTBK_FOD_000S]	Common Cause Failure – Reactor Trip Breakers	3.67E-02
4	[DG_DGEN_FTR_1234]	Diesel Generator 12 Fails to Run After First Hour	3.06E-02
5	CV_HUMA_ERR_0003	Human Error - Failure To Start PDP and Trip RCP	3.04E-02
6	[DG_DGEN_FTR_1134]	Diesel Generator 11 Fails to Run After First Hour	3.01E-02
7	[DG_DGEN_FTR_1334]	Diesel Generator 13 Fails to Run After First Hour	2.77E-02
8	[HH_PMPS_FTS_101A HH_PMPS_FTS_101B HH_PMPS_FTS_101C]	Common Cause Failure to Start of High Head Safety Injection Pumps	2.54E-02
9	DG_CBG4_XFO_1B14	DG 12 Feeder Breaker Transfers Open	2.31E-02
10	DG_CBG4_XFO_1A14	DG 11 Feeder Breaker Transfers Open	2.28E-02
11	[DG_DGEN_FTS_0234]	Diesel 12 Fails To Start	2.11E-02
12	DG_CBG4_XFO_1C14	DG 13 Feeder Breaker Transfers Open	2.10E-02
13	[DG_DGEN_FTS_0134]	Diesel 11 Fails To Start	2.08E-02
14	AF_PMTD_FTS_004D	Turbine Driven AFW Pump Fails to Start	2.06E-02
15	[DG_DGEN_FTS_0334]	Diesel 13 Fails To Start	1.91E-02
16	[EP_CBG4_FTO_E1A1 EP_CBG4_FTO_E1B1 EP_CBG4_FTO_E1C1]	Common Cause Failure 4.16kV Bus E1A, B and C Supply Breakers Fail To Open	1.61E-02
17	[VE_RMFNIFTR_0014 VE_RMFNIFTR_0015 VE_RMFNIFTR_0016]	Common Cause Failure to Run – EAB HVAC Supply Fans Fail to Start	1.52E-02
18	[VE_RMFNIFTR_0001 VE_RMFNIFTR_0002 VE_RMFNIFTR_0003]	Common Cause Failure to Run – EAB HVAC Return Fans Fail to Start	1.52E-02

Table F.2-3
Basic Events with Significant FV Importance (Continued)

	Basic Event	Description	F-V
19	[DG_DGEN_FTR_1134 DG_DGEN_FTR_1234 DG_DGEN_FTR_1334]	Common Cause Failure – Diesel Generators Fail to Run after First Hour	1.44E-02
20	[DG_DGEN_FTR_0234]	Diesel Generator 12 Fails to Run for First Hour	1.39E-02
21	[DG_DGEN_FTR_0134]	Diesel Generator 11 Fails to Run for First Hour	1.37E-02
22	[DG_DGEN_FTR_0334]	Diesel Generator 13 Fails to Run for First Hour	1.26E-02
23	EP_CBG4_FTO_TRNC	4.16kV Bus C Breakers Failure to Open	1.19E-02
24	EP_CBG4_FTO_TRNA	4.16kV Bus A Breakers Failure to Open	1.19E-02
25	VE_OPER_OSA	Operator Fails To Open EAB Doors And Start Smoke Purge	1.17E-02
26	AF_PMTD_FTR_004D	Turbine Driven AFW Pump Fails to Run	1.05E-02
27	EP_CBG4_FTO_TRNB	4.16kV Bus C Breakers Failure to Open	1.02E-02
28	IA_DGEN_FTR_0BOP	BOP Diesel Generator Fails to Run	9.48E-03
29	[EP_CBG4_FTC_1A12 EP_CBG4_FTC_1A13 EP_CBG4_FTC_1B12 EP_CBG4_FTC_1B13 EP_CBG4_FTC_1C12 EP_CBG4_FTC_1C13]	Common Cause Failure to Close – Supply Breakers to Load Centers	7.03E-03
30	[DG_DGEN_FTR_0134 DG_DGEN_FTR_0234 DG_DGEN_FTR_0334]	Common Cause Failure – Diesel Generators Fail to Run for First Hour	6.57E-03
31	RH_TUBEIRUP_HXRA	RHR Heat Exchanger A Tube Rupture (VESQ)	6.53E-03
32	RH_TUBEIRUP_HXRC	RHR Heat Exchanger C Tube Rupture (VESQ)	6.53E-03
33	RH_TUBEIRUP_HXRB	RHR Heat Exchanger B Tube Rupture (VESQ)	6.53E-03
34	CC_MOVLIERR_HXA	Operator Fails to Close MOV in HX A Path (VSEQ)	6.53E-03
35	CC_MOVLIERR_HXC	Operator Fails to Close MOV in HX A Path (VSEQ)	6.53E-03
36	CC_MOVLIERR_HXB	Operator Fails to Close MOV in HX A Path (VSEQ)	6.53E-03
37	RH_MOVLIXFO_060A	RHR MOV 60A Transfers Open (VSEQ)	6.52E-03
38	RH_MOVLIXFO_061C	RHR MOV 61C Transfers Open (VSEQ)	6.52E-03
39	RH_MOVLIXFO_061B	RHR MOV 61B Transfers Open (VSEQ)	6.52E-03
40	RH_MOVLIXFO_061A	RHR MOV 61A Transfers Open (VSEQ)	6.52E-03
41	RH_MOVLIXFO_060C	RHR MOV 60C Transfers Open (VSEQ)	6.52E-03
42	RH_MOVLIXFO_060B	RHR MOV 60B Transfers Open (VSEQ)	6.52E-03
43	RH_SEALINRP_PMPC	No Gross Leakage Thru RHR Pump Seals (VSEQ)	6.52E-03
44	RH_SEALINRP_PMPB	No Gross Leakage Thru RHR Pump Seals (VSEQ)	6.52E-03
45	RH_SEALINRP_PMPA	No Gross Leakage Thru RHR Pump Seals (VSEQ)	6.52E-03
46	[DG_CBG4_FTC_1B14]	DG B Feeder Breaker Fails To Close	6.34E-03
47	[DG_CBG4_FTC_1A14]	DG A Feeder Breaker Fails To Close	6.25E-03
48	AF_STNK_RUP_003A	Auxiliary feedwater (AFW) Storage Tank Ruptures	5.80E-03
49	[DG_CBG4_FTC_1C14]	DG C Feeder Breaker Fails To Close	5.75E-03
50	[HH_PMPS_FTS_101A]	High Head Safety Injection Pump A Fails to Start	5.65E-03

Table F.2-3
Basic Events with Significant FV Importance (Continued)

	Basic Event	Description	F-V
51	[CH_CHLR_FTR_0004]	Train A 300-Ton Chiller Fails To Operate	5.58E-03
52	[EW_AODP_FTO_9894 EW_AODP_FTO_9895 EW_AODP_FTO_9896]	Common Cause Failure ECW Intake Dampers	5.39E-03
53	[EP_CBG4_FTO_1A12 EP_CBG4_FTO_1A13 EP_CBG4_FTO_1B12 EP_CBG4_FTO_1B13 EP_CBG4_FTO_1C12 EP_CBG4_FTO_1C13]	Common Cause Failure to Open – Supply Breakers to Load Centers	5.39E-03
54	EP_NOMAINT	Inverters Not In Maintenance	5.02E-03
55	RC_OPER_FB_OBA		4.92E-03
56	[CH_CHLR_FTR_0006]	Train C 300-Ton Chiller Fails To Operate	4.71E-03
57	[CH_CHLR_FTR_0005]	Train B 300-Ton Chiller Fails To Operate	4.43E-03
58	[EW_PMPR_FTS_101A EW_PMPR_FTS_101B EW_PMPR_FTS_101C]	Common Cause Failure to Start – ECW Pumps	4.38E-03
59	[EW_PMPR_FTS_101A]	ECW Pump A Failure to Run	4.27E-03
60	[EW_RMFN_FTS_0001 EW_RMFN_FTS_0002 EW_RMFN_FTS_0003 EW_RMFN_FTS_0004 EW_RMFN_FTS_0005 EW_RMFN_FTS_0006]	Common Cause Failure to Start – ECW Intake Structure Room fans	4.19E-03
61	SR_SUMP_PLG_0001	Containment Emergency Sump Plugs	4.06E-03
62	[EW_PMPR_FTS_101C]	ECW Pump C Failure to Run	3.98E-03
63	[EW_PMPR_FTS_101B]	ECW Pump B Failure to Run	3.95E-03

Table F.2-4
Top Core Damage Sequences

Ranked Seq. #	Description	Planned Maintenance Configuration	System/Equipment Failures	Operator Action Failures	Recovery Action Failures	Total Scenario Frequency	% CDF	Cumulative
1,2,3	Tornado Induced Failure of Switchyard and ECP (HWIND)	None; Trains AB/AC/BC Running	N/A	None	None	8.98E-07	14.05%	14.05%
5, 6, 7	Excessive LOCA (ELOCA)	None; Trains AB/AC/BC Running	N/A	None	None	2.53E-07	3.96%	18.01%
9, 10,11	ECW Failure Due to Breach of MCR (FLECW)	None; Trains AB/AC/BC Running	N/A	None	None	2.36E-07	3.69%	21.71%
12, 13, 14	Loss of All Offsite Power (LOSPX)	None; Trains AB/AC/BC Running	One Hour Offsite Power recovery, All three ESF DGs	None	Fail to recover failed DGs and offsite power	2.15E-07	3.36%	25.07%
15,16,17	Fire Zone 071 Scenario (Z071X)	None; Trains AB/AC/BC Running	N/A	None	None	1.83E-07	2.86%	27.93%
18,19,20	Loss of All Offsite Power (LOSPX)	Trains A/B/C emergency cooling water (EW) CC DG CH RH RCFC CV,; Trains AB/AC/BC Running	One Hours Offsite Power recovery, All three ESF DGs	None	Fail to recover failed DGs and offsite power	1.66E-07	2.60%	30.53%
23,24,25	Interfacing Systems LOCA (VSEQ)	None; Trains AB/AC/BC Running	N/A	None	None	1.09E-07	1.71%	32.24%
22,26,27	Loss of 345kV Offsite Power (LOSP)	None; Trains AB/AC/BC Running	All 4.16 kV ESF buses E1A/B/C	None	None	1.09E-07	1.71%	33.94%
28,29,30	Loss of EAB HVAC, BCRUN, All Support (LOEAB3)	None; Trains AB/AC/BC Running	PDP pump	None	None	1.07E-07	1.67%	35.62%
4	Fire Zone 047 Scenario (Z047X)	Train A: EW, CC, DG, CH, RH, RCFC, CVB	N/A	None	None	8.7E-08	1.36%	36.98%
7	Fire Zone 047 Scenario (Z047X)	Train A: CH, HE(EAB) HE(CR)	N/A	None	None	8.18E-08	1.28%	38.26%
68-73	Steam Line Break Outside Containment (SLBD)	Trains A/B/C CH, EAB/CR HVAC	One 4.16kV ESF Bus	None	None	7.54E-08	1.18%	39.44%

Table F.2-4
Top Core Damage Sequences (Continued)

Ranked Seq. #	Description	Planned Maintenance Configuration	System/Equipment Failures	Operator Action Failures	Recovery Action Failures	Total Scenario Frequency	% CDF	Cumulative
31, 32, 33	Loss of All Offsite Power (LOSPX)	None; Trains AB/AC/BC Running	All 4.16 kV ESF buses E1A/B/C	None	None	6.55E-08	1.03%	40.46%
35. 36, 37	Control Room Fire Scenario 18 (FR18)	None; Trains AB/AC/BC Running	PDP pump	None	None	6.30E-08	0.99%	41.45%
38, 39, 40	Loss of All Offsite Power (LOSPX)	Trains EW CC DG CH RH RCFC CV; Trains AB/AC/BC Running	Two 4.16kV ESF buses	None	None	5.93E-08	0.93%	42.38%
44, 45, 46	Loss of All Offsite Power (LOSPX)	None; Trains AB/AC/BC Running	Two 4.16kV ESF buses	None	None	5.06E-08	0.79%	43.17%
113-118	Steam Line Break Outside Containment (SLBD)	Trains A/B/C CH HE(EAB) HE(CR); Trains AB/AC/BC Running	One EAB HVAC Train	None	None	5.03E-08	0.79%	43.96%
47, 48, 49	Tornado Induced Failure of Switchyard and ECP (HWIND)	Planned; Trains A/B/C EW,CC,DG,CH,RH, RCFC, CVB; Trains AB/AC/BC Running	N/A	None	None	4.94E-08	0.77%	44.73%
50, 51, 52	Loss of 345kV Offsite Power (LOSP)	None; Trains AB/AC/BC Running	One Hour Offsite Recovery; All 4.16 kV ESF buses E1A/B/C	None	None	4.88E-08	0.76%	45.49%
55, 56, 57	Loss of 345kV Offsite Power (LOSP)	None; Trains AB/AC/BC Running	One Hour Offsite Recovery; 3 ESF DGs, Emergency Transformer	None	Fail to recover 345/138 kV offsite power and DGs	4.75E-08	0.74%	46.24%
21	Fire Zone 047 Scenario (Z047X)	Train A EW, CC, DG, CH, RH, RCFC, CVB	N/A	None	None	4.70E-08	0.74%	46.97%
61, 62, 63	Loss of 345kV Offsite Power (LOSP)	Planned; Trains A/B/C EW, CC, DG, CH, RH, RCFC,	Two 4.16kV ESF buses	None	None	4.4258E-08	0.69%	47.67%
64, 65, 66	Tornado Induced Failure of Switchyard and ECP (HWIND)	None; Trains AB/AC/BC Running	N/A	None	Failure to recover from LOECW	4.26E-08	0.67%	48.33%

Table F.2-4
Top Core Damage Sequences (Continued)

Ranked Seq. #	Description	Planned Maintenance Configuration	System/Equipment Failures	Operator Action Failures	Recovery Action Failures	Total Scenario Frequency	% CDF	Cumulative
76, 77, 78	Loss of EAB HVAC, 1 TRAIN HVAC A=F (LOEAB2,5,8)	Planned; Trains A/B/C CH, EAB/CR HVAC; Trains AB/AC/BC Running	N/A	None	None	3.68E-08	0.58%	48.91%
79, 80, 81	Loss of 345kV Offsite Power (LOSP)	Planned; Trains A/B/C EW, CC, DG, CH, RH, RCFC; Trains AB/AC/BC Running	One Hours Offsite Recovery, Emergency Transformer; 2 ESF DG	None	Fail to recover 345/138 kV offsite power and SDGs	3.65E-08	0.57%	49.48%
82, 83, 84	Loss of 345kV Offsite Power (LOSP)	None; Trains AB/AC/BC running	One Hours Offsite Recovery, Emergency Transformer; All 4.16 kV ESF buses E1A/B/C	None	None	3.40E-08	0.53%	50.01%
85, 86, 87	Turbine Trip (TTRIP)	None; Trains AB/AC/BC Running	Reactor Trip, Unfavorable Exposure Time	Manual Reactor Trip	None	3.31E-08	0.52%	50.53%
88, 89, 90	Turbine Trip (TTRIP)	None; Trains AB/AC/BC Running	Reactor Trip, Unfavorable Exposure Time, Primary Pressure Relief	Manual Reactor Trip	None	3.24E-08	0.51%	51.04%
53, 54	Fire Zone 047 Scenario (Z047X	None; Trains AB/AC Running	N/A	None	None	3.20E-08	0.50%	51.54%
91, 95, 96	Loss of 345kV Offsite Power (LOSP)	Train A/B/C EW CC,DG,CH,RH RCFC CV; Trains AB/AC/BC Running	2 4.16kV ESF Buses	None	None	3.08E-08	0.48%	52.02%
92, 93, 94	Loss of All Offsite Power (LOSPX)	None; Trains AB/AC/BC Running	One Hours Offsite Recovery, All 3 ECW Trains	None	None	3.06E-08	0.48%	52.50%
97, 98, 99	RCP Seal LOCA (RCPL)	None; Trains AB/AC/BC Running	All 3 HHSI Trains	None	None	3.00E-08	0.47%	52.97%
100, 101, 102	Partial Loss of Main Feedwater (PLMFW)	None; Trains AB/AC/BC Running	Reactor Trip, Unfavorable Exposure Time	None	None	2.79E-08	0.44%	53.40%

Table F.2-4
Top Core Damage Sequences (Continued)

