Before the

United States Nuclear Regulatory Commission

Docket Nos. STN 50-498, STN 50-499

Houston Lighting & Power Company, et al.

South Texas Project Units 1 & 2

Amendment 7

Houston Lighting & Power Company, an applicant in the above captioned proceeding, for itself and for the City of San Antonio, Central Power and Light Company and the City of Austin, hereby files Amendment 7 to the Environmental Report - Operating License Stage.

Amendment 7 consists of updated information describing plant design, regional demography, and operational environmental monitoring programs.

Respectfully submitted,

HOUSTON LIGHTING & POWER COMPANY

J. H. Goldberg
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Vice President
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Amendment 7
Into The South Texas Project
Environmental Report

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APPENDIXES

3.2-1	Location of Operational Radiological Monitoring Stations
B-1	Piping Diagram: Steam Generator Blowdown

LIST OF ACRONYMS

AFW	auxiliary feedwater
ALARA	as low as reasonably achievable
ASME	American Society of Mechanical Engineers
BOD_5	biochemical oxygen demand
B&PV	boiler and pipe vessel
BRS	boron recycle system
BWR	boiling water reactor
CFR	Code of Federal Regulations
COA	City of Austin
COD	chemical oxygen demand
CPDS	condensate polishing demineralizer system
CPL	Central Power & Light Company
CPRW	condensate polisher regeneration waste
CPRWCT	condensate polisher regeneration waste collection tank
CPS	City Public Service of San Antonio
CVCS	chemical and volume control system
CWS	circulating water system
DBA	design basis accident
DF	decontamination factor
DNBR	departure from nucleate boiling ratio
DOT	Department of Transportation
DP&L	Dallas Power & Light Company
EPA	Environmental Protection Agency
ER	Environmental Report
ERCOT	Electrical Reliability Council of Texas

LIST OF ACRONYMS (Continued)

ER-CP	Environmental Report--Construction Permit Stage
ER-OL	Environmental Report--Operating License Stage
ESF	engineered safety features
ETS	Environmental Technical Specifications
FDT	floor drain tank
FES-CP	Final Environmental Statement--Construction Permit Stage
FHB	fuel handling building
FM	farm-to-market road
FPC	Federal Power Commission
FSAR	Final Safety Analysis Report
FWAT	flow weighted average temperature
FWPCAA	Federal Water Polution Control Act Amendments
GIWW	Gulf Intracoastal Waterway
GWPS	gaseous waste processing system
HEPA	high efficiency particulate air filters
HL&P	Houston Lighting & Power Company
HVAC	heating, ventilating, and air conditioning
ISI	in-service inspection
LCRA	Lower Colorado River Authority
LOCA	loss-of-coolant accident
LSA	low specific activity
LWA	limited work authorization
LWPS	liquid waste processing system
MAB	mechanical auxiliaries building
MDWS	makeup demineralizer water system

MEAB	mechanical-electrical auxiliaries building
MSL	mean sea level
NEPA	National Environmental Policy Act of 1969
NERC	National Electric Reliability Council
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NSSS	nuclear steam supply system
P&ID	piping and instrument diagram
PSAR	Preliminary Safety Analysis Report
PWR	pressurized water reactor
RCB	reactor containment building
RCDT	reactor coolant drain tank
RCPB	reactor coolant pressure boundary
RCS	reactor coolant system
RG	Regulatory Guide
RMWST	reactor makeup water storage tank
SFPCCS	spent fuel pool cooling and cleanup system
SIS	safety injection system
SRST	spent resin storage tank
STEC/MEC	South Texas and Medina Electric Cooperatives
STIS	South Texas Interconnected System
STP	South Texas Project
SWPS	solid waste processing system
TACB	Texas Air Control Board
TDH	Texas Department of Health

LIST OF ACRONYMS (Continued)

TDS	total dissolved solids
TDWR	Texas Department of Water Resources
TES	Texas Electric Service Company
TGB	turbine-generator building
TIS	Texas Interconnected System
TMPP	Texas Municipal Power Pool
TP&L	Texas Power & Light Company
TSS	total suspended solids
TWC	Texas Water Commission
TWDB	Texas Water Development Board
TWQB	Texas Water Quality Board
TWRC	Texas Water Rights Commission
USGS	U. S. Geological Survey
VCT	volume control tank
WEC	waste evaporator condensate
WECT	waste evaporator condensate tank
WHT	waste holdup tank
WMT	waste monitor tank
WNES	Westinghouse Nuclear Energy System
WTU	West Texas Utilities

CHAPTER 1

PURPOSE OF THE PROPOSED FACILITY

The participants in the South Texas Project (STP), and their portions of ownership are: Houston Lighting & Power Company (HL&P)--30.8 percent, Central Power and Light Company (CPL)--25.2 percent, City Public Service Board of San Antonio (CPS)--28 percent, and the City of Austin (COA)--16 percent. The City of San Antonio owns, and, through the City Public Service Board of San Antonio (CPS), a municipal board, operates the San Antonio public utility electric system. The City of Austin (COA) owns and operates Austin's electric utility system.

The participants in STP propose to operate the station in order to help meet projected increases in electric demand within the areas served and to replace older fossil fueled facilities.

The need for power was described in the Applicant's construction permit stage Environmental Report. In accordance with 10CFR51.53, no discussion of need for power is required in the operating license stage Environmental Report. 7

CHAPTER 2

THE SITE

2.1 SITE LOCATION AND LAYOUT

The South Texas Project (STP) is located in southwest Matagorda County, approximately 12 miles south-southwest of Bay City and 10 miles north of Matagorda Bay. The location of Unit 1 will be 96°02'53" west longitude, 28°47'42" north latitude (3,188,669 m north--788,157 m east; Zone 14R); Unit 2 will be located at 96°03'00" west longitude, 28°47'42" north latitude (3,188,699 m north--787,974 m east; Zone 14R). The site consists nominally of 12,300 acres, of which 7,000 acres make up the cooling reservoir, 65 acres are modified or occupied by the plant and plant facilities, and approximately 1,700 remain as a natural lowland habitat.

Figure 2.1-1 shows the general area within 50 miles of the site. Figure 2.1-2 shows the one- through five- and ten-mile perimeters of the site. An aerial photograph of the STP site and environs before construction is shown on Figure 2.1-3. Superimposed on this photograph is the site boundary (utility owned). Figure 2.1-4 is a diagram of the site layout and surrounding area. The exclusion area and railroad spur are also shown.

The exclusion area is an oval shaped area, having a minimum boundary distance 5
from the center of each containment building of 1430 meters. The center of the exclusion area "oval" is a point 93 meters directly west of the center of the Unit 2 reactor containment building. This point is also the center of the Low Population Zone, which is a circle with a radius of three miles. The closest approach of FM 521 to the exclusion area boundary is approximately 76 meters. Table 2.1-1 presents exclusion area boundary distances for Unit 1 and Unit 2 in each of the 16 cardinal compass directions. The participants in the STP own the land comprising the site, shown on Figure 2.1-4, except for the right-of-way of FM 521 and the right-of-way for a county road extending south from FM 521 and adjacent to the western boundary of the site.

A High Voltage Direct Current (HVDC) terminal will be operated by Central 6
Power and Light Company on a 17 acre tract in the exclusion area which will be leased to the HVDC Project by the owners of STP. The HVDC terminal is shown 7
in Figure 2.1-4.

The abutting and adjacent properties as well as developments near the site are shown on Figure 2.1-6.