Ranked Seq. #	Description	Planned Maintenance Configuration	System/Equipment Failures	Operator Action Failures	Recovery Action Failures	Total Scenario Frequency	% CDF	Cumulative
105, 106, 107	Partial Loss of Main Feedwater (PLMFW)	None; Trains AB/AC/BC Running	Reactor trip breakers fail, Pzr SRV failed and UET3 branch (anticipated transient without scram (ATWS))	Operators fail to trip reactor	None	2.73E-08	0.43%	53.83%
108, 109, 110	Loss of EAB HVAC All Support LOEAB3(6)(9)	None; Trains AB/AC/BC Running	Train D AFW	Operators fail to trip reactor	None	2.56E-08	0.40%	54.23%
111, 112, 119	Loss of All Offsite Power (LOSPX)	EW, CC, DG, CH, RH, RCFC AB/AC/BC Running	One Hours Offsite Recovery,, One ESF DG, One 4.16kV ESF Bus	N/A	Fail to recover 345/138 kV offsite power and SDGs	2.48E-08	0.39%	54.62%
122, 123, 124	Loss of 345kV Offsite Power (LOSP)	Trains AB/AC/BC Running	3 ECW Trains	None	None	2.28E-08	0.36%	54.98%
34	Loss of EAB HVAC, BCRUN, All Support (LOEAB3)	AFW Train D or SG D PORV, Trains BC Running	N/A	None	None	2.11E-08	0.33%	55.31%
41	Fire Zone 047 Scenario BC (Z47BC)	Train A LH HH CS SICOM	N/A	None	None	1.89E-08	0.30%	55.60%
103, 104	Loss of All Offsite Power (LOSPX)	Trains A and B EW, CC, DG,CH,RH,RCFC; Trains AB/AC/BC Running	1 EDG and 4.16kV ESF Bus C	None	Failure to Recover EDG	1.82E-08	0.28%	55.89%
42	Fire Zone 047 Scenario BC (Z47BC)	Train A CH, EAB/CR HVAC	N/A	None	None	1.78E-08	0.28%	56.17%
43	Loss of 345kV Offsite Power (LOSP)	Train C; EW, CC, DG, CH, RH, RCFC, CVA	Failure of ESF DGs	None	Failure to Recover Offsite Power and EDG	1.75E-08	0.27%	56.44%
58	Fire Zone 047 Scenario B (Z047B)	Train C LH HH CS SICOM	Failure of one engineered safety features activation system (ESFAS) train	None	None	1.56E-08	0.24%	56.68%

Table F.2-4
Top Core Damage Sequences (Continued)

Ranked Seq. #	Description	Planned Maintenance Configuration	System/Equipment Failures	Operator Action Failures	Recovery Action Failures	Total Scenario Frequency	% CDF	Cumulative
59	Fire Zone 047 Scenario (Z047X)	None; Trains BC Running	N/A	None	None	1.56E-08	0.24%	56.93%
60	Fire Zone 047 Scenario B (Z047B)	Train C, AFW C or PORV	ESFAS A	None	None	1.52E-08	0.24%	57.17%
67	Fire Zone 047 Scenario (Z047X)	None; Train BC Running	4.16kV ESF Bus A	None	None	1.41E-08	0.22%	57.39%
74	Control Room Fire Scenario 18 (FR18)	Train D AFW or SG PORV	Instrument Air	None	None	1.24E-08	0.19%	57.58%
75	Fire Zone 047 Scenario (Z047X)	None; Train BC Running	EAB Fan C	None	None	1.24E-08	0.19%	57.78%
120	Loss of All Offsite Power (LOSPX)	Train C; EW, CC, DG, CH, RH, RCFC, CVA	Offsite Power recovery in 1 hour, One ESF DG, One 4.16kV Emergency Bus	None	Failure to Recover Offsite Power and EDG	7.92E-09	0.12%	57.90%
120	Loss of All Offsite Power (LOSPX)	Train D AFW or SG PORV	Offsite Power recovery in 1 hour, Three ESF DGs	None	Failure to Recover Offsite Power and EDG	7.91E-09	0.12%	58.02%

Table F.3-1
Estimated STP core inventory

Nuclide	Core Inventory (Curies)	Nuclide	Core Inventory (Curies)
Co-58	1.05E+06	I-131	1.06E+08
Co-60	8.00E+05	I-132	1.52E+08
Kr-83m	1.40E+07	I-133	2.20E+08
Kr-85	1.20E+06	I-134	2.40E+08
Kr-85m	2.90E+07	I-135	2.00E+08
Kr-87	5.49E+07	Xe-131m	1.10E+06
Kr-88	7.79E+07	Xe-133	2.20E+08
Rb-86	4.07E+05	Xe-133m	6.81E+06
Sr-89	1.10E+08	Xe-135	5.49E+07
Sr-90	9.72E+06	Xe-135m	4.18E+07
Sr-91	1.30E+08	Xe-138	1.80E+08
Sr-92	1.40E+08	Cs-134	2.20E+07
Y-90	1.46E+07	Cs-136	6.31E+06
Y-91	1.40E+08	Cs-137	1.30E+07
Y-92	1.40E+08	Ba-139	2.04E+08
Y-93	1.60E+08	Ba-140	1.90E+08
Zr-95	1.80E+08	La-140	1.90E+08
Zr-97	1.80E+08	La-141	1.89E+08
Nb-95	1.77E+08	La-142	1.70E+08
Mo-99	1.98E+08	Ce-141	1.80E+08
Tc-99m	1.67E+08	Ce-143	1.70E+08
Ru-103	1.60E+08	Ce-144	1.40E+08
Ru-105	1.10E+08	Pr-143	1.60E+08
Ru-106	5.49E+07	Nd-147	7.09E+07
Rh-105	1.25E+08	Np-239	2.10E+09
Sb-127	1.25E+07	Pu-238	3.57E+05
Sb-129	3.40E+07	Pu-239	8.04E+04
Te-127	1.25E+07	Pu-240	1.02E+05
Te-127m	1.77E+06	Pu-241	1.71E+07
Te-129	3.30E+07	Am-241	1.13E+04
Te-129m	5.00E+06	Cm-242	4.31E+06
Te-131m	1.50E+07	Cm-244	2.53E+05
Te-132	1.57E+08		

Source: Reference STPNOC 2007 except cobalt inventories based on the PWR inventory in MACCS2 sample problem A multiplied by 4100/3412. The ratio is the STP SAMA power level divided by the sample problem A power level.

Table F.3-2
Accident Sequence Frequencies and Release Fractions

	Accident Sequence/ Frequency	ISGTR (3.71E-07)	R05SU (6.84E-07)	CICV (1.78E-07)	R07SU (1.17E-07)	R15U (6.76E-07)	R13U (4.23E-07)	R11U (2.05E-07)	BYPASS (2.77E-08)	INTACT [a] (3.10E-06)
Release Fraction by Release Category	Xe/Kr	2.60E-01	5.00E-01	2.90E-01	5.30E-01	5.50E-01	5.00E-01	1.00E+00	1.00E+00	1.10E-03
	I	1.30E-01	6.00E-03	2.30E-03	2.60E-02	2.00E-04	4.50E-04	7.50E-03	5.00E-01	2.20E-05
	Cs	9.30E-02	5.63E-03	2.11E-03	2.69E-02	1.35E-04	7.73E-04	4.53E-03	4.16E-01	2.20E-05
	Te	9.80E-03	4.30E-02	0.00E+00	2.53E-02	6.60E-03	5.01E-03	3.01E-02	4.47E-04	2.60E-05
	Sr	2.30E-03	3.00E-04	1.80E-06	5.30E-04	8.20E-05	4.30E-06	8.50E-04	5.40E-04	4.50E-07
	Ru	4.00E-02	6.70E-04	6.00E-05	2.33E-03	5.20E-05	1.50E-05	2.80E-04	1.80E-02	2.40E-06
	La	6.50E-03	7.60E-05	2.40E-07	1.00E-04	7.20E-05	5.00E-06	6.00E-04	2.70E-05	6.40E-08
	Ce	6.60E-03	2.50E-04	2.40E-07	5.30E-04	7.40E-05	7.10E-06	6.10E-04	3.00E-05	7.70E-07
	Ba	2.00E-02	4.10E-04	1.70E-05	1.10E-03	8.20E-05	1.40E-05	5.80E-04	4.95E-03	8.90E-07
	Sb	1.10E-01	1.48E-02	4.50E-04	3.00E-02	5.40E-03	3.00E-03	6.00E-02	1.40E-01	1.90E-05
	Release time (hr from scram) of bulk of noble gas/Cs release	3.8-24/8-12	3.5-24/3.5-14	3.5-21/3.5-5	3.5-24/3.5-7	28-48/28-48	30-48/30-48	27.9-43/27.9-43	28-29.5/8-29.5	3-48/3-8

[a] INTACT release fractions not given in STPNOC (2006b). Estimated as the release fractions from the Wolf Creek (also a PWR) SAMA submittal intact sequence. The INTACT frequency represents both the INTACT 1 and INTACT 2 accident sequences.

Table F.3-3
MACCS nuclide release categories vs. STP MAAP nuclide release categories

MACCS Nuclide Release Categories	STP MAAP Nuclide Release Categories
Xe/Kr	1 – noble gases
I	2 – CsI
Cs	2 & 6 – CsI and CsOH
Te	3 & 11- TeO_2 & Te_2
Sr	4 – SrO
Ru	5 – MoO_2 (Mo is in Ru MACCS category)
La	8 – La_2O_3
Ce	9 – CeO_2 & UO_2
Ba	7 – BaO
Sb (supplemental category)	10 – Sb

Table F.3-4
General Emergency Declaration Times (hours from reactor trip)

Accident Sequence	ISGTR	R05SU	CICV	R07SU	R15U	R13U	R11U	BYPASS	INTACT
G.E. Time	3	3	3	3	3	3	3	28	3

Table F.3-5
Highest Frequency Release Categories by Major Group

End State	Description	Frequency	% of Group
Group I	**Large Early Release**	**5.01E-07**	**100.0%**
ISGTR	Induced SGTR	3.71E-07	74.0%
VSEQ	Interfacing System LOCA	1.25E-07	25.0%
R01U	Large early failure, RV fails high pressure, no sprays, debris not cooled.	2.79E-09	0.6%
	All Other	2.20E-09	0.4%
Group II	**Small Early Release**	**1.16E-06**	**100.0%**
R05SU	Pre-existing small containment failure, RCS fails high pressure, no spray, debris not cooled.	6.84E-07	58.8%
CICV	Pre-existing small containment failure, fuel damage arrested in-vessel.	1.78E-07	15.3%
R07SU	Pre-existing small containment failure, RV fails low pressure, no spray, debris not cooled.	1.17E-07	10.1%
R05SLU	Pre-existing small containment failure followed by late large containment failure, RV fails at high pressure, no spray, debris not cooled.	7.37E-08	6.3%
	All Other	1.10E-07	9.4%
Group III	**Late Release**	**1.48E-06**	**100.0%**
R15U	Long term over-pressurization, RV fails low pressure, no spray, debris not cooled.	6.76E-07	45.8%
R13U	Long term over-pressurization, RV fails high pressure, no spray, debris not cooled.	4.23E-07	28.7%
R11U	Large late burn or over-pressurization, RV fails low pressure, no sprays, debris not cooled.	2.05E-07	13.9%
R09U	Large late burn or over-pressurization, RV fails high pressure, no sprays, debris not cooled.	1.02E-07	6.9%
BYPASS	SGTR or Letdown Isolation Failure	2.77E-08	1.9%
R13	Long term over-pressurization, RV fails high pressure, no spray, debris cooled.	1.21E-08	0.8%
	All Other	2.98E-08	2.0%
Group IV	**Intact Containment (core damage, but no significant release)**	**3.10E-06**	**100.0%**
INTACT2	Containment intact, vessel failure, no sprays.	2.55E-06	82.2%
INTACT1	Containment intact, core damage arrested in vessel, spray injection and recirculation.	5.52E-07	17.8%
	Core Damage Frequency (Total not success)	6.24E-06	

Table F.3-6
Level 3 Results Using Representative Release Categories

Release Category (Source Term ID)	Group I (ISGTR)	Group II (R05SU)	Group III (R13U)	Group IV (Intact)	Total
$Frequency_{BASE}$	5.01E-07	1.16E-06	1.48E-06	3.10E-06	6.24E-06
$Dose\text{-}Risk_{BASE}$	0.68	0.59	0.42	0.05	1.74
$OECR_{BASE}$	$1,202	$399	$23	$0	$1,624

Table F.3-7
Treatment of Unanalyzed Accident Sequences

Accident Sequence with Developed Source Term	Unanalyzed Accident Sequence(s) Binned to Source Term
ISGTR	VSEQ (1.25E-07) R01U (2.79E-09) “All Other” Group I sequences (2.2E-09)
R05SU	“All Other” Group II sequences (2.2E-09)
R07SU	R05SLU (7.37E-08)
R15U	R13 (1.21E-08)
R11U	R09U (1.02E-07) “All Other” Group III sequences (2.98E-08)

Table F.3-8
Validation of Representative Source Terms

Release Category	Group I (ISGTR)	Group II (R05SU)	Group II (CICV)	Group II (R07SU)	Group III (R15U)	Group III (R13U)	Group III (R11U)	Group III (Bypass)	Group IV (Intact)	Total
$Frequency_{BASE}$	5.01E-07	7.94E-07	1.78E-07	1.91E-07	6.88E-07	4.23E-07	3.37E-07	2.77E-08	3.10E-06	6.24E-06
$Dose\text{-}Risk_{BASE}$	0.68	0.41	0.04	0.14	0.10	0.12	0.14	0.06	0.05	1.74
$OECR_{BASE}$	$1,202	$273	$15	$204	$5	$7	$135	$78	$0	1919.00

Table F.5-1
Level 1 Importance Review

Event Name	Probability	Red W	Description	Potential SAMAs
TMEBBC	2.67E-01	1.286	No Planned Maint, Trains B, C Running	This SF only denotes the configuration of the plant systems at the time of the initiating event. For the three divisions of equipment, the running time is split evenly among the divisions and there are not significant differences between the core damage contributors based on the initial configuration. While this would generally not provide many specific risk insights, it is included with some initiating events that result directly in core damage and are not otherwise represented on the importance list, including High Wind, Excessive LOCA, External Flood, fire in zone Z071X, and ISLOCA. The High Wind IE (HWIND) is driven by tornado strikes. In these scenarios, offsite power is lost due to switchyard damage and debris in the essential cooling water intakes fails that system's suction path. This type of initiator could be mitigated by using the PDP to maintain RCP seal injection (from TSC EDG) and using a portable, 480V AC generator to power the station battery chargers for long term AFW support (SAMA 1). In order to ensure availability of the TSC EDG, the building housing the EDG and the transformers serving the EDG would have to be enhanced to withstand tornado events. Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). For Excessive LOCA, a Core Spray system could potentially be used to prevent CD (SAMA 2). The external flood event damages the same equipment as the high wind event with the addition of PDP failure, which would require SAMA 1a for mitigation. For the fire in zone Z071X, mitigation would require the use of an engine driven AFW pump in conjunction with protecting the PDP cables in the Aux Shutdown Area (SAMA 3). For ISLOCA, procedures could be developed to isolate CCW inside of containment (SAMA 4).

Table F.5-1
Level 1 Importance Review (Continued)

Event Name	Probability	Red W	Description	Potential SAMAs
TMEBCA	2.67E-01	1.278	No Planned Maint, Trains C, A Running	This SF only denotes the configuration of the plant systems at the time of the initiating event. For the three divisions of equipment, the running time is split evenly among the divisions and there are not significant differences between the core damage contributors based on the initial configuration. While this would generally not provide many specific risk insights, it is included with some initiating events that result directly in core damage and are not otherwise represented on the importance list, including High Wind, Excessive LOCA, External Flood, fire in zone Z071X, and ISLOCA. The High Wind IE (HWIND) is driven by tornado strikes. In these scenarios, offsite power is lost due to switchyard damage and debris in the essential cooling water intakes fails that system's suction path. This type of initiator could be mitigated by using the PDP to maintain RCP seal injection (from TSC EDG) and using a portable, 480V AC generator to power the station battery chargers for long term AFW support (SAMA 1). In order to ensure availability of the TSC EDG, the building housing the EDG and the transformers serving the EDG would have to be enhanced to withstand tornado events. Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). For Excessive LOCA, a Core Spray system could potentially be used to prevent CD (SAMA 2). The external flood event damages the same equipment as the high wind event with the addition of PDP failure, which would require SAMA 1a for mitigation. For the fire in zone Z071X, mitigation would require the use of an engine driven AFW pump in conjunction with protecting the PDP cables in the Aux Shutdown Area (SAMA 3). For ISLOCA, procedures could be developed to isolate CCW inside of containment (SAMA 4).

Table F.5-1
Level 1 Importance Review (Continued)

Event Name	Probability	Red W	Description	Potential SAMAs
TMEBAB	2.67E-01	1.277	No Planned Maint, Trains A, B Running	This SF only denotes the configuration of the plant systems at the time of the initiating event. For the three divisions of equipment, the running time is split evenly among the divisions and there are not significant differences between the core damage contributors based on the initial configuration. While this would generally not provide many specific risk insights, it is included with some initiating events that result directly in core damage and are not otherwise represented on the importance list, including High Wind, Excessive LOCA, External Flood, fire in zone Z071X, and ISLOCA. The High Wind IE (HWIND) is driven by tornado strikes. In these scenarios, offsite power is lost due to switchyard damage and debris in the essential cooling water intakes fails that system's suction path. This type of initiator could be mitigated by using the PDP to maintain RCP seal injection (from TSC EDG) and using a portable, 480V AC generator to power the station battery chargers for long term AFW support (SAMA 1). In order to ensure availability of the TSC EDG, the building housing the EDG and the transformers serving the EDG would have to be enhanced to withstand tornado events. Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). For Excessive LOCA, a Core Spray system could potentially be used to prevent CD (SAMA 2). The external flood event damages the same equipment as the high wind event with the addition of PDP failure, which would require SAMA 1a for mitigation. For the fire in zone Z071X, mitigation would require the use of an engine driven AFW pump in conjunction with protecting the PDP cables in the Aux Shutdown Area (SAMA 3). For ISLOCA, procedures could be developed to isolate CCW inside of containment (SAMA 4).

Table F.5-1
Level 1 Importance Review (Continued)

Event Name	Probability	Red W	Description	Potential SAMAs
GAA	6.21E-02	1.145	DG 11 FAILS - ALL SUPPORT AVAILABLE	The failure of EDG A is important due to its contribution to SBO sequences. Long term SBO mitigation capability could be achieved by using the PDP to provide RCP seal cooling and a portable 480V AC generator to support long term TD AFW operation (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). An AC cross-tie between units is available, but uncredited in the PRA. Crediting the cross-tie could reduce the SBO contribution, but the reduction would be limited by common cause failure issues for the EDGs.
OGRB	6.00E-01	1.142	NON-RECOVERY OF 345 AND 138KV	Long term loss of 345KV and 138KV power is important in SBO scenarios. This type of initiator could be mitigated by using the PDP to maintain RCP seal injection (from TSC EDG) and using a portable, 480V AC generator to power the station battery chargers for long term AFW support (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). A cross-tie between units is available, but uncredited in the PRA. Crediting the cross-tie could reduce the SBO contribution, but the reduction would be limited by common cause failure issues for the EDGs.
OGRA	4.64E-01	1.110	NON-RECOVERY OF 345KV ONLY	This SF is used for cases when only 345KV power is lost to the site; 138KV is still available up to the switchyard. These events are typically included in SBO scenarios in which the emergency buses or breakers are not available to align 138KV power to the required loads. This type of initiator could be mitigated by using the PDP to maintain RCP seal injection (from TSC EDG) and using a portable, 480V AC generator to power the station battery chargers for long term AFW support (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). Another option would be to provide an additional 138KV transformer (SAMA 5) as some important sequences including this SF also include failure of the 138KV transformer. This would not only mitigate potential accident scenarios with 138KV transformer failure, it would also reduce the risk of maintenance tasks on the existing transformer.

Table F.5-1
Level 1 Importance Review (Continued)

Event Name	Probability	Red W	Description	Potential SAMAs
GBB	6.86E-02	1.105	DG 12 FAILS - GA=F	The failure of EDG B is important due to its contribution to SBO sequences. Long term SBO mitigation capability could be achieved by using the PDP to provide RCP seal cooling and a portable 480V AC generator to support long term TD AFW operation (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). Another option would be to provide an additional 138KV transformer (SAMA 5) as some important sequences including this SF also include failure of the 138KV transformer. This would not only mitigate potential accident scenarios with 138KV transformer failure, it would also reduce the risk of maintenance tasks on the existing transformer. A cross-tie between units is available, but uncredited in the PRA. Crediting the cross-tie could reduce the SBO contribution, but the reduction would be limited by common cause failure issues for the EDGs.
OMB	8.35E-01	1.084	DG RECOVERY - TWO DGS FAILED	This SF is used to represent the probability of the failure to recover an EDG for conditions when 1 EDG is out of service and the other 2 EDGs fail to operate. It is important because of its contribution to LOOP scenarios that lead to SBOs after EDG failures. Long term SBO mitigation capability could be achieved by using the PDP to provide RCP seal cooling and a portable 480V AC generator to support long term TD AFW operation (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). Another option would be to provide an additional 138KV transformer (SAMA 5) as some important sequences including this SF also include failure of the 138KV transformer. This would not only mitigate potential accident scenarios with 138KV transformer failure, it would also reduce the risk of maintenance tasks on the existing transformer. A cross-tie between units is available, but uncredited in the PRA. Crediting the cross-tie could reduce the SBO contribution, but the reduction would be limited by common cause failure issues for the EDGs.

Table F.5-1
Level 1 Importance Review (Continued)

Event Name	Probability	Red W	Description	Potential SAMAs
EAC	7.67E-03	1.081	BUS E1A-O - LOOP	This SF represents the loss of power on 4KV bus E1A in LOOP conditions and contributes primarily to SBO scenarios (from both complete and partial LOOP events). Unavailability of the bus/breakers is often paired with similar failures from other divisions, which would limit the benefit of installing other 4KV power sources. This type of initiator could be mitigated by using the PDP to maintain RCP seal injection (from TSC EDG) and using a portable, 480V AC generator to power the station battery chargers for long term AFW support (SAMA 1). Another option would be to provide an additional 138KV transformer (SAMA 5) as some important sequences including this SF also include failure of the 138KV transformer. This would not only mitigate potential accident scenarios with 138KV transformer failure, it would also reduce the risk of maintenance tasks on the existing transformer.
OMC	8.35E-01	1.074	DG RECOVERY - THREE DGS FAILED	This SF is used to represent the probability of the failure to recover an EDG for conditions when 3 EDGs fail to operate. It is important because of its contribution to LOOP scenarios that lead to SBOs. Long term SBO mitigation capability could be achieved by using the PDP to provide RCP seal cooling and a portable 480V AC generator to support long term TD AFW operation (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). Another option would be to provide an additional 138KV transformer (SAMA 5) as some important sequences including this SF also include failure of the 138KV transformer. This would not only mitigate potential accident scenarios with 138KV transformer failure, it would also reduce the risk of maintenance tasks on the existing transformer. A cross-tie between units is available, but uncredited in the PRA. Crediting the cross-tie could reduce the SBO contribution, but the reduction would be limited by common cause failure issues for the EDGs.

Table F.5-1
Level 1 Importance Review (Continued)

Event Name	Probability	Red W	Description	Potential SAMAs
G3ABC	4.40E-04	1.071	TRAINS A, B, AND C DIESEL GENERATORS	This in an intermediate SF used in DG13 failures, most prominently for GCD. GCD is important based on its inclusion in LOOP events that lead to SBO. Long term SBO mitigation capability could be achieved by using the PDP to provide RCP seal cooling and a portable 480V AC generator to support long term TD AFW operation (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). Another option would be to provide an additional 138KV transformer (SAMA 5) as some important sequences including this SF also include failure of the 138KV transformer. This would not only mitigate potential accident scenarios with 138KV transformer failure, it would also reduce the risk of maintenance tasks on the existing transformer. A cross-tie between units is available, but uncredited in the PRA. Crediting the cross-tie could reduce the SBO contribution, but the reduction would be limited by common cause failure issues for the EDGs.
GCD	1.03E-01	1.070	DG 13 FAILS - GA=F, GB=F	GCD is important based on its inclusion in LOOP events that lead to SBO. Long term SBO mitigation capability could be achieved by using the PDP to provide RCP seal cooling and a portable 480V AC generator to support long term TD AFW operation (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). Another option would be to provide an additional 138KV transformer (SAMA 5) as some important sequences including this SF also include failure of the 138KV transformer. This would not only mitigate potential accident scenarios with 138KV transformer failure, it would also reduce the risk of maintenance tasks on the existing transformer. A cross-tie between units is available, but uncredited in the PRA. Crediting the cross-tie could reduce the SBO contribution, but the reduction would be limited by common cause failure issues for the EDGs.

Table F.5-1
Level 1 Importance Review (Continued)

Event Name	Probability	Red W	Description	Potential SAMAs
TMECBC	1.47E-02	1.060	Planned Maint Train A – Case 1, EW, CC, DG, CH, RH, RCFC, CVB	This SF (maintenance configuration designator) is important mostly due to its inclusion in LOOP/SBO sequences, which are addressed by using the PDP to maintain RCP seal injection (from TSC EDG) and using a portable, 480V AC generator to power the station battery chargers for long term AFW support (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). Another option would be to provide an additional 138KV transformer (SAMA 5) as some important sequences including this SF also include failure of the 138KV transformer. This would not only mitigate potential accident scenarios with 138KV transformer failure, it would also reduce the risk of maintenance tasks on the existing transformer. In addition, there is a contribution from a fire in Fire Zone 047 (cable spreading room), which results in failure of the "B" and "C" power divisions (AC/DC), the reactor containment fan coolers, recirculation cooling Train A, all charging pumps, "C" CCW, PORV 656A, MSIVs, the PDP, and the RCP CCW supply. The "A" train of AFW is OOS for maintenance based on the TMECBC SF and the remaining trains of AFW are failed through power dependence. SAMA 1 is an effective means of mitigating the LOOP scenarios. The fire scenario could be mitigated by using a portable, engine driven SG makeup pump (B.5. pump or similar) and the PDP pump for seal cooling. The PDP cables in the cable spreading room would have to be protected so that the pump would be available after the fire (SAMA 3a).

Table F.5-1
Level 1 Importance Review (Continued)

Event Name	Probability	Red W	Description	Potential SAMAs
TMECAB	1.47E-02	1.060	Planned Maint Train C - Case 1, EW, CC, DG, CH, RH, RCFC, CVA	This SF (maintenance configuration designator) is important mostly due to its inclusion in LOOP/SBO sequences, which are addressed by using the PDP to maintain RCP seal injection (from TSC EDG) and using a portable, 480V AC generator to power the station battery chargers for long term AFW support (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). Another option would be to provide an additional 138KV transformer (SAMA 5) as some important sequences including this SF also include failure of the 138KV transformer. This would not only mitigate potential accident scenarios with 138KV transformer failure, it would also reduce the risk of maintenance tasks on the existing transformer.
OGA	6.20E-04	1.053	LOOP AFTER EVENT	This SF is primarily important due to its contribution to SBO sequences in which all standby diesel generators (SBDGs) fail. The cause of the LOOP is not specifically identified for the event, but the data source on which the event includes only 3 switchyard centered events. For this analysis, it is assumed that power is available to the site, but switchyard faults prevent alignment of the power to the emergency buses. This type of initiator could be mitigated by using the PDP to maintain RCP seal injection (from TSC EDG) and using a portable, 480V AC generator to power the station battery chargers for long term AFW support (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). Another potential option, depending on the switchyard failure, would be to provide an additional 138KV transformer (SAMA 5).
EXA	3.97E-01	1.051	EMERGENCY XFMR FAILURE - AFTER LOOP	The failure of the emergency 138KV transformer is important in partial LOOP events with EDG or 4KV bus failures (leads to SBO). The reliability of the 138KV power source could be improved by installing an additional transformer between the 138KV source and the emergency 4KV buses (SAMA 5).

Table F.5-1
Level 1 Importance Review (Continued)

Event Name	Probability	Red W	Description	Potential SAMAs
TMECCA	1.47E-02	1.048	Planned Maint Train B - Case 1, EW, CC, DG, CH, RH, RCFC	This SF ((maintenance configuration designator) is important mostly due to its inclusion in LOOP/SBO sequences, which are addressed by using the PDP to maintain RCP seal injection (from TSC EDG) and using a portable, 480V AC generator to power the station battery chargers for long term AFW support (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). Another option would be to provide an additional 138KV transformer (SAMA 5) as some important sequences including this SF also include failure of the 138KV transformer. This would not only mitigate potential accident scenarios with 138KV transformer failure, it would also reduce the risk of maintenance tasks on the existing transformer.
HAA	4.36E-03	1.047	HHSI TRAIN A - ALL SUPPORT	The largest contributors including the SF are fires in Fire Zone 047 (cable spreading room), which results in failure of the "B" and "C" power divisions (AC/DC), the reactor containment fan coolers, recirculation cooling Train A, all charging pumps, "C" CCW, PORV 656A, MSIVs, the PDP, and the RCP CCW supply. In this case, "A" division is available and if the PDP cables in the cable spreading room were protected, primary side integrity could be maintained and the "A" AFW pump could be used for heat removal (SAMA 3b). Additional contributors include the RCP seal LOCA initiating events with subsequent failure of all HHSI (pump hardware). A potential means of reducing these types of contributors would be to install an additional, diverse HHSI pump (SAMA 6).

Table F.5-1
Level 1 Importance Review (Continued)

Event Name	Probability	Red W	Description	Potential SAMAs
TMEDBC	5.80E-03	1.045	Planned Maint Train A - Case 2, CH, HE(EAB), HE(CR)	The largest contributor that includes this SF, which is a top 10 sequence for STP, is a fire in Fire Zone 047 (Z047X, cable spreading room) that results in failure of the "B" and "C" power divisions (AC/DC), the reactor containment fan coolers, recirculation cooling Train A, all charging pumps, "C" CCW, PORV 656A, MSIVs, the PDP, and the RCP CCW supply. The "A" train of AFW is OOS for maintenance based on the TMEDBC SF and the remaining trains of AFW are failed through power dependence. This fire scenario could be mitigated by using a portable, engine driven SG makeup pump and the PDP pump for seal cooling. The PDP cables in the cable spreading room would have to be protected so that the pump would be available after the fire (SAMA 3a). The fire scenario Z47BC is similar to the Z047X event, but the MSIVs and the RCP CCW supply are not failed. SAMA 3a is also appropriate for this contributor. Finally, there are steam line break contributors with an additional power division failure that leave only 1 train of 50% EAB HVAC available. A potential solution is to provide portable fans in conjunction with temporary ductwork to provide adequate cooling to the EAB (SAMA 7).
PDC	3.92E-02	1.042	OFF SITE POWER AVAILABLE (HE000	This SF is primarily important in loss of EAB HVAC scenarios; offsite power is available, but critical electrical systems in the EAB fail due to overheating. A potential solution is to provide portable fans in conjunction with temporary ductwork to provide adequate cooling to the EAB (SAMA 7). Fire scenario 18, which is a fire in the Control Room Envelope (CRE) that fails the EAB and Control Room Envelope Cooling functions, is also a contributor to sequences that include PDC. In these cases, a potential enhancement would be to enhance the fire barriers in control panel 22/4 in order to limit the potential for fires to propagate between divisions of EAB and CRE HVAC controls (SAMA 8).

Table F.5-1
Level 1 Importance Review (Continued)

Event Name	Probability	Red W	Description	Potential SAMAs
REFE	1.05E-01	1.041	DG RECOVER GIVEN 2 DGS AND BATTERY DEPLETED	Recovery of 2 EDGs with the batteries depleted is asked for complete Loss of Offsite Power cases with one EDG out of service for maintenance. Long term SBO mitigation capability could be achieved by using the PDP to provide RCP seal cooling and a portable 480V AC generator to support long term TD AFW operation (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). In addition, the availability of the 480V generator could improve the recovery probability of the EDGs given that the battery chargers would be powered by the generator. Another option would be to provide an additional 138KV transformer (SAMA 5) as some important sequences including this SF also include failure of the 138KV transformer. This would not only mitigate potential accident scenarios with 138KV transformer failure, it would also reduce the risk of maintenance tasks on the existing transformer.
OTA	1.42E-02	1.041	OPER MANUALLY TRIPS REACTOR - N main feedwater (MFW), ATWS	The operator action to trip the reactor is important in scenarios where the automatic SCRAM function fails. In this case, power is available at the MG sets and SCRAM only requires power to be interrupted for success. AMSAC represents an existing, automated system that can be used to diagnose ATWS conditions and initiate automated responses to mitigate the accident. The reliability of the SCRAM function could be enhanced by using AMSAC to back up the existing automated SCRAM signal (SAMA 9).
REFD	7.22E-02	1.039	DG RECOVER GIVEN 3 DGS AND BATTERY DEPLETED	Recovery of 3 EDGs with the batteries depleted is asked for complete Loss of Offsite Power cases with three initial EDG failures. Long term SBO mitigation capability could be achieved by using the PDP to provide RCP seal cooling and a portable 480V AC generator to support long term TD AFW operation (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a).