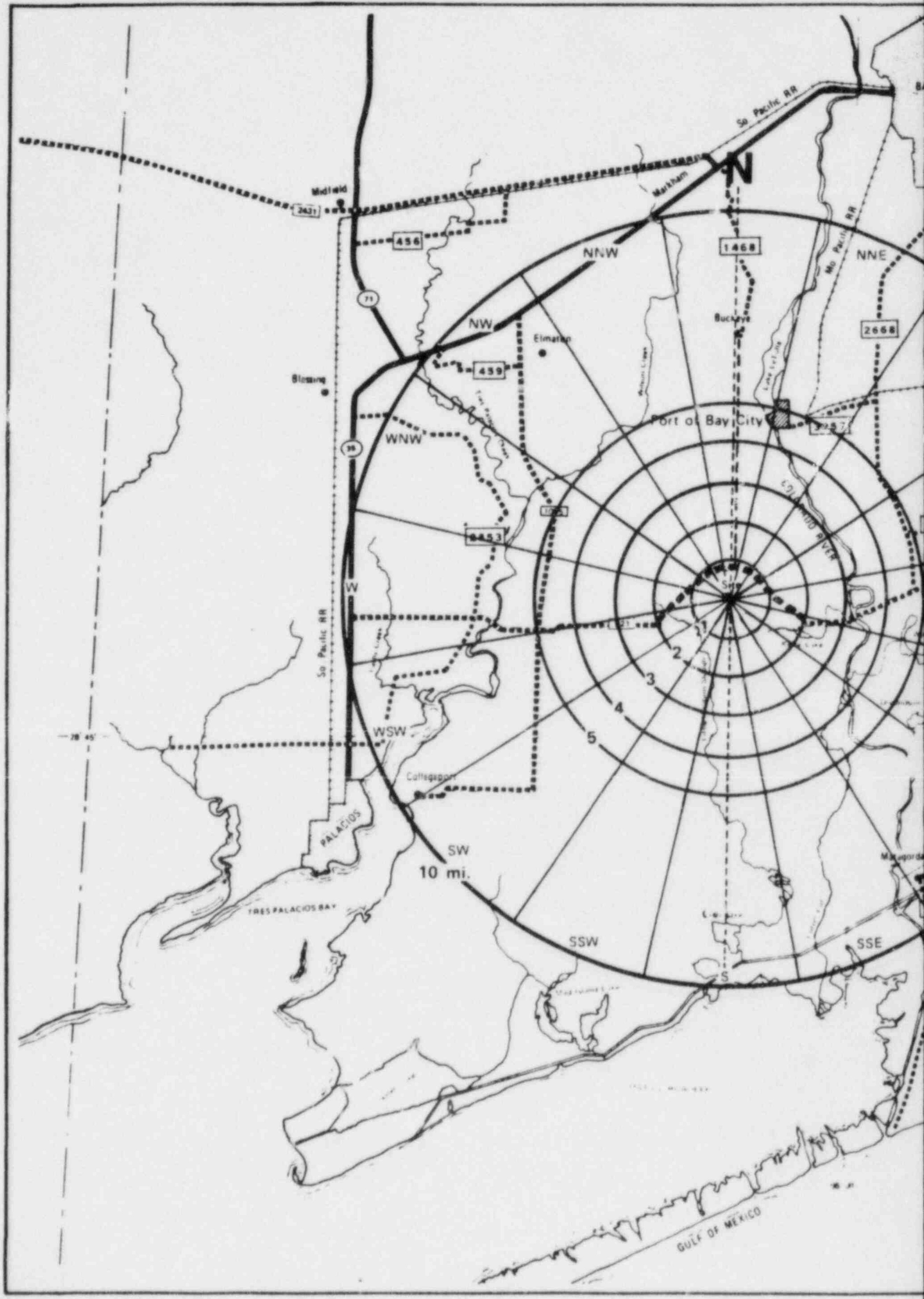
The local relief of the area is characterized by fairly flat land, approximately 23 feet above mean sea level. Through the site boundary flows the west branch of the Colorado River as well as several sloughs, one of which feeds Kelly Lake, a 34.4-acre water body in the northeast corner of the site. The site and its immediate environs fall within the Coastal Prairie which extends as a broad band parallel to the Texas Gulf Coast. Of the approximately 50,240 acres within a 5-mile radius of the site, bottomland comprises 19 percent; the remaining 81 percent is upland. The bottomland includes 52 percent cleared land and 48 percent wooded area, most of which, with the exception of two small islands, is classified as agricultural. The upland consists of 91 percent cleared agricultural land, 8 percent woodlands, and 1 percent industrial.

Major road access to the site is from farm-to-market road (FM) 521 and (FM) 1468. The site development plan, shown on Figure 2.1-7, reflects the major features of plant development. The main element of the plan is the nuclear power plant and its support facilities. The plant was sited to enable functional and safe operation of a nuclear power plant compatible with the natural environment of the surrounding site and community. 7

Currently no developed public recreation facilities exist along the Colorado River between Bay City and Matagorda. Neither are there any state or federal wildlife reserves along the river, but, since duck and geese are prevalent near the Gulf, some hunting is done along the lower reaches of the river.

Recreational potential in the immediate vicinity of the project site is in the form of a group of vacation homes directly across (to the east of) the Colorado River from the site. The area between the cooling reservoir and the Colorado River contains a wide variety of plant material dominated by mature live oak trees. Wildlife is abundant within the area of riparian influence. With the natural vegetation, water habitat, and lack of development within the area of riparian influence, that area is a natural lowland habitat and will be allowed to remain such. A visitor's center is located east of the site near the intersection of FM 521 and the permanent plant access road.

Parking, restrooms, and an interpretive exhibit to describe the plant's development and operation are provided at the visitors' center.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Port of Bay City
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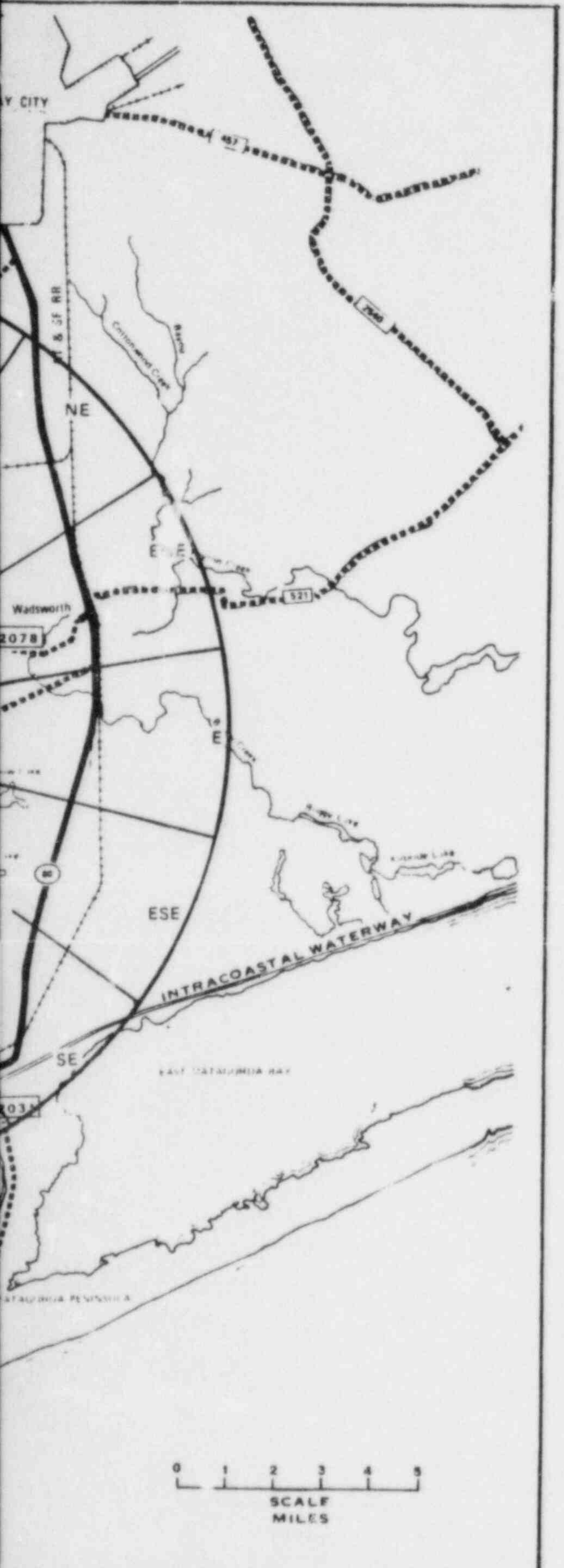