Table F.5-1
Level 1 Importance Review (Continued)

Event Name	Probability	Red W	Description	Potential SAMAs
RTA	3.43E-05	1.038	REACTOR TRIP - POWER AVAILABLE M/G SETS	This SF represents the failure of the automatic SCRAM function. In this case, power is available at the MG sets and SCRAM only requires power to be interrupted for success (the operator has failed to do this). AMSAC represents an existing, automated system that can be used to diagnose ATWS conditions and initiate automated responses to mitigate the accident. The reliability of the SCRAM function could be enhanced by using AMSAC to back up the existing automated SCRAM signal (SAMA 9).
AF1D	1.26E-02	1.031	AFWP 14	AF1D is an intermediate split fraction used for multiple TD AFW split fractions. A large portion of the contribution comes from loss of EAB HVAC scenarios, which are dominated by supply and return fan failures. Given that failure of the fans precludes success of the "smoke purge" mode for alternate cooling, an additional means of alternate cooling is required. A potential solution is to provide portable fans in conjunction with temporary ductwork to provide adequate cooling to the EAB (SAMA 7). Fire scenario 18, which is a fire in the CRE that fails the EAB and Control Room Envelope Cooling functions, is also a contributor to sequences related to this intermediate SF. In these cases, a potential enhancement would be to enhance the fire barriers in control panel 22/4 in order to limit the potential for fires to propagate between divisions of EAB and CRE HVAC controls (SAMA 8).

Table F.5-1
Level 1 Importance Review (Continued)

Event Name	Probability	Red W	Description	Potential SAMAs
EBD	1.95E-02	1.031	BUS E1B, EA=F	The failure of the division "B" 4KV buss/breakers is important due to its contribution to SBO sequences. Long term SBO mitigation capability could be achieved by using the PDP to provide RCP seal cooling and a portable 480V AC generator to support long term TD AFW operation (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). Another option would be to provide an additional 138KV transformer (SAMA 5) as some important sequences including this SF also include failure of the 138KV transformer. This would not only mitigate potential accident scenarios with 138KV transformer failure, it would also reduce the risk of maintenance tasks on the existing transformer. A cross-tie between units is available, but uncredited in the PRA. Crediting the cross-tie could reduce the SBO contribution, but the reduction would be limited by common cause failure issues for the EDGs.
G2AB	4.26E-03	1.031	TRAINS A AND B DIESEL GENERATOR	G2AB is an intermediate split fraction for the GBB split fraction. The failure of EDG B is important due to its contribution to SBO sequences. Long term SBO mitigation capability could be achieved by using the PDP to provide RCP seal cooling and a portable 480V AC generator to support long term TD AFW operation (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). Another option would be to provide an additional 138KV transformer (SAMA 5) as some important sequences including this SF also include failure of the 138KV transformer. This would not only mitigate potential accident scenarios with 138KV transformer failure, it would also reduce the risk of maintenance tasks on the existing transformer. A cross-tie between units is available, but uncredited in the PRA. Crediting the cross-tie could reduce the SBO contribution, but the reduction would be limited by common cause failure issues for the EDGs.

Table F.5-1
Level 1 Importance Review (Continued)

Event Name	Probability	Red W	Description	Potential SAMAs
OMA	8.35E-01	1.030	DG RECOVERY - ONE DG FAILED	This SF is used to represent the probability of the failure to recover one EDG. Generally, the contributing sequences are LOOP/SBO scenarios in which all offsite power is lost and two of the divisions of power are failed by combinations of maintenance and electrical bus level failures. Long term SBO mitigation capability could be achieved by using the PDP to provide RCP seal cooling and a portable 480V AC generator to support long term TD AFW operation (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). A cross-tie between units is available, but uncredited in the PRA. Crediting the cross-tie could reduce the SBO contribution, but the reduction would be limited by common cause failure issues for the EDGs.
TMEDAB	5.80E-03	1.028	Planned Maint Train C - Case 2, CH, HE(EAB), HE(CR)	This SF (maintenance configuration designator) is important mostly due to its inclusion in loss of EAB HVAC scenarios and LOOP/SBO events. SAMA 1 is an effective means of mitigating these scenarios. In addition, alternate EAB HVAC using portable fans and ductwork could mitigate any challenges resulting from insufficient EHC flow (SAMA 7).
HBB	1.97E-02	1.028	HHSI TRAIN B - HA=F	For this SF, contributors include the RCP seal LOCA initiating events with subsequent failure of all HHSI (pump hardware). A potential means of reducing these types of contributors would be to install an additional, diverse HHSI pump (SAMA 6). SGTR events with failure of all HHSI are also contributors. The HHSI x-tie is also a potential means of addressing the SGTR events, but a potentially more cost effective option would be to enhance the plant procedures to direct flooding of the SGs. This would provide a means of scrubbing the fission products passed through the ruptured SG and reduce the magnitude of the scenario's source term (SAMA 10).

Table F.5-1
Level 1 Importance Review (Continued)

Event Name	Probability	Red W	Description	Potential SAMAs
TMEEBC	6.40E-03	1.027	Planned Maint Train A - Case 3, LH, HH, CS, SICOM	The largest contributor that includes this SF, which is a top 10 sequence for STP, is a fire in Fire Zone 047 (Z047X, cable spreading room) that results in failure of the "B" and "C" power divisions (AC/DC), the reactor containment fan coolers, recirculation cooling Train A, all charging pumps, "C" CCW, PORV 656A, MSIVs, the PDP, and the RCP CCW supply. This fire scenario could be mitigated by using a portable, engine driven SG makeup pump and the PDP pump for seal cooling. The PDP cables in the cable spreading room would have to be protected so that the pump would be available after the fire (SAMA 3a). The fire scenario Z47BC is similar to the Z047X event, but the MSIVs and the RCP CCW supply are not failed. SAMA 3a is also appropriate for this contributor.
HCD	2.11E-01	1.027	HHSI TRAIN C - HA=F, HB=F	For this SF, contributors include the RCP seal LOCA initiating events with subsequent failure of all HHSI (pump hardware). A potential means of reducing these types of contributors would be to install an additional, diverse HHSI pump (SAMA 6). SGTR events with failure of all HHSI are also contributors. The HHSI x-tie is also a potential means of addressing the SGTR events, but a potentially more cost effective option would be to enhance the plant procedures to direct flooding of the SGs. This would provide a means of scrubbing the fission products passed through the ruptured SG and reduce the magnitude of the scenario's source term (SAMA 10).
HI3ABC	1.82E-05	1.027	3 HHSI TRAINS FAIL	This in an intermediate SF for HCD. For this SF, contributors include the RCP seal LOCA initiating events with subsequent failure of all HHSI (pump hardware). A potential means of reducing these types of contributors would be to install an additional, diverse HHSI pump (SAMA 6). SGTR events with failure of all HHSI are also contributors. The HHSI x-tie is a also potential means of addressing the SGTR events, but a potentially more cost effective option would be to enhance the plant procedures to direct flooding of the SGs. This would provide a means of scrubbing the fission products passed through the ruptured SG and reduce the magnitude of the scenario's source term (SAMA 10).

Table F.5-1
Level 1 Importance Review (Continued)

Event Name	Probability	Red W	Description	Potential SAMAs
TMEDCA	5.80E-03	1.027	Planned Maint Train B - Case 2, CH, HE(EAB), HE(CR)	This SF (maintenance configuration designator) is important mostly due to its inclusion in loss of EAB HVAC scenarios and LOOP/SBO events. SAMA 1 is an effective means of mitigating these scenarios. Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). In addition, alternate EAB HVAC using portable fans and ductwork could mitigate any challenges resulting from insufficient EHC flow (SAMA 7).
EAD	3.40E-03	1.025	BUS E1A-S - LOOP	This SF represents the loss of power on 4KV bus E1B in LOOP conditions and contributes primarily to SBO scenarios (from both complete and partial LOOP events). Unavailability of the bus/breakers is often paired with similar failures from other divisions, which would limit the benefit of installing other 4KV power sources. This type of initiator could be mitigated by using the PDP to maintain RCP seal injection (from TSC EDG) and using a portable, 480V AC generator to power the station battery chargers for long term AFW support (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a).
G2BC	4.26E-03	1.024	TRAINS B AND C DIESEL GENERATOR	This in an intermediate SF for GCB and GCF, which are contributors to LOOP/SBO events. Long term SBO mitigation capability could be achieved by using the PDP to provide RCP seal cooling and a portable 480V AC generator to support long term TD AFW operation (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). Another option would be to provide an additional 138KV transformer (SAMA 5) as some important sequences including this SF also include failure of the 138KV transformer. This would not only mitigate potential accident scenarios with 138KV transformer failure, it would also reduce the risk of maintenance tasks on the existing transformer. A cross-tie between units is available, but uncredited in the PRA. Crediting the cross-tie could reduce the SBO contribution, but the reduction would be limited by common cause failure issues for the EDGs.

Table F.5-1
Level 1 Importance Review (Continued)

Event Name	Probability	Red W	Description	Potential SAMAs
G2AC	4.26E-03	1.024	TRAINS A AND C DIESEL GENERATOR	This in an intermediate SF for GCC and GHC, which are contributors to LOOP/SBO events. Long term SBO mitigation capability could be achieved by using the PDP to provide RCP seal cooling and a portable 480V AC generator to support long term TD AFW operation (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). Another option would be to provide an additional 138KV transformer (SAMA 5) as some important sequences including this SF also include failure of the 138KV transformer. This would not only mitigate potential accident scenarios with 138KV transformer failure, it would also reduce the risk of maintenance tasks on the existing transformer. A cross-tie between units is available, but uncredited in the PRA. Crediting the cross-tie could reduce the SBO contribution, but the reduction would be limited by common cause failure issues for the EDGs.
EBH	3.50E-02	1.023	BUS E1B, EA=F	The failure of the division "B" 4KV buss/breakers is important due to its contribution to SBO sequences. Long term SBO mitigation capability could be achieved by using the PDP to provide RCP seal cooling and a portable 480V AC generator to support long term TD AFW operation (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). A cross-tie between units is available, but uncredited in the PRA. Crediting the cross-tie could reduce the SBO contribution, but the reduction would be limited by common cause failure issues for the EDGs. The top contributing sequence for this SF is a partial LOOP, for which the failure of the single transformer from the 138KV line is a major contributor. Providing an additional transformer to distribute power from the 138KV power line is another means of reducing the risk from the sequences including the EBH SF (SAMA 5).

Table F.5-1
Level 1 Importance Review (Continued)

Event Name	Probability	Red W	Description	Potential SAMAs
EBF	1.57E-02	1.022	BUS E1B, EA=F	This SF is included largely in partial LOOP/SBO scenarios in which the other 2 emergency 4KV bus trains also fail. Failure of the buses or circuit breakers that serve the buses precludes credit for alternate 4KV power sources. Long term SBO mitigation capability could be achieved by using the PDP to provide RCP seal cooling and a portable 480V AC generator to support long term TD AFW operation (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). Another option would be to provide an additional 138KV transformer (SAMA 5) as some important sequences including this SF also include failure of the 138KV transformer. This would not only mitigate potential accident scenarios with 138KV transformer failure, it would also reduce the risk of maintenance tasks on the existing transformer. A cross-tie between units is available, but uncredited in the PRA. Crediting the cross-tie could reduce the SBO contribution, but the reduction would be limited by common cause failure issues for the EDGs.
EPABC4	9.77E-06	1.022	E1B=O, E1C=O, E1A=S - LOOP	EPABC4 is an intermediate SF for ECR, which represents failure of bus train "C" given failures of the "A" and "B" trains. This SF is included largely in partial LOOP/SBO scenarios in which the other 2 emergency 4KV bus trains also fail. Failure of the buses or circuit breakers that serve the buses precludes credit for alternate 4KV power sources. Long term SBO mitigation capability could be achieved by using the PDP to provide RCP seal cooling and a portable 480V AC generator to support long term TD AFW operation (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). Another option would be to provide an additional 138KV transformer (SAMA 5) as some important sequences including this SF also include failure of the 138KV transformer. This would not only mitigate potential accident scenarios with 138KV transformer failure, it would also reduce the risk of maintenance tasks on the existing transformer. A cross-tie between units is available, but uncredited in the PRA. Crediting the cross-tie could reduce the SBO contribution, but the reduction would be limited by common cause failure issues for the EDGs.

Table F.5-2
Level 2 Importance Review

Event Name	Probability	Red W	Description	Potential SAMAs
C4A	3.70E-01	1.568	NO CONTAINMENT HEAT REMOVAL	The SF represents the "no containment heat removal available" condition, which is common to many scenarios. The SF primarily contributes to tornado strike scenarios in which the switchyard is damaged (LOOP) and debris clogs the essential cooling water intakes. This type of initiator could be mitigated by using the PDP to maintain RCP seal injection (from TSC EDG) and using a portable, 480V AC generator to power the station battery chargers for long term AFW support (SAMA 1). Another top contributor is a partial LOOP (loss of 345KV) with failure of all three 4KV bus trains. These can also be mitigated by SAMA 1. Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). In addition, loss of EAB HVAC sequences are also included in the top sequences. A potential solution is to provide portable fans in conjunction with temporary ductwork to provide adequate cooling to the EAB (SAMA 7). To address the lack of containment cooling directly, the fire water system could be modified so that it could pump water through the containment spray spargers to remove heat and prevent overpressure failure (SAMA 11).
TMEBBC	2.67E-01	1.281	No Planned Maint, Trains B, C Running	Addressed in the Level 1 importance list.
TMEBCA	2.67E-01	1.271	No Planned Maint, Trains C, A Running	Addressed in the Level 1 importance list.
TMEBAB	2.67E-01	1.270	No Planned Maint, Trains A, B Running	Addressed in the Level 1 importance list.
GAA	6.21E-02	1.112	DG 11 FAILS - ALL SUPPORT AVAILABLE	Addressed in the Level 1 importance list.
OGRB	6.00E-01	1.111	NON-RECOVERY OF 345 AND 138KV	Addressed in the Level 1 importance list.
OGRA	4.64E-01	1.098	NON-RECOVERY OF 345KV ONLY	Addressed in the Level 1 importance list.
EAC	7.67E-03	1.088	BUS E1A-O - LOOP	Addressed in the Level 1 importance list.
GBB	6.86E-02	1.083	DG 12 FAILS - GA=F	Addressed in the Level 1 importance list.
OMB	8.35E-01	1.067	DG RECOVERY - TWO DGS FAILED	Addressed in the Level 1 importance list.

Table F.5-2
Level 2 Importance Review (Continued)

Event Name	Probability	Red W	Description	Potential SAMAs
C3D	1.00E-01	1.061	NO CONTAINMENT FAILURE LIKELY	This SF represents the scenarios in which core debris exits the vessel after core damage and a combustible gas burn occurs, but does not fail the containment. Containment does fail due to subsequent long term overpressurization, but not due to the initial burn. The contributing scenarios include tornado strikes that fail the switchyard and result in EAC intake clogging, external flooding scenarios, and fire events. The high winds initiators could be mitigated by using the PDP to maintain RCP seal injection (from TSC EDG) and using a portable, 480V AC generator to power the station battery chargers for long term AFW support (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a). The external flood event damages the same equipment as the high wind event with the addition of PDP failure, which would require SAMA 1a for mitigation. For the fire in zone Z071X, mitigation would require the use of an engine driven AFW pump in conjunction with protecting the PDP cables in the Aux Shutdown Area (SAMA 3). The Z047X fire scenario could be mitigated by using a portable, engine driven SG makeup pump and the PDP pump for seal cooling. The PDP cables in the cable spreading room would have to be protected so that the pump would be available after the fire (SAMA 3a). o address the lack of containment cooling directly, the fire water system could be modified so that it could pump water through the containment spray spargers to remove heat and prevent overpressure failure (SAMA 11).
OGA	6.20E-04	1.059	LOOP AFTER EVENT	Addressed in the Level 1 importance list.

Table F.5-2
Level 2 Importance Review (Continued)

Event Name	Probability	Red W	Description	Potential SAMAs
RPS	5.00E-01	1.059	- RCS PRESS<200 PSIA @VB GIVEN STUCK OPEN PORV @UTAF	This SF is included in fire scenarios in the Aux Shutdown area that impact multiple trains of equipment, including Train A, Train B, Train C, AFW Train D, and the PDP. A potential means of addressing fire scenarios that impact multiple trains of equipment is to focus on protecting a single, essential success path in the fire area rather than protecting the entire area. If the PDP cables in the Aux Shutdown Area were protected and a high pressure, engine driven SG injection pump were provided for secondary side makeup, RCP seal cooling could be maintained and SG makeup would be available for heat removal (SAMA 3). Fire scenario 18, which is a fire in the CRE that fails the EAB and Control Room Envelope Cooling functions, is also a contributor to sequences that include this SF. In these cases, a potential enhancement would be to enhance the fire barriers in control panel 22/4 in order to limit the potential for fires to propagate between divisions of EAB and CRE HVAC controls (SAMA 8).
OMC	8.35E-01	1.059	DG RECOVERY - THREE DGS FAILED	Addressed in the Level 1 importance list.
RPT	5.00E-01	1.058	- 200<RCS PRESS<600 PSIA @VB GIVEN A STUCK OPEN PORV @UTAF	This SF is included in fire scenarios in the Aux Shutdown area that impact multiple trains of equipment, including Train A, Train B, Train C, AFW Train D, and the PDP. A potential means of addressing fire scenarios that impact multiple trains of equipment is to focus on protecting a single, essential success path in the fire area rather than protecting the entire area. If the PDP cables in the Aux Shutdown Area were protected and a high pressure, engine driven SG injection pump were provided for secondary side makeup, RCP seal cooling could be maintained and SG makeup would be available for heat removal (SAMA 3). Fire scenario 18, which is a fire in the CRE that fails the EAB and Control Room Envelope Cooling functions, is also a contributor to sequences that include this SF. In these cases, a potential enhancement would be to enhance the fire barriers in control panel 22/4 in order to limit the potential for fires to propagate between divisions of EAB and CRE HVAC controls (SAMA 8).

Table F.5-2
Level 2 Importance Review (Continued)

Event Name	Probability	Red W	Description	Potential SAMAs
TMECBC	1.47E-02	1.057	Planned Maint Train A - Case 1, EW, CC, DG, CH, RH, RCFC, CVB	Addressed in the Level 1 importance list.
G3ABC	4.40E-04	1.056	TRAINS A, B, AND C DIESEL GENERATORS	Addressed in the Level 1 importance list.
GCD	1.03E-01	1.055	DG 13 FAILS - GA=F, GB=F	Addressed in the Level 1 importance list.
TMECAB	1.47E-02	1.055	Planned Maint Train C - Case 1, EW, CC, DG, CH, RH, RCFC, CVA	Addressed in the Level 1 importance list.
TMEDBC	5.80E-03	1.054	Planned Maint Train A - Case 2, CH, HE(EAB), HE(CR)	Addressed in the Level 1 importance list.
EXA	3.97E-01	1.049	EMERGENCY XFMR FAILURE - AFTER LOOP	Addressed in the Level 1 importance list.
TMECCA	1.47E-02	1.044	Planned Maint Train B - Case 1, EW, CC, DG, CH, RH, RCFC	Addressed in the Level 1 importance list.
TMEEBC	6.40E-03	1.039	Planned Maint Train A - Case 3, LH, HH, CS, SICOM	Addressed in the Level 1 importance list.
PDC	3.92E-02	1.039	OFF SITE POWER AVAILABLE (HE000	Addressed in the Level 1 importance list.
ISS	6.33E-02	1.039	RCS PRESS > 2000 PSIA @ UTAF, N SORV OR SEAL LOCA	This SF is included in many scenarios including high wind events, LOOPs, fires, and external floods where it identifies evolutions in which the RCS remains at high pressure at core melt. Many of these scenarios could be mitigated by using the PDP to maintain RCP seal injection (from TSC EDG) and using a portable, 480V AC generator to power the station battery chargers for long term AFW support (SAMA 1). Alternatively, the RCP seal protection portion of this SAMA could be addressed through installation of the Westinghouse Shutdown Seals (SAMA 1a).

Table F.5-2
Level 2 Importance Review (Continued)

Event Name	Probability	Red W	Description	Potential SAMAs
LSB	8.00E-01	1.039	INDUCED PORV FAILURE WEN RCS PRESS > 2000 PSIA OR OP OPENS P	This SF represents the probability that a pressurizer PORV will fail open at high pressure due to passage of high temp gases, superheated vapor, and aerosols. The subsequent pressure reduction can preclude high pressure melt events, which is a positive outcome. The sequences including this SF are dominated by fire events (Z071X, FR18, and Z047B), which are addressed through the disposition of important SFs in the level 1 importance list. A Level 2 specific insight is that the sequences including the LSB SF are also generally long term containment failure cases. To address the lack of containment cooling directly, the fire water system could be modified so that it could pump water through the containment spray spargers to remove heat and prevent overpressure failure (SAMA 11).
RPP	5.35E-01	1.036	- 200<RCS PRESS<600 PSIA @VB GIVEN A SEAL LOCA @UTAF	This SF is used as part of the accident sequence delineation and identifies the RCS pressure just prior to vessel breach. The largest contributors including this SF are high wind and fire events, which are both captured through review of the important level 1 SFs. A Level 2 specific insight is that the sequences including the RPP SF are also generally long term containment failure cases. To address the lack of containment cooling directly, the fire water system could be modified so that it could pump water through the containment spray spargers to remove heat and prevent overpressure failure (SAMA 11).
HAA	4.36E-03	1.036	HHSI TRAIN A - ALL SUPPORT	Addressed in the Level 1 importance list.
EBD	1.95E-02	1.035	BUS E1B, EA=F	Addressed in the Level 1 importance list.
TMEDAB	5.80E-03	1.033	Planned Maint Train C - Case 2, CH, HE(EAB), HE(CR)	Addressed in the Level 1 importance list.
REFE	1.05E-01	1.033	DG RECOVER GIVEN 2 DGS AND BATTERY DEPLETED	Addressed in the Level 1 importance list.
TMEDCA	5.80E-03	1.032	Planned Maint Train B - Case 2, CH, HE(EAB), HE(CR)	Addressed in the Level 1 importance list.

Table F.5-2
Level 2 Importance Review (Continued)

Event Name	Probability	Red W	Description	Potential SAMAs
REFD	7.22E-02	1.030	DG RECOVER GIVEN 3 DGS AND BATTERY DEPLETED	Addressed in the Level 1 importance list.
OTA	1.42E-02	1.030	OPER MANUALLY TRIPS REACTOR - N MFW, ATWS	Addressed in the Level 1 importance list.
EAD	3.40E-03	1.029	BUS E1A-S - LOOP	Addressed in the Level 1 importance list.
ISX	2.29E-01	1.028	RCS PRESS > 2000 PSI, SEAL LOCA	The SF ISX represents the probability that an induced SGTR has occurred for the conditions in the RCS during/after core damage. In order for an ISGTR to occur, there must be a flow path for the hot gases from the core to the SG tubes. Maintaining water in the piping between the core and the SGs will help prevent an ISGTR from occurring. Including guidance in the plant procedures to prevent the operators from running the RCPs when core damage is imminent or after it has occurred can help reduce the likelihood that the water loop seal would be cleared at a critical time (SAMA 12). For ISX, however, most of the contributors are SBO scenarios that would not include power to run the RCPs and a more effective mitigating strategy would be to provide for long term AFW operation with a 480V generator and protecting the TSC DG to ensure the availability of RCP seal cooling (SAMA 1).
RTA	3.43E-05	1.028	REACTOR TRIP - POWER AVAILABLE M/G SETS	Addressed in the Level 1 importance list.
EBH	3.50E-02	1.027	BUS E1B, EA=F	Addressed in the Level 1 importance list.
EBF	1.57E-02	1.027	BUS E1B, EA=F	Addressed in the Level 1 importance list.
EPABC4	9.77E-06	1.027	E1B=O, E1C=O, E1A=S - LOOP	Addressed in the Level 1 importance list.

Table F.5-3
Phase 1 SAMA List

SAMA Number	SAMA Title	SAMA Description	Source	Cost Estimate	Baseline Phase I Disposition
1	Use Portable 480V AC Generator for Long Term AFW Support and Protect the TSC EDG to Support the PDP for RCP Seal Cooling	High winds events and other SBO scenarios require a long term means of RCP seal cooling and secondary side heat removal. The PDP can provide RCP seal injection in SBO scenarios given that it is powered from the TSC EDG; however, the TSC EDG and its associated transformers would have to be protected to ensure it would not be failed by the tornado event. The availability of TD AFW can be extended beyond 4 hours by providing a portable 480V AC generator to power a station battery charger.	PRA Importance List	STP has estimates the cost of implementation to be $3,457,400 (STPNOC 2009a).	As the cost of implementation is greater than the MACR, this SAMA has been screened from further analysis.
1a	Use Portable 480V AC Generator for Long Term AFW Support and Install Westinghouse Shutdown Seals to Preserve Primary Side Inventory	High winds events and other SBO scenarios require a long term means of providing secondary side heat removal and a strategy for preserving primary side inventory. The Westinghouse Shutdown Seals can prevent significant primary side leakage given loss of RCP seal cooling. The availability of TD AFW can be extended beyond 4 hours by providing a portable 480V AC generator to power a station battery charger. If these enhancements are used in conjunction, it would be possible to maintain the reactor in a safe, stable state for at least 24 hours.	PRA Importance List	STP has estimates the cost of implementation to be $10,738,000 (STPNOC 2009a).	As the cost of implementation is greater than the MACR, this SAMA has been screened from further analysis.

Table F.5-3
Phase 1 SAMA List (Continued)

SAMA Number	SAMA Title	SAMA Description	Source	Cost Estimate	Baseline Phase I Disposition
2	Install a Core Spray System	For Excessive LOCA events, a system that could provide a continuous spray of water onto the core may be able to prevent core damage until containment water level can be raised to cover the core	PRA Importance List	A redundant containment spray system was estimated to cost $5,800,000 (BGE 1998). This is used as an extreme lower bound cost estimate for this SAMA. If a core spray system could even be incorporated into the current reactor vessel, it would require interface with the RCS and extensive re-engineering, which would greatly inflate the cost of the system.	As the cost of implementation is greater than the MACR, this SAMA has been screened from further analysis.
3	Use Portable Engine Driven SG Makeup Pump and PDP Injection with Fire Wrap on PDP Cables in the Auxiliary Shutdown Area	For fires in the Aux Shutdown Area that fail multiple divisions of equipment, SG makeup could be provided by a portable, engine driven, high pressure injection pump and the PDP could maintain RCP seal cooling if the cables in the fire area were protected. Flow control may require the use of decay heart curves and local flow indicators to account for loss of SG level instrumentation.	PRA Importance List	STP has estimates the cost of implementation to be $4,059,672 (STPNOC 2009a).	As the cost of implementation is greater than the MACR, this SAMA has been screened from further analysis.

Table F.5-3
Phase 1 SAMA List (Continued)

SAMA Number	SAMA Title	SAMA Description	Source	Cost Estimate	Baseline Phase I Disposition
3a	Use Portable Engine Driven SG Makeup Pump and PDP Injection with Fire Wrap on PDP Cables in Cable Spreading Room	For loss of EAB HVAC scenarios where the turbine driven AFW pump fails, SG makeup could be provided by a portable, engine driven, high pressure injection pump. Flow control may require the use of decay heart curves and local flow indicators to account for loss of SG level instrumentation. RCP seal injection would require continued operation of the PDP to prevent a seal LOCA. For cable spreading room fires, continued use of the PDP would require protecting any PDP cables that are routed through the room.	PRA Importance List	STP has estimates the cost of implementation to be $4,190,357 (STPNOC 2009a).	As the cost of implementation is greater than the MACR, this SAMA has been screened from further analysis.
3b	Install Fire Wrap on PDP Cables in Cable Spreading Room	For the cable spreading room fire scenario Z047X, the "A" power train is still available for some contributors and "A" AFW could be used for heat removal if primary side integrity is maintained. Protecting the PDP cables in the cable spreading room is a potential means of maintaining primary side integrity.	PRA Importance List	STP has estimates the cost of implementation to be $796,677 (STPNOC 2009a).	As the cost of implementation is greater than the MACR, this SAMA has been screened from further analysis.

Table F.5-3
Phase 1 SAMA List (Continued)

SAMA Number	SAMA Title	SAMA Description	Source	Cost Estimate	Baseline Phase I Disposition
4	Develop Procedures to Isolate CCW Inside Containment	For STP, ISLOCA contributions are limited by the fact that RHR is placed inside containment. The dominant ISLOCA scenario in the current PRA model is based on failure of the tubes in the RHR/CCW heat exchanger, which would provide a pathway for primary side water to leave the containment. The ISLOCA scenario could be terminated by closing an in-containment valve in the CCW line, but currently, STP does not have procedures that direct this action. If procedures are developed to direct isolation of the CCW line for these Hx rupture scenarios, it would significantly reduce the ISLOCA contribution. However, it should be noted that that probability assigned to the Hx rupture is likely conservative and work is being performed by Westinghouse and STP to further analyze this failure mode. If the results of the analysis indicate that the failure mode is significantly lower than what is currently assumed, the ISLOCA contribution would be eliminated as an important contributor for STP and this SAMA would not be required.	PRA Importance List	The cost of a procedure change is estimated to be $100,000 (CPL 2004). This is considered to address engineering analysis, training, and update of materials.	As the cost of implementation is less than the MACR, this SAMA has been retained for Phase II analysis.

Table F.5-3
Phase 1 SAMA List (Continued)

SAMA Number	SAMA Title	SAMA Description	Source	Cost Estimate	Baseline Phase I Disposition
5	Install an Additional Transformer to Distribute Power from the 138KV Offsite Power Line to the Emergency 4KV Buses	The existing emergency transformer, while highly beneficial, represents a single point failure of the alternate offsite power source. For partial LOOP events, loss of the transformer requires STP to rely on on-site power sources. Providing an additional transformer would provide defense in depth for partial LOOP events and more flexibility for alternate power configurations (including maintenance configurations).	PRA Importance List	STP has estimates the cost of implementation to be $3,026,700 (STPNOC 2009a).	As the cost of implementation is greater than the MACR, this SAMA has been screened from further analysis.
6	Install an Additional Diverse, HHSI Pump	RCP seal LOCAs with subsequent failure of all HHSI trains have been identified as contributors to STP risk. A means of reducing the contribution from these types of scenarios would be to install an additional, diverse HHSI pump. The pump, which would be sized to mitigate small LOCAs, would be powered from an existing emergency power bus and connect to the existing HHSI suction and discharge piping.	PRA Importance List	STP has estimates the cost of implementation to be $2,301,000 (STPNOC 2009a).	As the cost of implementation is greater than the MACR, this SAMA has been screened from further analysis.

Table F.5-3
Phase 1 SAMA List (Continued)

SAMA Number	SAMA Title	SAMA Description	Source	Cost Estimate	Baseline Phase I Disposition
7	Provide Portable Fans and Ductwork for Alternate EAB Room Cooling	Loss of the EAB HVAC system can result in failure of critical electrical equipment in all power divisions. The dominant HVAC failures also disable the existing alternate cooling mode (smoke purge), so a separate cooling system is required to reduce the risk of loss of HVAC scenarios. In this case, portable fans could be used in conjunction with temporary duct work to achieve the required cooling flows in important areas.	PRA Importance List	Salem Generating Station estimated the cost of implementation to be $475,000 per unit for the Main Control Room (including engineering analysis, procedure updates, and training). For the STP site, this would be $950,000 assuming that the scope of cooling the entire EAB would not add significant costs to the estimate.	As the cost of implementation is greater than the MACR, this SAMA has been screened from further analysis.
8	Enhance Fire Barriers in CRE Panel 22/4	While failure to control the plant from the Alternate Shutdown Panel may be conservatively estimated in the STPEGS PRA, some fire scenarios are potentially important and present opportunities for improvement. The contributions from fires that fail all EAB and CRE HVAC (FS18) could potentially be reduced by adding fire barriers to separate the controls for the different divisions of EAB and CRE HVAC on panel 22/4. Improving the availability of the EAB and CRE HVAC systems precludes electrical system failures and control room evacuation.	PRA Importance List	STP has estimates the cost of implementation to be $1,150,500 (STPNOC 2009a).	As the cost of implementation is greater than the MACR, this SAMA has been screened from further analysis.