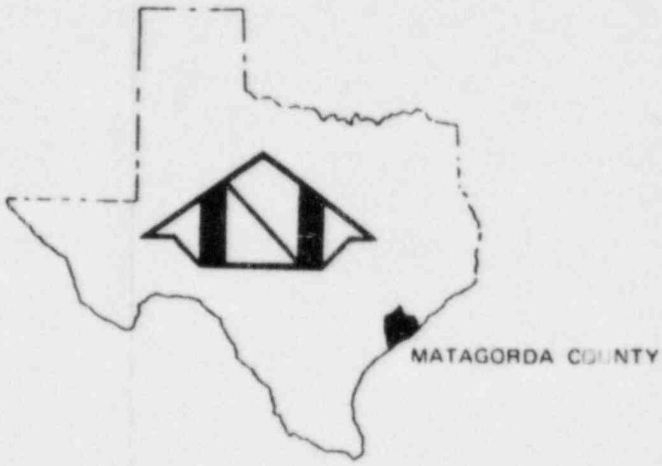

Also Available On
Aperture Card

LEGEND:

Highways

Local

State

Railroads

County Boundary

Incorporated Towns

Unincorporated Towns

TI
APERTURE
CARD

SOUTH TEXAS PROJECT
UNITS 1 & 2

IMMEDIATE ENVIRONS OF THE
SOUTH TEXAS PROJECT

Figure 2.1-2

Amendment 7

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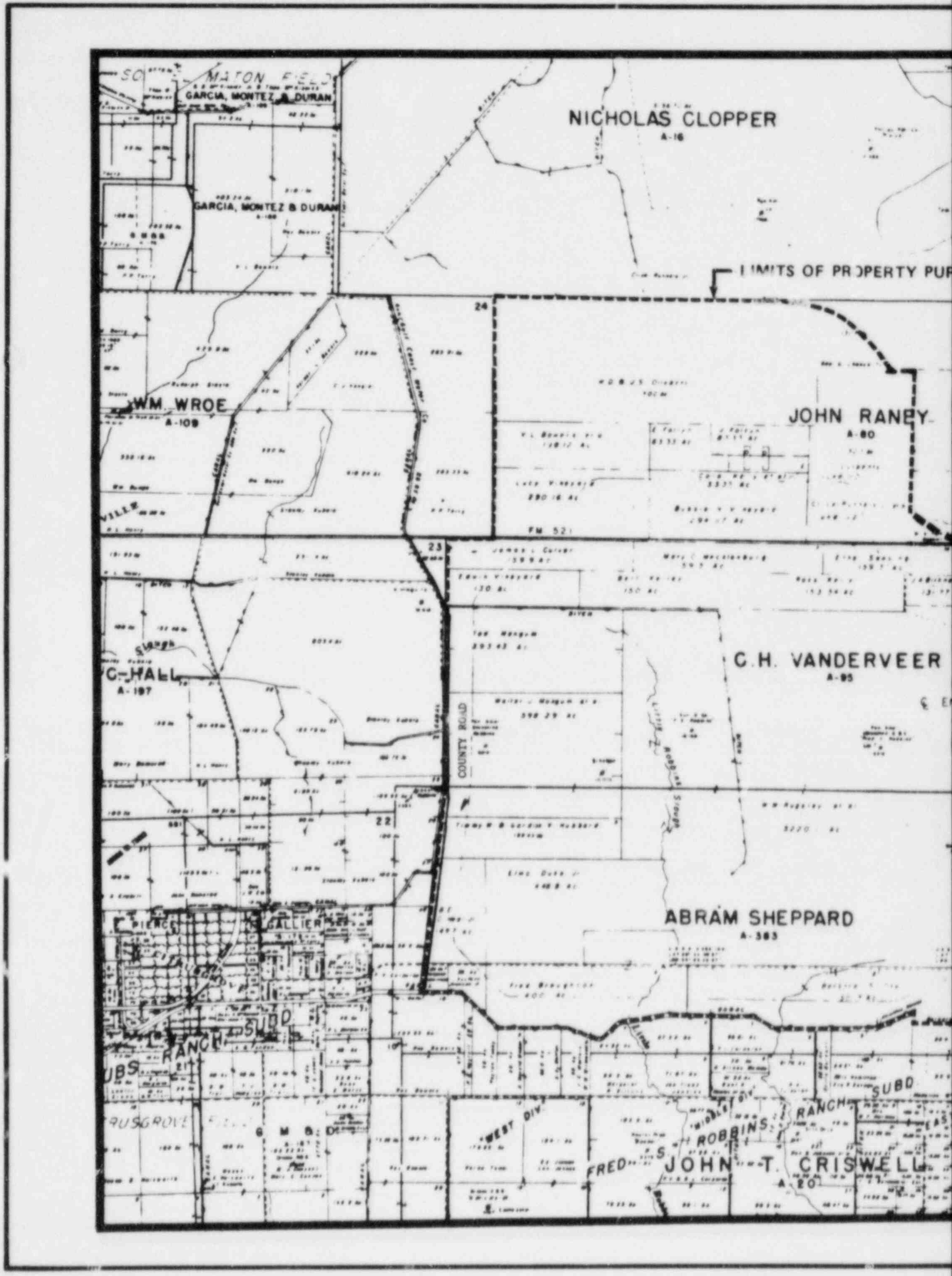
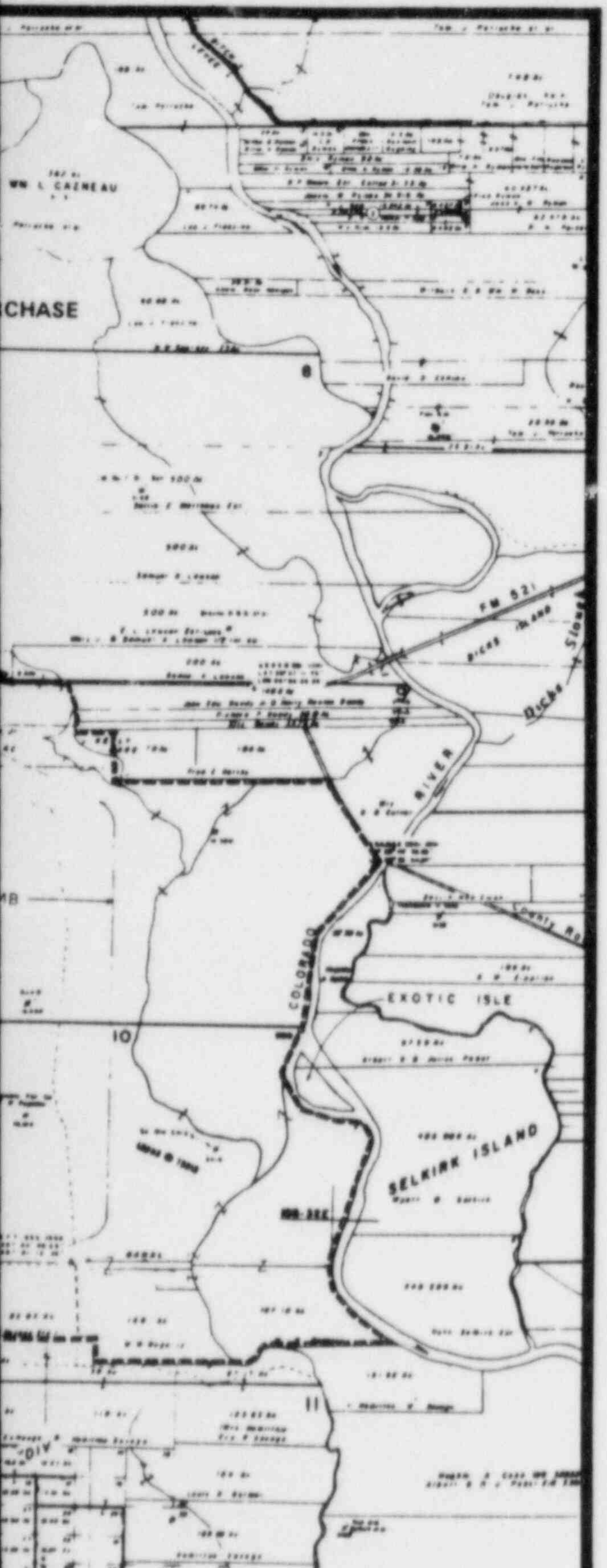


NICHOLAS CLOPPER
A-16
GARCIA, MONTEZ & DURAN
GARCIA, MONTEZ & DURAN
LIMITS OF PROPERTY PUR
24
WM. WROE
A-109
JOHN RANEY
A-80
FM 521
23
C.H. VANDERVEER
A-95
C. HALL
A-197
COUNTY ROAD
22
ABRAM SHEPPARD
A-383
SUBD
RANCH
FRED S. ROBBINS RANCH SUBD
WEST DIV
JOHN T. CRISWELL
A-20



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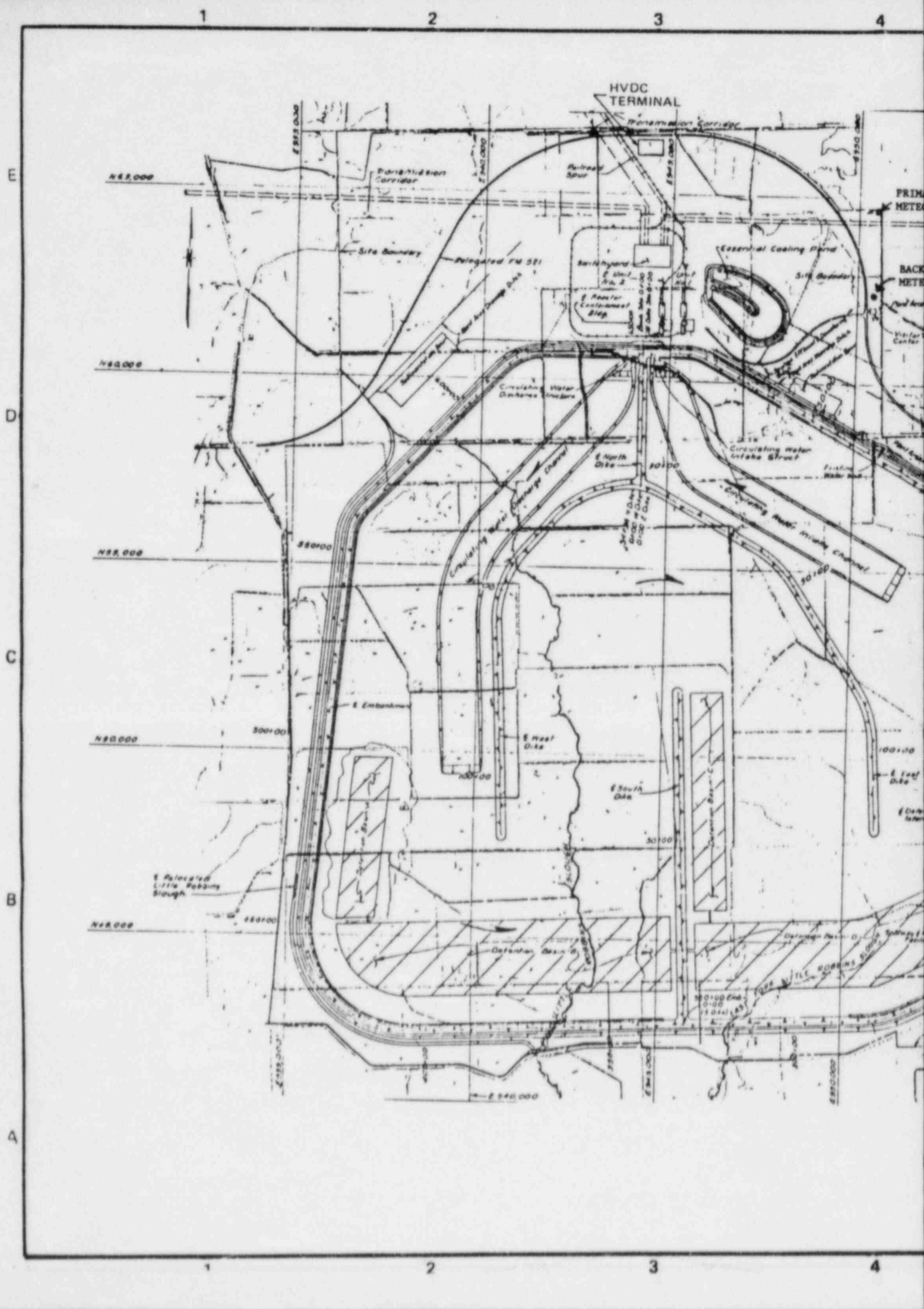
SOUTH TEXAS PROJECT
UNITS 1 & 2