Table F.5-3
Phase 1 SAMA List (Continued)

SAMA Number	SAMA Title	SAMA Description	Source	Cost Estimate	Baseline Phase I Disposition
9	Use AMSAC to Back Up the Existing SCRAM Signal	AMSAC represents an existing, automated system that can be used to diagnose ATWS conditions and initiate automated responses to mitigate the accident. The reliability of the SCRAM function could be enhanced by using AMSAC to back up the existing automated SCRAM signal	PRA Importance List	Salem Generating Station estimated the cost of implementation to be $485,000 per unit. For the STP site, this would be $970,000.	As the cost of implementation is greater than the MACR, this SAMA has been screened from further analysis.
10	Enhance Procedures to Ensure the SGs are Filled or Maintained Filled In SGTR Events to Scrub Fission Products	This SAMA makes a procedure change that directs operators to fill or maintain filled the steam generators prior to core damage to provide mechanical scrubbing of fission products.	PRA Importance List	The cost of a procedure change is estimated to be $100,000 (CPL 2004). This is considered to address engineering analysis, training, and update of materials.	As the cost of implementation is less than the MACR, this SAMA has been retained for Phase II analysis.
11	Modify Fire Protection System to Supply CS Headers	For long term loss of containment heat removal cases, it may be possible to prevent containment overpressure failures by modifying the Fire Protection system so that the diesel driven fire pumps could supply flow through the Containment Spray spargers.	PRA Importance List	STP has estimates the cost of implementation to be $849,600 (STPNOC 2009a).	As the cost of implementation is greater than the MACR, this SAMA has been screened from further analysis.

Table F.5-3
Phase 1 SAMA List (Continued)

SAMA Number	SAMA Title	SAMA Description	Source	Cost Estimate	Baseline Phase I Disposition
12	Enhance Procedures to Prevent Clearing of RCS Cold Leg Water Seals	This SAMA models the procedure change that would preclude the operators from clearing the water seals in the RCS cold legs just prior to, or after core damage. If the loop seals are cleared there is an unobstructed flow path for hot gases to flow from the damaged core through the steam generator tubes increasing the likelihood of an induced steam generator tube rupture.	PRA Importance List	The cost of a procedure change is estimated to be $100,000 (CPL 2004). This is considered to address engineering analysis, training, and update of materials.	As the cost of implementation is less than the MACR, this SAMA has been retained for Phase II analysis.
13	Develop Procedures to Open Doors and/or Use Portable Fans for Alternate SBDG Room Cooling	Loss of the SBDG HVAC system results in overheating of the SBDG rooms and is assumed to result in the subsequent failure of the equipment located in the rooms. Ensuring procedures are available to direct operators to open the doors to the SBDG rooms on loss of HVAC could allow the SBDGs to continue operating even after HVAC failure.	Industry SAMA Review	The cost of a procedure change is estimated to be $100,000 (CPL 2004). This is considered to address engineering analysis, training, and update of materials.	As the cost of implementation is less than the MACR, this SAMA has been retained for Phase II analysis.
14	Provide Capability to Cross-tie Emergency 4KV Divisions on a Single Unit	STP already has the capability to cross-tie emergency 4KV AC divisions to the opposite unit, but it is not credited in the PRA. The benefit of providing inter-divisional cross-tie capability on a single unit would likely be limited if the inter-unit cross-ties were credited, but the inter-divisional cross-ties could be beneficial for cases when the SBGs on the opposite unit are not available for support.	Industry SAMA Review	STP has estimates the cost of implementation to be $4,484,000 (STPNOC 2009a).	As the cost of implementation is greater than the MACR, this SAMA has been screened from further analysis.

Table F.5-3
Phase 1 SAMA List (Continued)

SAMA Number	SAMA Title	SAMA Description	Source	Cost Estimate	Baseline Phase I Disposition
15	Develop Emergency Procedures for Alternate ECWIS Room Cooling	Loss of the ECWIS HVAC system will result in failure of the ECW pumps. Providing procedures that direct the operators to open the ECWIS doors could provide a mean alternate cooling and allow continued operation of the ECW pumps.	Industry SAMA Review	The cost of a procedure change is estimated to be $100,000 (CPL 2004). This is considered to address engineering analysis, training, and update of materials.	As the cost of implementation is less than the MACR, this SAMA has been retained for Phase II analysis.
16	Portable, Engine Driven Instrument Air Compressor	STP has the ability to power IA compressor 14 from the BOP diesel in LOOP events, but the availability of IA could be further improved if a portable, engine driven IA compressor could be connected to the system as an alternate air source.	Industry SAMA Review	STP has estimates the cost of implementation to be $1,227,200 (STPNOC 2009a).	As the cost of implementation is greater than the MACR, this SAMA has been screened from further analysis.
17	Completely Automate the Start and Load of the PDP on the TSC EDG	Reducing the number of actions that the operators are required to take to restore RCP seal cooling after a loss can improve the reliability of the action. While the action is currently relatively simple, the time available to restore RCP seal cooling is only 13 minutes (after a total cooling loss of cooling). If the operators are only required to open the valves from the PDP to the RCP seals, then the manipulation time for this time critical action could be reduced.	Industry SAMA Review	STP has estimates the cost of implementation to be $2,426,080 (STPNOC 2009a).	As the cost of implementation is greater than the MACR, this SAMA has been screened from further analysis.

Table F.5-3
Phase 1 SAMA List (Continued)

SAMA Number	SAMA Title	SAMA Description	Source	Cost Estimate	Baseline Phase I Disposition
17a	Install Westinghouse RCP Shutdown Seals	This is a passive alternative to the automated RCP seal cooling system alignment proposed in SAMA 12. The seals would activate on high heat and seal around the RCP pump shaft so that leakage through the seals is essentially eliminated as a concern.	Industry SAMA Review/PRA Importance List	STP has estimates the cost of implementation to be $7,611,000 (STPNOC 2009a).	As the cost of implementation is greater than the MACR, this SAMA has been screened from further analysis.

Table F-6.1
Phase 2 SAMA List

SAMA Number	SAMA Title	SAMA Description	Cost Estimate	Baseline Phase 2 Disposition
4	Develop Procedures to Isolate CCW Inside Containment	For STP, ISLOCA contributions are limited by the fact that RHR is placed inside containment. The dominant ISLOCA scenario in the current PRA model is based on failure of the tubes in the RHR/CCW heat exchanger, which would provide a pathway for primary side water to leave the containment. The ISLOCA scenario could be terminated by closing an in-containment valve in the CCW line, but currently, STP does not have procedures that direct this action. If procedures are developed to direct isolation of the CCW line for these Hx rupture scenarios, it would significantly reduce the ISLOCA contribution. However, it should be noted that that probability assigned to the Hx rupture is likely conservative and work is being performed by Westinghouse and STP to further analyze this failure mode. If the results of the analysis indicate that the failure mode is significantly lower than what is currently assumed, the ISLOCA contribution would be eliminated as an important contributor for STP and this SAMA would not be required.	The cost of a procedure change is estimated to be $100,000 (CPL 2004). This is considered to address engineering analysis, training, and update of materials.	The averted cost-risk for this SAMA is less than the cost of implementation; therefore, the SAMA is not cost beneficial.
10	Enhance Procedures to Ensure the SGs are Filled or Maintained Filled In SGTR Events to Scrub Fission Products	This SAMA makes a procedure change that directs operators to fill or maintain filled the steam generators prior to core damage to provide mechanical scrubbing of fission products.	The cost of a procedure change is estimated to be $100,000 (CPL 2004). This is considered to address engineering analysis, training, and update of materials.	The averted cost-risk for this SAMA is less than the cost of implementation; therefore, the SAMA is not cost beneficial.

Table F-6.1
Phase 2 SAMA List (Continued)

Cost Estimate		Baseline Phase 2 Disposition		
12	Enhance Procedures to Prevent Clearing of RCS Cold Leg Water Seals	This SAMA models the procedure change that would preclude the operators from clearing the water seals in the RCS cold legs just prior to, or after core damage. If the loop seals are cleared there is an unobstructed flow path for hot gases to flow from the damaged core through the steam generator tubes increasing the likelihood of an induced steam generator tube rupture.	The cost of a procedure change is estimated to be $100,000 (CPL 2004). This is considered to address engineering analysis, training, and update of materials.	The averted cost-risk for this SAMA is less than the cost of implementation; therefore, the SAMA is not cost beneficial.
13	Develop Procedures to Open Doors and/or Use Portable Fans for Alternate SBDG Room Cooling	Loss of the SBDG HVAC system results in overheating of the SBDG rooms and is assumed to result in the subsequent failure of the equipment located in the rooms. Ensuring procedures are available to direct operators to open the doors to the SBDG rooms on loss of HVAC could allow the SBDGs to continue operating even after HVAC failure.	The cost of a procedure change is estimated to be $100,000 (CPL 2004). This is considered to address engineering analysis, training, and update of materials.	The averted cost-risk for this SAMA is less than the cost of implementation; therefore, the SAMA is not cost beneficial.
15	Develop Emergency Procedures for Alternate ECWIS Room Cooling	Loss of the ECWIS HVAC system will result in failure of the ECW pumps. Providing procedures that direct the operators to open the ECWIS doors could provide a mean alternate cooling and allow continued operation of the ECW pumps.	The cost of a procedure change is estimated to be $100,000 (CPL 2004). This is considered to address engineering analysis, training, and update of materials.	The averted cost-risk for this SAMA is less than the cost of implementation; therefore, the SAMA is not cost beneficial.

Table F.7.2-1
Sensitivity of STP Baseline Risk (Dose/Economic) to Parameter Changes

Parameter	Input Discussion	Ratio to 50-Mile Baseline Population Dose/Cost Risk	Output Discussion
Annual Met Data Set	Each year 2006-2008	Dose = 93% (2007) to no change (2008) Cost = 89% (2007) to 98% (2008)	2006, maximum dose risk and cost risk year, chosen as baseline.
Nuclide Release Extrapolation, RELFRC	Nuclide releases for four sequences do not level off by the concluding time of the level-2 analysis. Those releases were extrapolated to 72-hours from scram for this sensitivity case	Dose = 105% Cost = 103%	Explicit level-2 results used for base case. Increases in risk noted with extrapolated releases. Increase well within conservatism introduced by meteorology specification in last spatial segment (see final row of this table).
Release Height, DPLHITE	Baseline assumed release from top of containment vessel. Releases at ground-level, 25% up containment, 50% up containment and 75% up containment considered.	Dose = 98% to 99% Cost = 93% to 98%	Decrease in release height increases close-in deposition. Larger downwind population affected by relatively depleted plume. Minimum risks at ground-level, increasing with increasing release height.
Release Heat, DPLHEAT	Baseline assumed no heat (ambient). 1 and 10 MW heat released with each of 4 plume segments for each accident sequence.	Dose= No change to 103% Cost = 101% to 103%	Effect of buoyant plume rise is similar to increase in release height. Risk increases going from 1 to 10 MW per plume segment. Increase well within conservatism introduced by meteorology specification in last spatial segment (see final row of this table).
Wake Effects, SIGYINIT, SIGZINIT	Baseline determined from containment building. Uncertainty due to proximity of other buildings. Base case wake size halved and doubled.	Dose = No change Cost = No change to 101%	Minor changes very near release.

Table F.7.2-1
Sensitivity of STP Baseline Risk (Dose/Economic) to Parameter Changes (Continued)

Parameter	Input Discussion	Ratio to 50-Mile Baseline Population Dose/Cost Risk	Output Discussion
Evacuation Speed, ESPEED	One-half and double base case evacuation speed	Dose = 102% to 99% Cost = No change	Small increases in dose risk as evacuation speed decreases. 0-10 mile risk is minor contributor to 50-mile risk.
Evacuation Preparation Time, DLTSHL	Baseline considered 50% of population evacuating as indicator of period from emergency declaration until evacuation begins. One-half and double base case preparation period considered.	Dose = 99% to 101% Cost = No change	Small increases in dose risk as preparation time increases. 0-10 mile risk is minor contributor to 50-mile risk.
Meteorology specification in last spatial segment, LIMSPA	Rainfall imposed at all times from 40 to 50 miles from release to force conservative population exposure for base case. Sensitivity allows 40-50 mile meteorology to temporally follow the onsite meteorology.	Dose = 77% Cost = 65%	Entire decrease is due to removing perpetual rainfall (wet deposition) and specifying measured meteorology in ring from 40 to 50 miles from site.

[a] “No change” indicates < 0.5% change in risk.

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SNC 2007	SNC (Southern Nuclear Operating Company, Inc.). 2007. Applicant's Environmental Report; Operating License Renewal Stage; Vogtle Electric Generating Plant Units 1 and 2. Attachment F – Severe Accident Mitigation Alternatives. June. Available on U. S. Nuclear Regulatory Commission website at http://www.nrc.gov/reactors/operating/licensing/renewal/applications/vogtle.html.
STPNOC 2006a	STPNOC (STP Nuclear Operating Company). 2006. Probabilistic Risk Assessment Level 2 Results Revision 5.0. Prepared by Ray Fine, August 19.
STPNOC 2006b	STPNOC (STP Nuclear Operating Company). 2006. Probabilistic Risk Assessment Level 2 Accident Progression STP REV5. Prepared by Ray Fine, May 6.
STPNOC 2007	STPNOC (STP Nuclear Operating Company). 2007. Request for License Amendment Related to Application of the Alternate Source Term. Letter from David W. Rencurrel Vice President Engineering and Strategic Projects to U.S. Nuclear Regulatory Commission, Letter #NOC-AE-07002127 and attachments, March 22, 2007.
STPNOC 2009a	STPNOC (STP Nuclear Operating Company). 2009. Email correspondence between Albert McIntyre (STPNOC), and Donald MacLeod (ERIN). “RE: HHSI”. September 1.
STPNOC 2009b	STPNOC (STP Nuclear Operating Company). 2009. South Texas Project Units 3 & 4 COLA (Environmental Report), Rev. 3. September.
USEPA 1972	EPA (U.S. Environmental Protection Agency). 1972. Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Throughout the Contiguous United States. AP-101, Holzworth, George C. January.
WCNOC 2006	Wolf Creek Nuclear Operating Corporation. 2006. Applicant’s Environmental Report; Operating License Renewal Stage, Attachment F. Wolf Creek Nuclear Operating Corporation, Burlington, Kansas.

ATTACHMENT G

COASTAL ZONE CONSISTENCY CERTIFICATION

<u>Letter</u> <u>Page</u>

STP Nuclear Operating Company
South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

December 2, 2009
NOC-TX-09020576
File No. W12.02
STI No. 32583340

Ms. Tammy Brooks
Coastal Coordination Council Secretary
Consistency Review Coordinator
Coastal Protection Division
Texas General Land Office
P. O. Box 12873
Austin, TX 78711-2873

SUBJECT: Federal Consistency Certification Request in Support of the South Texas Project Units 1 & 2 License Renewal

Dear Ms. Brooks:

In 2010, STP Nuclear Operating Company (STPNOC) plans to apply to the U.S. Nuclear Regulatory Commission (NRC) for renewal of the operating licenses for Units 1 & 2 on its approximately 12,220-acre site in Matagorda County, Texas. The existing operating licenses for STP Units 1 & 2 were initially issued for 40-year terms that expire in 2027 and 2028, respectively. License renewal would extend the operating period for the reactors by 20 years beyond the expiration of their existing licenses. The federal Coastal Zone Management Act imposes requirements on applicants for a federal license that could affect a state's coastal zone. This requirement is applicable to renewal of federal licenses for activities not previously reviewed by the state. This letter transmits the following items listed below for your review pursuant to the requirements of 31 TAC 506.30.

A. A copy of the Preliminary Final Environmental Report that will be submitted to the Nuclear Regulatory Commission (NRC):

   Enclosed with this letter is a CD containing the Applicant's Preliminary Final Environmental Report – Operating License Renewal Stage – South Texas Project Units 1 & 2 dated August 2009.

B. A detailed description of the proposed activity and its associated facilities, which is adequate to permit an assessment of their possible effects on Coastal Natural Resource Areas (CNRAs):

   Attachment 1 to this letter is a description of the proposed project which consists of license renewal and continued operation of existing STP Units 1 & 2.

C. A list identifying all federal, state, and local permits or authorizations subject to the Texas Coastal Management Plan (TCMP) and required for the proposed activity and its associated facilities:

Attachment 2 to this letter contains a list of applicable federal, state, and local agency permits and authorizations from Chapter 9 of the Environmental Report. This list is in the process of being updated before final submittal next year. The Colorado River intake dredging permit number is now SWG-1992-02707 and expires 12/31/2019. Renewal of the coastal easement (LC980025) is in progress at this time which will include the intake, barge slips and reservoir blowdown discharge area adjacent to the Colorado River.