ABUTTING AND ADJACENT PROPERTIES AND NEARBY DEVELOPMENTS OF SOUTH TEXAS PROJECT

Figure 2.1-6

AMENDMENT 7

8412280081-02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TERMINAL
Transmission Corridor
Site Boundary
Switchyard
Essential Cooling Pond
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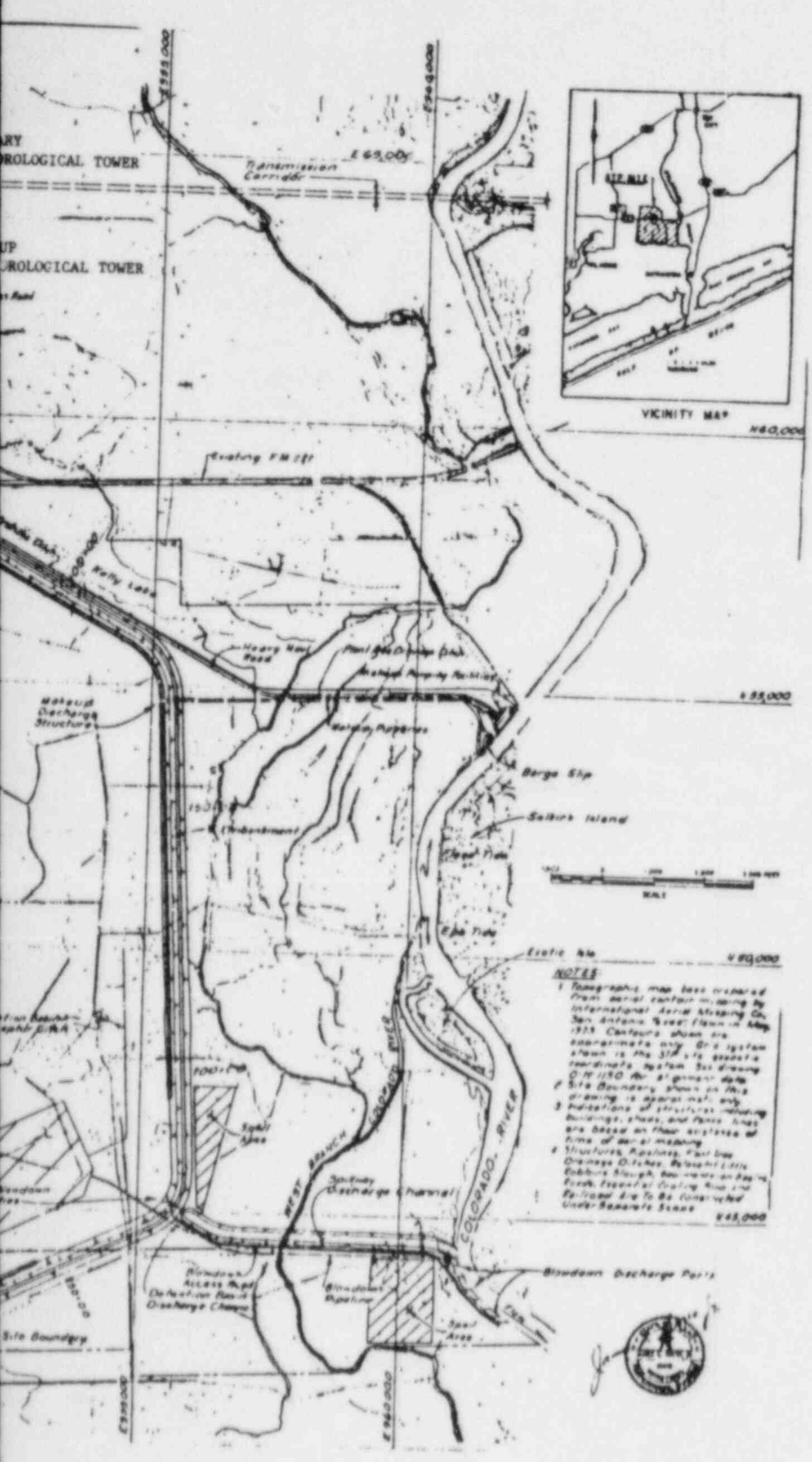
N 55,000
N 50,000
N 45,000



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SOUTH TEXAS PROJECT
UNITS 1 & 2

SITE DEVELOPMENT PLAN

FIGURE 2.1-7 AMENDMENT 7

8412280081-03

2.2 REGIONAL DEMOGRAPHY, LAND, AND WATER USE

2.2.1 POPULATION AND POPULATION DISTRIBUTION

Towns and cities within 50 miles of the STP site are shown on Figure 2.1-1. They are also listed in Table 2.2-1, along with their 1970 and 1980 (to the extent available in 1980 U.S. census listings) resident populations and their distances and directions from the plant. Figure 2.1-2 shows the locations of the municipalities and other features within a 10-mile radius of the plant. 5

Within 10 miles of the plant the estimated 1980 population was 4,122 persons; within 5 miles it was 488 persons. The closest incorporated communities are Bay City and Palacios. Both, however, are outside the 10-mile radius. Matagorda, an unincorporated community, is about 8 miles southeast of the plant. Q 311.2

All full-time and part-time residences within 4 miles of the plant site are shown on Figure 2.2-0. The nearest full-time residence is in the west-southwest sector approximately 15,000 feet from the reactors. Resident populations allocated to sectors within 10 miles of the STP, but beyond the site boundary, were developed from area proportioning of 1980 census tract data. Projections were developed on the same basis. Q 311.1b

Figure 2.2-1 shows the estimated 1980 population distribution within 50 miles of the STP. These population data reflect information from the most recent (1980) census. Figures 2.2-2 through 2.2-6 show corresponding projected populations for the years 1990, 2000, 2010, 2020 and 2030. The population projections were developed using 1970 and 1980 final Census Data with Rice Center's Rural Growth Allocation Model developed for this work by Rice Center/Dames & Moore in 1980/1981 (Ref. 2.2-7), and updated for the STP project in 1982 (Ref. 2.2-8). The 1970 and 1980 final Census Data were obtained for the eight counties located within 50 miles of the STP: Brazoria, Calhoun, Colorado, Fort Bend, Jackson, Matagorda, Victoria and Wharton. Census tract (or minor census division) data were compiled. Land use data, growth conditions and study area control totals were updated to reflect recent changes. The Growth Allocation model (Ref. 2.2-7) was then "calibrated" on the 1970-1980 base period by adjusting attractiveness factors in each of the census tracts to match each tract's share of growth during the base period. Forecasts were then made for the eight-county region. Q 311.2

The areal proportion of each tract within each sector was measured. For tracts without significant urban population, it was assumed the population was evenly distributed. Urban populations located in more than one sector were allocated in proportion to the 1980 Census population to the tracts containing the urban area. The proportion was considered a constant for projections to 2030.

2.2.1.1 Residential Developments

Two developments, Selkirk Island and Exotic Isle, are within approximately 4 miles southeast of the reactor containment buildings. Selkirk Island is a 1,100-acre island development operated as a community. The project includes 420 homesites of which 401 are within five miles of the STP. 7

The other development, Exotic Isle, is a much smaller area and is a resort/ retirement complex. The island is divided into 84 lots. Together the devel- 7 opments represent 504 home or retirement sites (Ref. 2.2-10). In projecting the population for the developments, which are planned almost entirely for retirement use, the figure of 2.5 persons per housing unit was used as a conservative number and the population was assumed to remain constant throughout the life of the project. The resort/home/retirement nature of the development makes them primarily recreational facilities. Selkirk Island provides, for its residents, boating, fishing, and hunting capabilities along with a swimming pool. During the warmer months, approximately 35 people per day use the swimming facilities (Ref. 2.2-5). There are three piers, 45, 40, and 30 feet in length, maintained for the use of residents of Selkirk Island. It is expected that approximately eight boats can dock at the facility at any one time. Approximately 25 boats per day during weekends are launched from the boat ramp at Selkirk (Ref. 2.2-5). Seven duck blinds are maintained for hunting activities, and fishing is done from individual properties. Approximately 75 hunters use the facilities during the 3-month season. Selkirk Island provides a 5-acre marina for the use of property owners.

The subdivision development of Citrus Grove, 4 miles southwest of the site, has 15 dwellings consisting of a occupied houses and 6 mobile homes. The 7 remaining land is being offered for sale in 400-acre lots. Robbins Ranch, 4.5 miles south of the site, was planned to be developed as small irrigated farms; however, these plans have not materialized. There are no seasonal or permanent dwelling in the area. There are 14 seasonal dwellings on the Exotic Isle development. Excluding Selkirk Island and Exotic Isle, there are 40 occupied 7 dwellings (including mobile homes) located within five miles of the STP. Population data for these developments are included in the population wheels on Figures 2.2-1 through 2.2-6.

Since most people purchasing homesites in the developments are doing so as retirement investments, a number of people may reside in these homes seasonally until their retirement. See Figure 2.1-6 for location of the Selkirk Island and Exotic Isle developments with respect to the plant site.