D. A brief assessment relating to the relevant elements of the TCMP and the probable effects of the proposed activity and its associated facilities on CNRAs:

Attachment 3 to this letter contains a list of each of the CNRAs identified in the TCMP along with the probable effects from the continued operation of STP Units 1 & 2 on these resource areas.

E. An evaluation indicating the project and its effects are consistent with TCMP goals:

Attachment 4 to this letter contains a list of the goals of the TCMP and the consistency of the effects of the continued operation of STP Units 1 & 2 on these goals.

F. An evaluation indicating that the project and its effects are consistent with TCMP policies:

Attachment 5 to this letter contains a list of the policies of the TCMP and the consistency of the effects of the continued operation of STP Units 1 & 2 on these policies.

G. Consistency certification:

"STPNOC certifies that the proposed activity (license renewal and continued operation of South Texas Project Units 1 & 2) complies with Texas' approved coastal management program and will be conducted in a manner consistent with such program."

Ms. Tammy Brooks
December 2, 2009
Page 3

Please do not hesitate to call me at 361-972-8328 or contact me via e-mail if there are questions or you need additional information to complete a review of the proposed action. Thank you in advance for your assistance.

Sincerely,

S. L. Dannhardt
Environmental Manager

Enclosure: Preliminary Final Environmental Report (CD)

Attachments: 1. Description of Project
2. Status of Permits, Consultations and Approvals for STP Units 1 & 2
3. Probably Effects of STP Units 1 & 2 on Coastal Natural Resource Areas
4. STP Units 1 & 2 Consistency with TCMP Goals
5. STP Units 1 & 2 Consistency with TCMP Policies

ATTACHMENT 1

DESCRIPTION OF PROJECT

The Proposed Project

Pursuant to the Atomic Energy Act of 1954, as amended, and Title 10 of the Code of Federal Regulations, STP Nuclear Operating Company (STPNOC) on behalf of itself and the owners of STP Units 1 & 2: NRG South Texas LP, the City of San Antonio, acting by and through the City Public Service Board (CPS Energy) and the City of Austin is submitting an application to renew the STP Units 1 & 2 operating licenses.

Purpose and Need

The proposed federal action requiring a consistency certification is the Nuclear Regulatory Commission's (NRC) renewal of the operating licenses for STP Units 1 & 2. The purpose and need for the proposed action is to provide an option that allows for power generation capability beyond the term of the current operating license to meet future system generating needs. The renewed operating licenses would allow Units 1 to operate until 2047 and Unit 2 to operate until 2048, providing an additional 20 years of operation beyond their current licensed operating periods of 40 years each.

Site Location

The STP site is located on approximately 12, 220 acres in a rural area of Matagorda County, Texas, approximately 12 miles south-southwest of the city limit of Bay City, Texas and 10 miles north of Matagorda Bay, along the west bank of the Colorado River (Figures 1 & 2). The location of STP Units 1 & 2 on the STP site is shown in Figure 3.

Reactor Information

The South Texas Project has two 1350-megawatt Westinghouse pressurized water reactors. Unit 1 was declared commercially operational on August 25, 1988 and Unit 2 on June 19, 1989.

Cooling System Information

STP Units 1 & 2 will continue use of the 7000 acre Main Cooling Reservoir (MCR) for plant cooling. Makeup water for the MCR will be withdrawn intermittently from the Colorado River using the existing intake structure. Discharges from the MCR will be made to the Colorado River via the blowdown pipeline as necessary to maintain water quality in the MCR in accordance with a TPDES permit.

Transmission System Information

STP Units 1 & 2 will utilize the existing switchyard and transmission corridor.

Attachment 1
Page 2 of 4

Figure 1: 50-Miles Radius Surrounding the South Texas Project

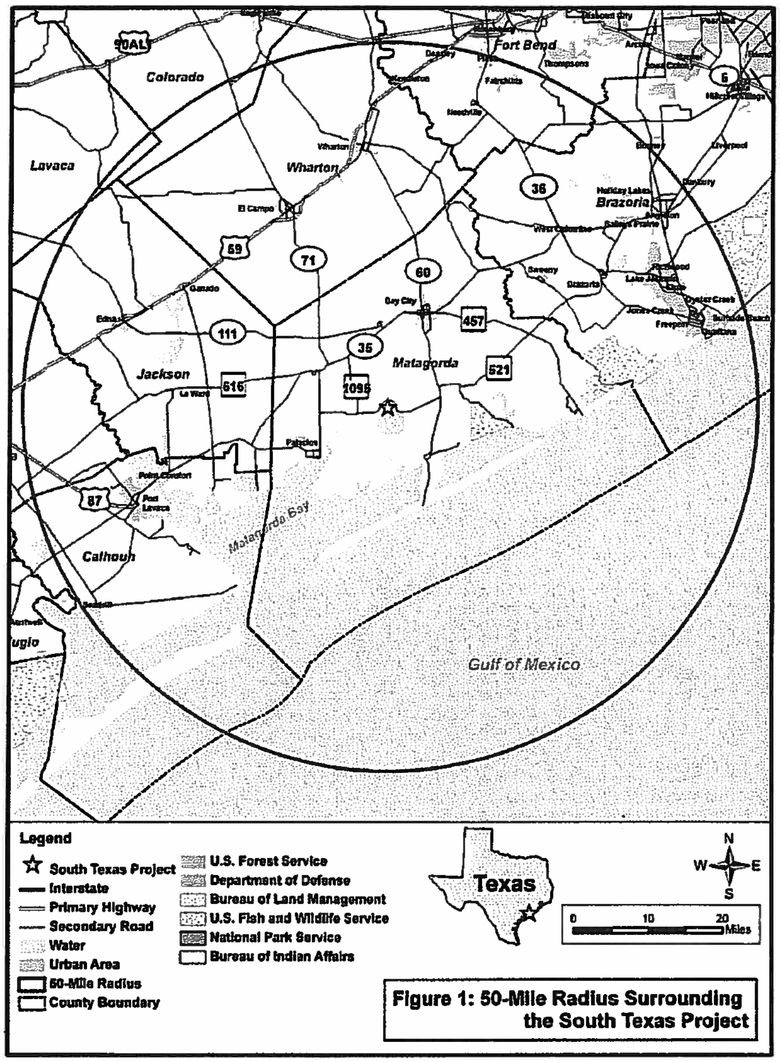

Figure 1: 50-Mile Radius Surrounding the South Texas Project

Attachment I
Page 3 of 4

Figure 2: South Texas Project Site

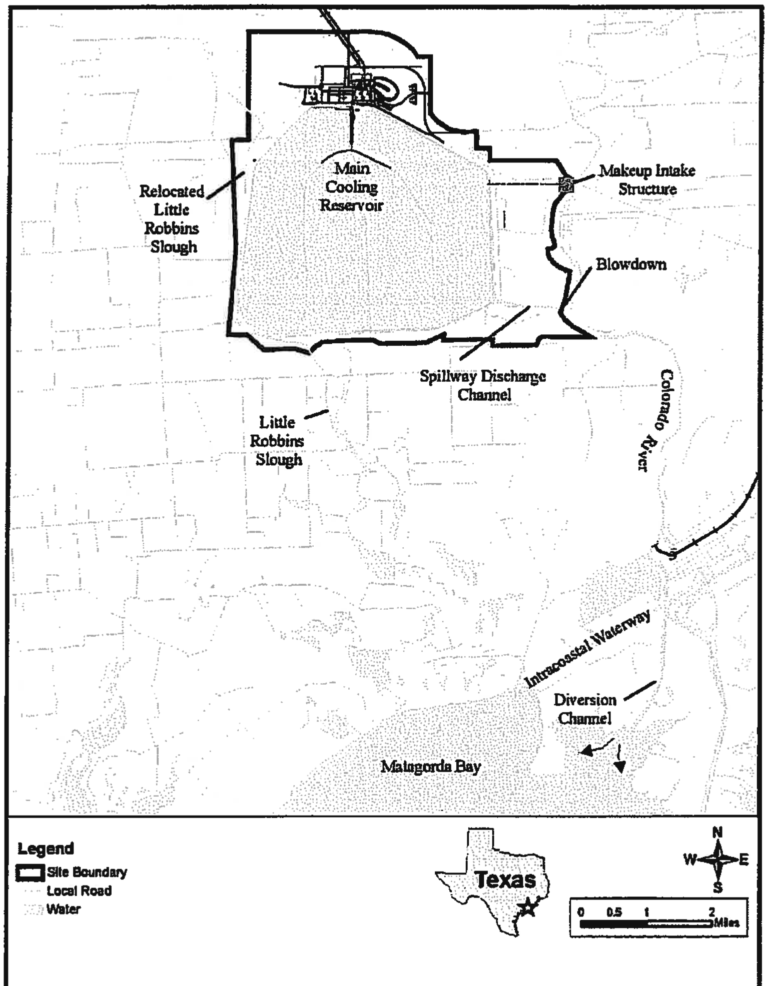

Figure 2: STP Site

Attachment 1
Page 4 of 4

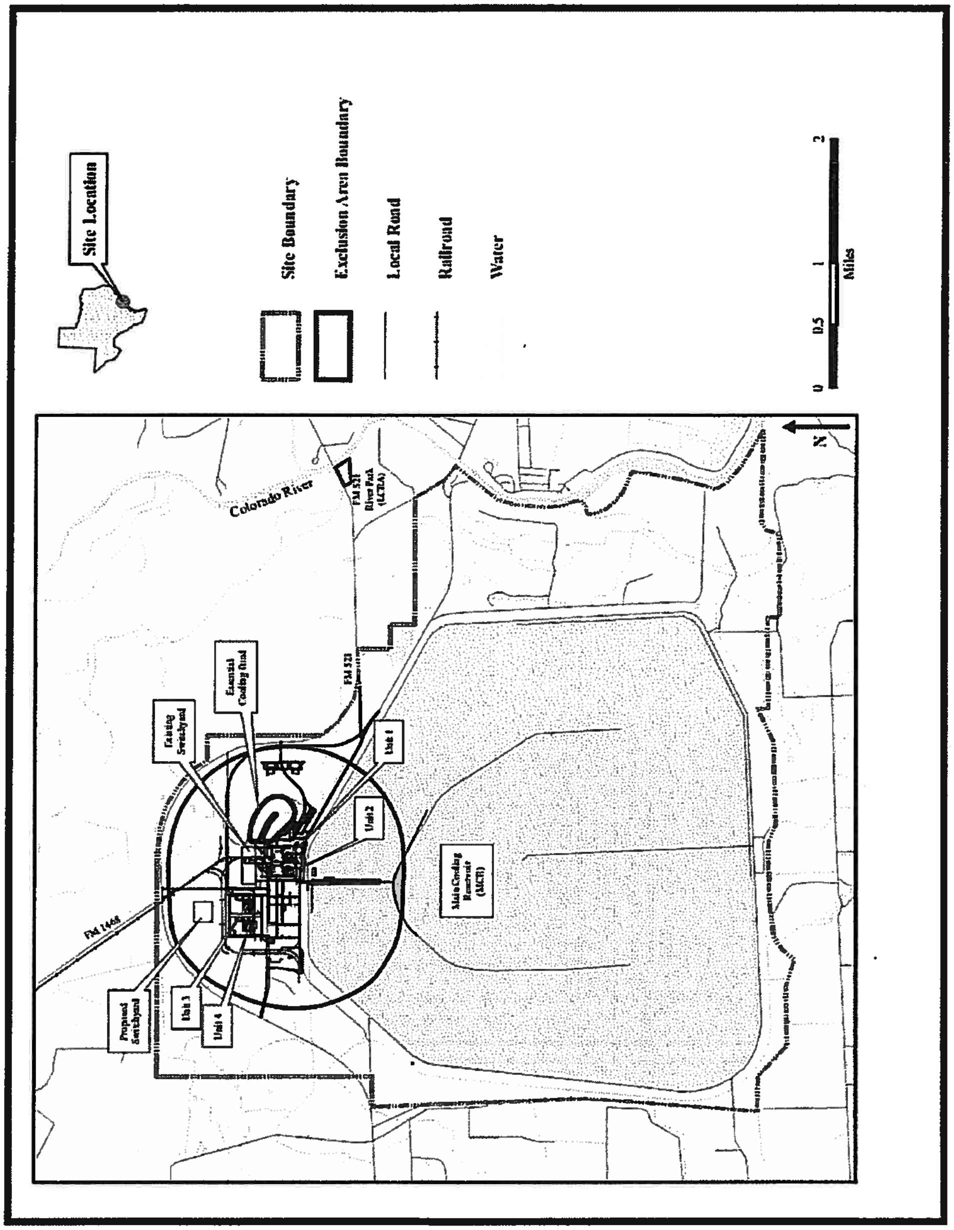

Figure 3: South Texas Project Site Layout

9.3 TABLES

Table 9.1-1 Environmental Authorizations for Current STP Units 1 & 2 Operations

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
Federal and State Requirements					
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011, et seq.), 10 CFR 50.10	License to operate	NPF-76 (STPNOC 2009 STPLR-317)	Issued: 03/22/1988 Expires: 08/20/2027	Operation of STP Unit 1
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011, et seq.), 10 CFR 50.10	License to operate	NPF-80 (NRC 1988 STPLR-318)	Issued: 12/16/1988 Expires: 12/15/2028	Operation of STP Unit 2
U.S. Department of Transportation	49 USC 5108	Registration	061008 550 051QR (USDOT 2008 STPLR 67)	Issued: 06/10/2008 Expires: 06/30/2010	Hazardous materials shipments
U.S. Army Corps of Engineers	Section 10 of the Rivers and Harbors Act of 1899	Permit for maintenance dredging	Permit No. 10570 (USACE 2004 STPLR-04)	Issued: 11/04/2004 Expires: 12/31/2014	Maintenance dredging of barge slip
U.S. Army Corps of Engineers	Section 10 of the Rivers and Harbors Act of 1899	Permit for maintenance dredging	Permit No. 14848 (TCEQ 2008 STPLR-66)	Issued: 06/09/1999 Expires: 12/31/2009	Maintenance dredging of intake canal

Table 9.1-1 Environmental Authorizations for Current STP Units 1 & 2 Operations (continued)

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
Federal and State Requirements (continued)					
Texas Commission on Environmental Quality	Clean Water Act (33 USC Section 1251 et seq.) Texas Administrative Code (TAC) (30 TAC 305)	TPDES Permit	WQ0001908000 (TCEQ 2005 and TCEQ 2006 **STPLR-03** and **STPLR-41**)	Issued: 07/21/2005 Expires: 12/01/2009	Treat wastewater and discharge to Colorado River from Main Cooling Reservoir
Texas Commission on Environmental Quality	30 TAC 116	Air Permit	Permit No. 7410 (TCEQ 2007 **STPLR-38**)	Issued: 12/23/2004 Expires: 12/23/2014	Air permit for auxiliary boilers and voiding of a PSD permit, PSD-TX-209M1
Texas Commission on Environmental Quality	30 TAC 122	Federal Operating Air Permit	Permit No. 0801 (TCEQ 2006 **STPLR-40**)	Issued: 01/25/2006 Expires: 01/25/2011	Air permit for various emission sources
Texas Commission on Environmental Quality	30 TAC 335	Registration of Industrial and Hazardous Waste	Solid Waste Registration No: 30651, EPA ID: TXD020810503 (TCEQ 2008 **STPLR-42**)	Issued: 08/16/1976 Expires: NA, registration must be amended upon changes in waste profile or activities	Registration of industrial and hazardous waste generation and management
Texas Commission on Environmental Quality	30 TAC 335.580	Permit for Commercial Industrial Nonhazardous Waste Landfill	Registration No. 30651 Permit No. **TBD**	Issued: **TBD** Expires: 12/2008	Onsite disposal of Class III industrial solid waste
Texas Commission on Environmental Quality	30 TAC 290	Potable Water System	TCEQ ID No. 1610103	Issued: **TBD** Expires: **TBD**	Operation of public potable water system
Texas Water Commission	Final decree of the 264th Judicial District Court of Bell County in Cause No. 115,414-A-3	Certificate of Adjudication	14-5437 (TWC 1989 **STPLR-12**)	Issued: 06/28/1989 Expires: NA	Water rights for diversion and impoundment of water from Colorado River

Table 9.1-1 Environmental Authorizations for Current STP Units 1 & 2 Operations (continued)

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
Federal and State Requirements (continued)					
Texas Commission on Environmental Quality	30 TAC 334	Registration of Aboveground and Underground Storage Tanks	TBD	Issued: TBD Expires: TBD	Operation of aboveground and underground storage tanks
Tennessee Department of Environment and Conservation	Tennessee Code Annotated 68-202-206	License to ship radioactive material	TBD	Expires: TBD	Shipments of radioactive material to processing facilities in Tennessee
Utah Department of Environmental Quality	Utah Rule 313-26	License to ship radioactive material	Permit No. 0606003900 (STPNOC 2008 STPLR-31)	Issued: 07/21/2008 Expires: 07/21/2009	Shipments of radioactive material to disposal facility in Utah
Local Requirements					
Coastal Plains Groundwater Conservation District	Texas Water Code Chapter 36	Authorization for groundwater withdrawals	Permit No. OP-04122805 (need document here STPLR-06)	Issued: 03/01/2005 Expires: 02/28/2008	Groundwater withdrawal from five wells

TPDES – Texas Pollutant Discharge Elimination System

TABLE 9.1-2 Environmental Authorization for STP Units 1 & 2 License Renewal

Agency	Authority	Requirement	Remarks
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011 et seq.)	License renewal	Environmental Report submitted in support of license renewal application
U.S. Fish and Wildlife Service (FWS)	Endangered Species Act Section 7 (16 USC 1536)	Consultation	Requires federal agency issuing a license to consult with the FWS (Appendix C)
National Oceanic and Atmospheric Administration -National Marine Fisheries Service (NOAA-NMFS)	Endangered Species Act Section 7 (16 USC 1536)	Consultation	Requires federal agency issuing a license to consult with the NOAA-NMFS (Appendix C)
Texas Parks and Wildlife Department	Endangered Species Act Section 7 (16 USC 1536)	Consultation	TPWD consulted for any concerns related to threatened and endangered species (Attachment C)
Texas Environmental Quality Commission	Clean Water Act Section 401 (33 USC 1341)	Certification	Requires State certification that proposed action would comply with Clean Water Act standards (Attachment B)
Texas Historical Commission	National Historic Preservation Act Section 106 (16 USC 470f)	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with State Historic Preservation Officer (Attachment D)
Texas Coastal Coordination Council	Federal Coastal Zone Management Act (16 USC 1451 et seq.)	Certification	Requires the applicant to certify to the licensing agency that the proposed activity would be consistent with the state's federally approved coastal zone management program

ATTACHMENT 3

PROBABLE EFFECTS OF STP UNITS 1 & 2 ON COASTAL NATURAL RESOURCE AREAS

CNRA	Effects Due To STP Units 1 & 2 Operation
Waters of the open Gulf of Mexico	No impacts to waters of the Open Gulf of Mexico from operation of STP Units 1 & 2 are anticipated.
Tidally influenced waters not in the open Gulf of Mexico	Potential impacts to the Colorado River waters from operation include increases in turbidity due to maintenance dredging at the existing Reservoir Makeup Pumping Facility (makeup water intake structure) and the barge landing facility. These impacts have been characterized as SMALL and would not require mitigation beyond the use of the Best Management Practices required by the USACE permits issued for this work. Operational impacts would include an increase in potential impingment and entrainment of aquatic organisms during makeup pumping activities. These impacts are considered to be SMALL as the USEPA and TCEQ have certified that the design, location and operation of the intake structure reflect Best Technology Available as required by Section 316(b) of the CWA.
Submerged lands under Coastal Waters	The existing barge landing facility and the Reservoir Makeup Pumping Facility are located adjacent to submerged lands under coastal waters. No new structures will be placed on submerged lands; however, maintenance activities including dredging and upgrading of existing equipment will occur in accordance with existing permits. STPNOC and GLO are currently modifying the existing lease terms and conditions relating to these facilities. Impacts to submerged lands as a result of the maintenance of these facilities will be SMALL.
Coastal wetlands	No impacts to coastal wetlands from operations of STP Units 1 & 2 are anticipated.
Submerged aquatic vegetation	No areas of submerged aquatic vegetation occur at the site, therefore none are affected by STP Units 1 & 2 operation.
Tidal sand and mud flats	No tidal sand or mud flats occur at the site, therefore none are affected by STP Units 1 & 2 operation.

ATTACHMENT 3 Continued

CNRA	Effects Due To STP Units 1 & 2 Operation
Oyster reefs	No oyster reefs are located on or near the site, therefore none are affected by STP Units 1 & 2 operation.
Hard substrate reefs	No hard substrate reefs are located on or near the site, therefore none are affected by STP Units 1 & 2 operation.
Coastal barriers	No coastal barriers are located on or near the site, therefore none are affected by STP Units 1 & 2 operation.
Coastal shore areas	No coastal shore areas are located on or near the site, therefore none are affected by STP Units 1 & 2 operation.
Gulf beaches	No gulf beaches are located on or near the site, therefore none are affected by STP Units 1 & 2 construction or operation.
Critical dune areas	No critical dune areas are located on or near the site, therefore none are affected by STP Units 1 & 2 operation.
Special hazard areas	No special hazard areas are located on or near the site, therefore none are affected by STP Units 1 & 2 operation.
Critical erosion areas	No critical erosion areas are located on or near the site, therefore none are affected by STP Units 1 & 2 operation.
Coastal historic areas	The Texas Historical Commission has determined that there are no coastal historic areas located on or near the site, therefore none are affected by STP Units 1 & 2 operation.
Coastal preserves	No coastal preserves are located on or near the site, therefore none are affected by STP Units 1 & 2 operation.

ATTACHMENT 4

STP UNITS 1 & 2 CONSISTENCY WITH TCMP GOALS

TCMP Goal	STP Units 1 & 2 Consistency
(1) to protect, preserve, restore, and enhance the diversity, quality, quantity, functions, and values of coastal natural resource areas (CNRAs).	The continued operation of STP Units 1 & 2 will have minimal impact on CNRAs and, consequently no negative impacts on the diversity, quality quantity, functions and values of these areas. Thus, the project is consistent with this goal.
(2) to ensure sound management of all coastal resources by allowing for compatible economic development and multiple human uses of the coastal zone.	The primary responsibility of the network of state agencies and subdivisions that are subject to the provisions of the TCMP is to ensure that proposed actions are consistent with the uniform goals of the TCMP through the exercise of their respective statutory authorities. Consistency with this goal is assured by this responsibility. The status of all approvals, permits and consultations with networked state agencies and subdivisions is presented in Attachment 2.
(3) to minimize loss of human life and property due to the impairment and loss of protective features of CNRAs.	The continued operation of STP Units 1 & 2 will cause no impairment to or loss of any protective features of CNRAs. Thus, the project is consistent with this goal.
(4) to ensure and enhance planned public access to and enjoyment of the coastal zone in a manner that is compatible with private property rights and other uses of the coastal zone.	The continued operation of STP Units 1 & 2 will affect no existing or planned public access or enjoyment of the coastal zone.
(5) to balance the benefits from economic development and multiple human uses of the coastal zone, the benefits from protecting, preserving, restoring, and enhancing CNRAs, the benefits from minimizing loss of human life and property, and the benefits from public access to and enjoyment of the coastal zone.	The primary responsibility of the network of state agencies and subdivisions that are subject to the provisions of the TCMP is to ensure that proposed actions are consistent with the uniform goals of the TCMP through the exercise of their respective statutory authorities. Consistency with this goal is assured by this responsibility. The status of all approvals, permits and consultations with networked state agencies and subdivisions is presented in Attachment 2.

STP UNITS 1 & 2 CONSISTENCY WITH TCMP GOALS Continued

TCMP Goal	STP Units 1 & 2 Consistency
(6) to coordinate agency and subdivision decision-making affecting CNRAs by establishing clear, objective policies for the management of the CNRAs.	The primary responsibility of the network of state agencies and subdivisions that are subject to the provisions of the TCMP is to ensure that proposed actions are consistent with the uniform goals of the TCMP through the exercise of their respective statutory authorities. Consistency with this goal is assured by this responsibility. The status of all approvals, permits and consultations with networked state agencies and subdivisions is presented in Attachment 2.
(7) to make agency and subdivsion decision-making affecting CNRAs efficient by identifying and addressing duplication and conflicts among local, state, and federal regulatory and other programs for the management of CNRAs.	The primary responsibility of the network of state agencies and subdivisions that are subject to the provisions of the TCMP is to ensure that proposed actions are consistent with the uniform goals of the TCMP through the exercise of their respective statutory authorities. Consistency with this goal is assured by this responsibility. The status of all approvals, permits and consultations with networked state agencies and subdivisions is presented in Attachment 2.
(8) to make agency and subdivision decision-making affecting CNRAs more effective by employing the most comprehensive, accurate, and reliable information and scientific data available and by developing, distributing for public comment, and maintaining a coordinated, publicly accessible geographic information system of maps of the coastal zone and CNRAs at the earliest possible date.	The primary responsibility of the network of state agencies and subdivisions that are subject to the provisions of the TCMP is to ensure that proposed actions are consistent with the uniform goals of the TCMP through the exercise of their respective statutory authorities. Consistency with this goal is assured by this responsibility. The status of all approvals, permits and consultations with networked state agencies and subdivisions is presented in Attachment 2.
(9) to make coastal management processes visible, coherent, accessible, and accountable to the people of Texas by providing for public participation in the ongoing development and implementation of the Texas CMP.	The primary responsibility of the network of state agencies and subdivisions that are subject to the provisions of the TCMP is to ensure that proposed actions are consistent with the uniform goals of the TCMP through the exercise of their respective statutory authorities. Consistency with this goal is assured by this responsibility. The status of all approvals, permits and consultations with networked state agencies and subdivisions is presented in Attachment 2.

STP UNITS 1 & 2 CONSISTENCY WITH TCMP GOALS Continued

TCMP Goal	STP Units 1 & 2 Consistency
(10) to educate the public about the principal coastal problems of state concern and technology available for the protection and improved management of CNRAs.	The primary responsibility of the network of state agencies and subdivisions that are subject to the provisions of the TCMP is to ensure that proposed actions are consistent with the uniform goals of the TCMP through the exercise of their respective statutory authorities. Consistency with this goal is assured by this responsibility. The status of all approvals, permits and consultations with networked state agencies and subdivisions is presented in Attachment 2.

ATTACHMENT 5

STP UNITS 1 & 2 CONSISTENCY WITH APPLICABLE TCMP POLICIES

31 TAC 501.15	**Policy for Major Federal Actions**
31 TAC 501.15(b)	The Lead Federal Agency for STP Units 1 & 2 is the Nuclear Regulatory Commission (NRC). The NRC will contact relevant local, state and federal agencies as stakeholders in the process. In compliance with the National Environmental Policy Act, NRC will prepare an Environmental Impact Statement for the project.
31 TAC 501.15(c)	The primary responsibility of the network of state agencies and subdivisions that are subject to the provisions of the TCMP is to ensure that proposed actions are consistent with the uniform policies of the TCMP through the exercise of their respective statutory authorities. Consistency with this policy is assured by this responsibility. The status of all approvals, permits and consultations with networked state agencies and subdivisions is presented in Attachment 2.
31 TAC 501.16	**Policies for Construction of Electric Generating and Transmission Facilities**
31 TAC 501.16(a)(1)	STP Units 1 & 2 are located at an existing nuclear power plant site. No public beaches are affected.
31 TAC 501.16(a)(2)	STP Units 1 & 2 employ closed-loop cooling systems rather than once-through technology. The existing intake structures installed for Units 1 & 2 have been certified by TCEQ to demonstrate Best Technology Available under Section 316(b) of the Clean Water Act.
31 TAC 501.16(a)(3)	No CNRAs are affected by continued operation of STP Units 1 & 2. Impacts on areas used for spawning, nesting and seasonal migrations of fish and wildlife species will be minimized to the extent practicable.
31 TAC 501.16(a)(4)	No new electric transmission lines associated with the operation of STP Units 1 & 2 will affect Coastal Barrier Resource System Units or Otherwise Protected Areas regulated under the Coastal Barrier Resources Act.
31 TAC 501.16(b)	Operation of STP Units 1 & 2 will not require a Certificate of Convenience and Necessity from the PUC.

STP UNITS 1 & 2 CONSISTENCY WITH APPLICABLE TCMP POLICIES Continued

31 TAC 501.21	**Policies for Discharge of Municipal and Industrial Wastewater to Coastal Waters**
31 TAC 501.21(a-d)	The primary responsibility of the network of state agencies and subdivisions that are subject to the provisions of the TCMP is to ensure that proposed actions are consistent with the uniform policies of the TCMP through the exercise of their respective statutory authorities. Consistency with this policy is assured by this responsibility. The status of all approvals, permits and consultations with networked state agencies and subdivisions is presented in Attachment 2.
31 TAC 501.22	**Policies for Nonpoint Source (NPS) Water Pollution**
31 TAC 501.22(a-d)	The primary responsibility of the network of state agencies and subdivisions that are subject to the provisions of the TCMP is to ensure that proposed actions are consistent with the uniform policies of the TCMP through the exercise of their respective statutory authorities. Consistency with this policy is assured by this responsibility. The status of all approvals, permits and consultations with networked state agencies and subdivisions is presented in Attachment 2.
31 TAC 501.23	**Policies for Development in Critical Areas**
31 TAC 501.23(a-d)	Operation of STP Units 1 & 2 will not impact any Critical Areas as defined in 31 TAC 501.3
31 TAC 501.24	**Policies for Construction of Waterfront Facilities and Other Structures on Submerged Lands**
31 TAC 501.24(a)	Operation of STP Units 1 & 2 will not require new waterfront facilities or other structures on submerged lands.
31 TAC 501.24(b)	STP Units 1 & 2 will have no impacts on beach access or use rights of the public.
31 TAC 501.24(c)	The primary responsibility of the network of state agencies and subdivisions that are subject to the provisions of the TCMP is to ensure that proposed actions are consistent with the uniform policies of the TCMP through the exercise of their respective statutory authorities. Consistency with this policy is assured by this responsibility. The status of all approvals, permits and consultations with networked state agencies and subdivisions is presented in Attachment 2.

STP UNITS 1 & 2 CONSISTENCY WITH APPLICABLE TCMP POLICIES Continued

31 TAC 501.25	**Policies for Dredging and Dredged Material and Placement**
31 TAC 501.25(a-c)	Dredging associated with the maintenance of the Reservoir Makeup Pumping Facility (makeup water intake structure) and the barge slips is approved by existing Army Corps of Engineers Permits No. 10570(6) and SWG-1992-02707. Dredged material will be disposed of in an upland disposal area identified in the permits in accordance with the terms and conditions contained therein and in accordance with the provisions of the Section 401(b) Certification issued by the TCEQ.
31 TAC 501.25(d)	There are no presently identified beneficial uses for the dredged material. However, it will be permanently located at the approved disposal site and available should a beneficial reuse be identified.
31 TAC 501.32	**Policies for Emission of Air Pollutants**
31 TAC 501.32	The primary responsibility of the network of state agencies and subdivisions that are subject to the provisions of the TCMP is to ensure that proposed actions are consistent with the uniform policies of the TCMP through the exercise of their respective statutory authorities. Consistency with this policy is assured by this responsibility. The status of all approvals, permits and consultations with networked state agencies and subdivisions is presented in Attachment 2.
31 TAC 501.33	**Policies for Appropriations of Water**
31 TAC 501.33(a & b)	The primary responsibility of the network of state agencies and subdivisions that are subject to the provisions of the TCMP is to ensure that proposed actions are consistent with the uniform policies of the TCMP through the exercise of their respective statutory authorities. Consistency with this policy is assured by this responsibility. The status of all approvals, permits and consultations with networked state agencies and subdivisions is presented in Attachment 2.

Coastal Coordination Council

P.O. Box 12873 ♦ Austin, Texas 78711-2873 ♦ (800) 998-4GLO ♦ FAX (512) 475-0680

January 29, 2010

Ms. Sandra Dannhardt
STPNOC
PO Box 289
Wadsworth Texas 77483

Re: Renewal of South Texas Project Units 1 and 2
South Texas Project Nuclear Operating Company

Dear Ms. Dannhardt:

The renewal project referenced above will extend the operating period for the reactors by 20 years beyond the expiration of their existing licenses, currently 2027 and 2028. The project was undertaken before Texas had a federally approved Coastal Management Program (CMP) and based on information provided in the letter dated December 2, 2009, it has been determined that there are no significant unresolved consistency issues. Therefore, pursuant to Section 506.11(13), this project is consistent with the CMP goals and policies.

If you have any questions or concerns, please contact me at (512) 463-9212 or at tammy.brooks@glo.state.tx.us.

Sincerely,

Tammy S. Brooks
Coastal Coordination Council Secretary
Consistency Review Coordinator
Texas General Land Office