2.2.1.2 <u>Transient Population</u> 7

2.2.1.2.1 Visitors' Center. As previously discussed in Section 2.1, a visitor's information center has been constructed east of the STP site. (Figure 2.1-5.) 6 7

2.2.1.2.2 Migrant Labor Force. A recent inquiry of the Matagorda County Agricultural Extension agent and the Texas Employment Commission revealed that 7 there are no migrant workers within 10 miles of the plant. The mechanized nature of agriculture of the county has minimized hand labor (Ref. 2.2-10). 7

2.2.1.2.3 Seasonal Homes. According to information published by the Bureau of Business Research, University of Texas State Data Center, and the 1980 U.S. Census of Housing, there were 381 vacant seasonal and migratory housing units in Matagorda County in 1980. The resort/retirement communities of Selkirk 7 Island and Exotic Isle located 3.5 miles southwest of the plant area provide the only seasonal dwelling within 5 miles of the site. These two developments represent a total of about 30 seasonal dwellings and 120 permanent dwellings (Ref. 2.2-10).

2.2.1.3 Population Center

The nearest "population center," as defined in 10CFR100, is the city of Victoria, Texas, which had a 1980 population of 50,695. Its nearest corporate boundary is 59 miles west of the plant. Projections indicate, however, that 5
the population of Bay City will exceed 25,000 by the year 2010. For this reason Bay City has been designated as the population center. The distance to Bay City, approximately 12 miles, is considerably greater than the distance required by 10CFR100, i.e., 1-1/3 times the low population zone distance.

2.2.1.4 Public Facilities and Institutions

Two surveys, one in July 1973 and a second in October 1977, were conducted to determine existing and planned public facilities and institutions such as schools, hospitals, prisons, and parks within 10 miles of the plant. An assessment of socioeconomic conditions, completed in 1980, updated some of the 5
information provided in the 1973 and 1977 surveys. The results of the surveys and assessment are reflected in the subsections below.

2.2.1.4.1 Schools. There are no schools within 5 miles of the site. Schools within 10 miles of the plant are listed in Table 2.2-2 and indicated on Figure 2.2-7. Only three schools are within 10 miles of the plant: Tidehaven High School (8 miles NNW) and Tidehaven Intermediate School (8.5 miles NNW), both located in El Maton, Texas, and the Matagorda Elementary School in Matagorda, Texas (8 miles SE). Four schools in Palacios are just over 10 miles from the plant; 5 7
Palacios High School, Palacios Junior High School, Eastside Elementary School, and Central Elementary School (Ref. 2.2-1). The institution of higher education closest to the plant is Wharton County Junior College, 37 miles to the north. 7

2.2.1.4.2 Hospitals. There are no hospitals within 10 miles of the plant. The only hospital facilities within the county are Matagorda General Hospital located in Bay City and Wagner General Hospital in Palacios. The Matagorda General Hospital has three surgical rooms and 116 beds (Ref. 2.2-9). 5
Included in the facility is a 28-bed convalescent center. Also located in Bay City is the Bay Villa Convalescent home. This facility, with a 106-bed capacity, provides convalescent nursing facilities to area residents. The Matagorda County Health Department is located in the county courthouse and maintains a staff which includes one registered nurse and one health inspector (Ref. 2.2-1 and 2.2-2).

Wagner General Hospital in Palacios provides general medical and surgical facilities for persons in the southwestern end of the county. The hospital has a 43-bed capacity and a staff of 59 (Ref. 2.2-5 and 2.2-9).

2.2.1.4.3 Prisons. There are no prisons within 10 miles of the plant site (Ref. 2.2-1).

2.2.1.4.4 Parks and Recreational Areas. Parks and other recreational areas within 10 miles of the plant are indicated on Figure 2.2-7. The recreational facilities closest to the site are all privately owned. Oliver's Bait Camp (1) (numbers refer to Figure 2.2-7), 10 miles east-southeast of the plant, has 2 acres of land providing boating and fishing facilities. Old Box Factory (2), 10 miles east-southeast of the plant, also has 2 acres of land and also Q330.2
provides boating facilities. Carlson's Park (3), 10 miles southeast of the

plant, has 2 acres of land and has boating and fishing facilities (Ref. 2.2-4). The U. S. Fish and Wildlife Service has plans to purchase or lease the Mad Island Marsh Complex south of the site to preserve it as a prime waterfowl wintering area (Ref. 2.2-6). Q330.2

2.2.1.4.5 Diversion Project at the Mouth of the Colorado River. The project is situated on the Texas Coastline approximately one mile south of Matagorda (see Figure 2.2-8). The river diversion features are to be located in Matagorda Bay and the Colorado River delta adjacent to the Gulf Intracoastal Waterway (GIWW) near the town of Matagorda.

The project, initiated in May, 1984 and projected to be completed in the summer of 1988, will enhance the Bay's commercial productivity and take advantage of incidental opportunities to provide flood control and reduce navigation hazards and navigation maintenance dredging. Project details and impacts are discussed in the Corps of Engineers Environmental Impact Statement, March 1981. 7

2.2.1.5 Zoning

Matagorda County and Bay City do not have land use zoning regulations or a planning commission. The only land use regulations within the county are deed restrictions for subdivisions. The county government for Matagorda County is a county commission made up of four precincts, each having a county commissioner. The STP is located in Precinct 3. No building permit was required for the STP site.

2.2.2 USE OF ADJACENT LANDS AND WATERS

The most important industry in Matagorda County is agriculture. The 1982 Census of Agriculture indicates that approximately 188,500 acres of land in Matagorda County are in harvested cropland. Approximately 60,500 acres in the county were irrigated in 1982.

Crop production in Matagorda County includes grain sorghum, rice, corn, wheat, cotton, soybeans, and turf grass. The 1984 planted acreages for the various crops in Matagorda County are as follows: 7

Grain Sorghum	75,372 ac.
Corn	14,152 ac.
Cotton	3,939 ac.
Rice	39,113 ac.
Wheat	3,589 ac.
Soybeans	17,212 ac.
Turf Grass (estimate)	17,000 ac.
Acreage Conservation Reserve (set aside acreage)	18,187 ac.

As indicated above, almost twice as much grain sorghum as rice was grown in the county in 1984. The total value of agricultural products sold in Matagorda County in 1982 was in excess of $54,000,000 with grain crops accounting for over $37,000,000.

The livestock industry utilizes fairly large acreages within the county. In 1982, the livestock industry in Matagorda County accounted for almost $9,000,000 in sales. 7

The primary land use within 10 miles of the STP site is cropland, followed by pastureland, rangeland, and woodland which are used for the grazing of beef cattle.

2.2.3 NEARBY INDUSTRIAL, TRANSPORTATION, AND MILITARY FACILITIES

The material presented in the "Environmental Report--Construction Permit Stage" requires updating as discussed below.

2.2.3.1 HIGH VOLTAGE DIRECT CURRENT TERMINAL

A High Voltage Direct Current (HVDC) interconnection (-400 kV) is to be operated between terminals at the Central and South West System Walker County Power Plant and the STP. The southern terminal is to be located on a 17-acre tract of the STP site southeast of the intersection of the FM 521 and the STP construction access road, just inside and adjacent to the Exclusion Area Boundary as shown on Figure 2.1-4. The terminal will consist of an AC switchyard, an AC-DC converter building, and a DC switchyard. A 345 kV line consisting of one circuit will connect the STP switchyard with the terminal. 6

The HVDC terminal will be located close to and will be physically dominated by the existing STP facilities. Therefore, the terminal is not expected to have an adverse visual impact on the environment when viewed from FM 521.

Operation of the HVDC terminal is not expected to have adverse effects resulting from radio noise, ozone, induced voltages, or ground currents. Protective equipment will be installed to handle line and ground currents that occur under short circuit conditions.

Audible noise resulting from operation of the HVDC will not exceed 65 dB(A) at the boundary of the terminal and is not expected to be heard by motorists on FM 521. A person standing at the fence of the terminal is expected to hear a "hum" similar to that from a typical AC switchyard. Thus, operation of the HVDC will not have significant noise impact off-site.

Potable water will be supplied by a deep well to be drilled on the terminal site. Sewage effluent will be discharged to a septic tank and leaching field located on the seventeen acre tract. The DC converter will be air cooled, and there will be no gaseous or liquid discharges from the terminal facility. Areas around the terminal will be grassed to prevent erosion.

No significant adverse environmental impacts are anticipated to result from operation of the HVDC terminal.

2.2.3.2 DuPont Facility

DuPont owns and operates a high density polyethylene plant located approximately 7 miles east of the STP site. Construction began on this plant in 1981 7
and the plant was opened in November 1983. The plant site covers 2,100 acres and employs approximately 150 persons.

REFERENCES

Section 2.2:

2.2-1 NUS Corporation, Demography, Land and Water Use Survey, (Rockville, Maryland, 1973).

2.2-2 Bay City Chamber of Commerce, Matagorda County Fact Book (Bay City, Texas, 1971).

2.2-3 American Hospital Association, The AHA Guide to Health Care Field (1971).

2.2-4 Houston-Galveston Area Council, Parks Recreation and Open Space (1971).

2.2-5 Brown & Root, Inc., 1977 Demography, Land and Water Use Survey, (Houston, Texas).

2.2-6 U.S. Department of Interior, Fish & Wildlife Service, Region 2, Wetland Preservation Program, Category 8, Texas Gulf Coast (March 1977).

2.2.7 Rice Center, 18 County Population and Employment Forecast, (December 1980, revised January 1981).

2.2-8 Rice Center, Correspondence to Dames & Moore regarding updating population forecast, (June 15, 1982). 5

2.2-9 NUS Corporation, Revised Assessment of Socioeconomic Conditions at the South Texas Project, (Rockville, Maryland, 1980).

2.2-10 Espey, Huston and Associates, Inc., Correspondence to HL&P updating socio-economic information, (October, 1984). 7

TABLE 2.2-1

TOWNS AND CITIES WITHIN 50 MILES OF SOUTH TEXAS PROJECT

Q311.2

0-10 Miles	Distance (mi) and Direction	Population 1970	Population 1980
Buckeye	8 N	25	17***
Rymers	8 NE	6	6***
Wadsworth	8 ENE	152	176***
Gulf Hill	8 ESE	0	0***
Matagorda	8 SW	1,219	605***
Citrus Grove	4 W	0	40***
Collegeport	9 WSW	91	122***
Simpsonville	4 W	12	17***
El Maton	8 NW	165	175***
10-20 Miles			
Markham	12 N	603	1,554
Rossge	15 N	*	3***
Bay City	12 NNE	11,733	17,837***
Van Vleck	19 NNE	1,051	1,167***
Caney	18 NE	296	296***
Rugeley	19 NE	*	[illegible]***
Chinquapin	17 E	*	**
Gulf	11 ESE	*	**
Camp Hulen	14 WSW	*	**
Palacios	13 WSW	3,642	4,667
Blessing	12 WNW	571	860***
Francitas	18 WNW	30	**
Midfield	15 NW	70	210***

7

* Population information not available in U.S. Census Bureau 1970 listing of current population.

** Population information not available in U.S. Census Bureau 1980 listing of current population. 5

*** Population estimate based on Matagorda County tax rolls. 7

TABLE 2.2-1 (Continued)

TOWNS AND CITIES WITHIN 50 MILES OF SOUTH TEXAS PROJECT

Q311.2

10-20 Miles (Cont'd)	Distance (mi) and Direction	Population 1970	Population 1980
Clemville	15 NNW	54	100***
Magnet	16 N	70	**
20-30 Miles			
Chalmers	21 NNE	*	0***
McCroskey	24 NNE	*	0***
Ashwood	25 NNE	*	6***
Pledger	29 NNE	159	91***
Sugar Valley	24 NE	*	45***
Allenhurst	21 NE	*	0***
Hasima	24 NE	*	0***
Abercrombie	26 NE	*	0***
Old Ocean	27 NE	900	**
Sweeney	26 NE	3,191	3,538
Cedar Lane	23 ENE	85	90***
Gainesmore	25 ENE	*	0***
Hawkinsville	25 ENE	*	0***
Cedar Lake	27 ENE	148	120***
Four Corners	29 ENE	*	0***
Sargent	25 E	76	304***
Olivia	26 WSW	200	215***
Port Alto	24 WSW	*	**

7

7

* Population information not available in U.S. Census Bureau 1970 listing of current population.

** Population information not available in U.S. Census Bureau 1980 listing of current population. 5

*** Population estimate based on Matagorda County tax rolls. 7

TABLE 2.2-1 (Continued)

TOWNS AND CITIES WITHIN 50 MILES OF SOUTH TEXAS PROJECT

20-30 Miles (Cont'd)	Distance (mi) and Direction	Population 1970	Population 1980
Weedhaven	25 W	*	**
La Ward	26 W	247	218
Danevang	21 NNW	61	**
30-40 Miles			
Lane City	30 N	111	**
Mackay	34 N	*	**
Boling	35 N	541 }	1,348 (Boling and Iago combined)
Iago	36 N	32 }	
Burr	37 N	*	**
Dinsmore	38 N	*	**
Wharton	37 N	7,881	9,033
New Gulf	35 NNE	963	**
Don-Tol	32 NNE	*	**
Danciger	32 NNE	300	**
Damon	39 NNE	360	**
West Columbia	35 NE	3,335	4,109
East Columbia	36 NE	89	**
El Barnardo	30 NE	*	**
Brazoria	35 ENE	1,681	3,025
Hinkles Ferry	34 ENE	35	**
Perry Landing	37 ENE	*	**
Jones Creek	39 ENE	1,268	2,634
Churchill Bridge	33 ENE	*	**
Port O'Connor	33 SW	*	1,031

* Population information not available in U.S. Census Bureau 1970 listing of current population.

** Population information not available in U.S. Census Bureau 1980 listing of current population.

TABLE 2.2-1 (Continued)

TOWNS AND CITIES WITHIN 50 MILES OF SOUTH TEXAS PROJECT

30-40 Miles (Cont'd)	Distance (mi) and Direction	Population 1970	Population 1980
Indianola	33 SW	*	**
Magnolia Beach	34 WSW	*	**
Port Lavaca	37 WSW	10,491	10,911
Point Comfort	33 WSW	1,446	1,125
Keeran	39 W	*	**
La Salle	38 W	75	**
Vanderbilt	35 W	667	**
Lolita	31 W	300	**
Red Bluff	32 WNW	*	**
Manson	37 WNW	*	**
Edna	39 WNW	5,332	5,650
Ganado	33 WNW	1,640	1,770
Louise	32 NW	310	**
Hillje	32 NW	51	**
El Campo	31 NNW	8,563	10,462
El Campo South	30 NNW	1,880	
Pierce	33 NNW	49	**
Jones	38 NNW	*	**
40-50 Miles			
Spanish Camp	42 N	*	**
Hungerford	43 N	178	**
Kendleton	46 N	161	606
Powell Point	48 N	*	**
Marlowe	42 NNE	*	**
Guy	43 NNE	25	**

* Population information not available in U.S. Census Bureau 1970 listing of current population.

** Population information not available in U.S. Census Bureau 1980 listing of current population.

TABLE 2.2-1 (Continued)

TOWNS AND CITIES WITHIN 50 MILES OF SOUTH TEXAS PROJECT

40-50 Miles (Cont'd)	Distance (mi) and Direction	Population 1970	Population 1980
Needville	45 NNE	1,024	1,417
Long Point	46 NNE	*	**
Fairchilds	48 NNE	95	**
Otey	47 NE	300	**
Chenango	48 N	*	**
Anchor	46 NE	*	**
Bailey Prairie	42 NE	228	353
Snide	42 NE	75	**
Angleton	46 NE	9,770	13,929
Angleton South	47 NE	1,017	
Van Pelt	46 ENE	*	**
Bastrop Beach	47 ENE	*	**
Lake Jackson	42 ENE	13,376	19,102
Clute	44 ENE	6,023	9,577
Lake Barbara	45 ENE	605	**
Stratton Ridge	47 ENE	*	**
Oyster Creek	47 ENE	600	1,473
Velasco Heights	45 ENE	*	**
Velasco	45 ENE	*	**
Freeport	45 ENE	11,997	13,444
Gulf Park	42 ENE	2,000	**
Seadrift	48 WSW	1,092	1,277
North Seadrift	49 WSW	*	
Long Mott	49 WSW	76	**
Green Lake	49 WSW	51	**
Clarks	43 WSW	*	**

* Population information not available in U.S. Census Bureau 1970 listing of current population.

** Population information not available in U.S. Census Bureau 1980 listing of current population.

TABLE 2.2-1 (Continued)

TOWNS AND CITIES WITHIN 50 MILES OF SOUTH TEXAS PROJECT

40-50 Miles (Cont'd)	Distance (mi) and Direction	Population 1970	Population 1980
Kamey	44 WSW	*	**
Placedo	48 W	500	**
Carr	44 W	*	**
Inez	46 W	300	**
El Toro	43 WNW	*	**
Navidad	49 WNW	*	**
Morales	50 WNW	25	**
Cordele	44 NW	74	**
Provident City	49 NW	*	**
New Taiton	41 NNW	*	**
Nada	48 NNW	165	**
Glen Flora	40 NNW	210	**
Egypt	45 NNW	26	**
Sand Ridge	46 NNW	*	**
Elm Grove	48 NNW	*	**
Bonus	48 NNW	42	**
Richwood	42 ENE	1,452	2,591

* Population information not available in U.S. Census Bureau 1970 listing of current population.

** Population information not available in U.S. Census Bureau 1980 listing of current population.

TABLE 2.2-2

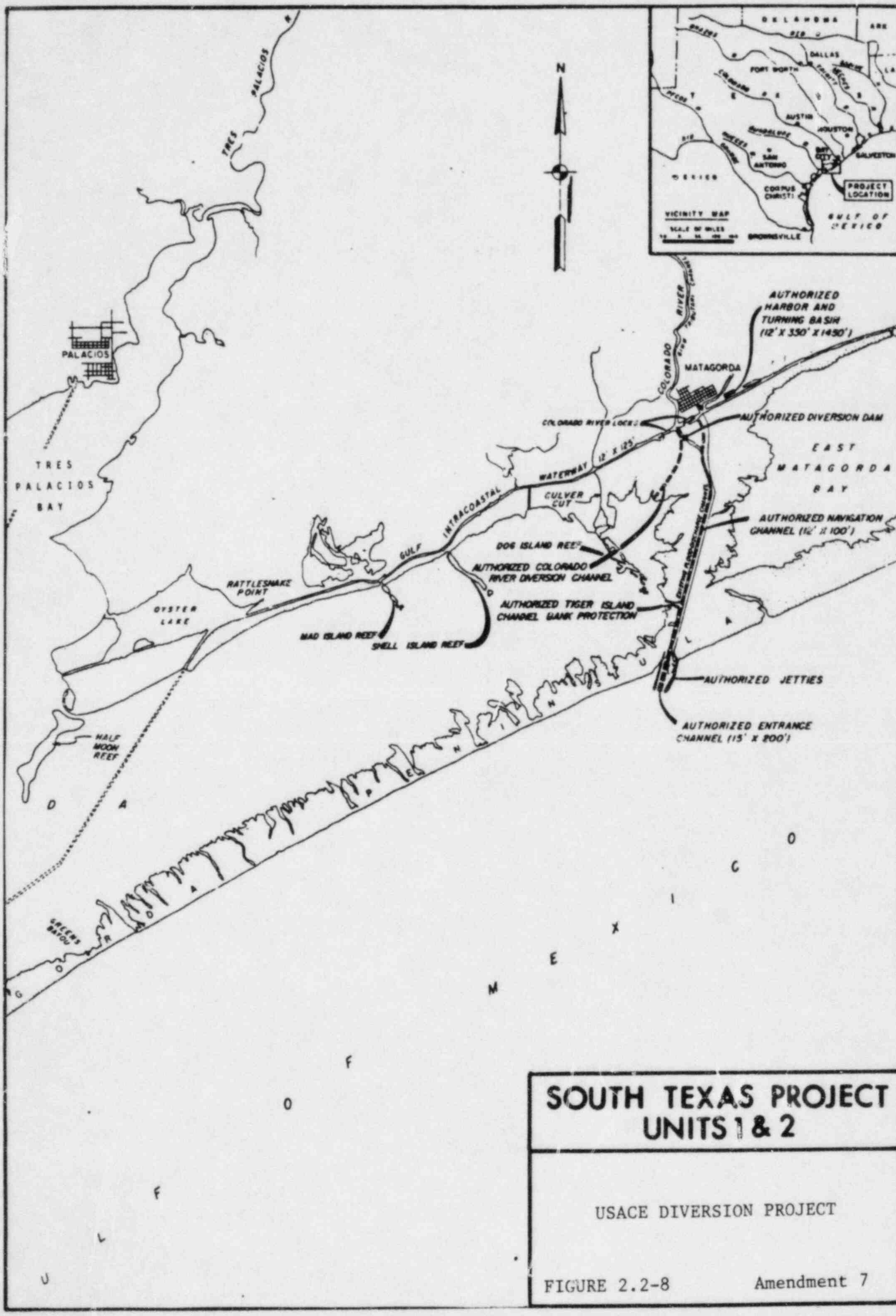
SCHOOLS WITHIN 10 MILES OF SOUTH TEXAS PROJECT
(Except as Indicated)

School*	Distance (mi) and Direction
1. Matagorda Elementary (Matagorda)	8 SSE
2. Tidehaven High School (El Maton)	8 NNW
3. Tidehaven Intermediate (El Maton)	8.5 NNW
4. Central Elementary (Palacios)	10 - 11 SW**
5. Eastside Elementary (Palacios)	10 - 11 SW**
6. Palacios Junior High School (Palacios)	10 - 11 SW**
7. Palacios High School (Palacios)	10 - 11 SW**

7

* Numbers correspond with Figure 2.2-7.

** These schools are just beyond 10 miles of the plant.



SOUTH TEXAS PROJECT UNITS 1 & 2

USACE DIVERSION PROJECT

FIGURE 2.2-8 Amendment 7

2.4 GEOLOGY AND SOILS

The material presented in the Environmental Report--Construction Permit Stage requires no updating except as discussed below.

2.4.5 STRUCTURAL GEOLOGY

Sixty-one oil and gas fields are located within 15 miles of the plant site. The producing strata of these fields are generally found in geologic structures from 6,000 feet to 15,000 feet below the surface. The nearest producing fields are approximately 3 miles from the plant site. |7

Oil and gas production within the region is declining. Table 2.4-1 gives a summary of the production and facilities of the fields within a 5-mile radius of the site as of December 1983. |7

REFERENCES

<u>Section 2.4</u>:

2.4-2 Deleted 7

TABLE 2.4-1

GAS AND OIL PRODUCTION FIELDS WITHIN 5 MILES OF THE STP SITE

	Duncan Slough	South Duncan Slough	Cane Island	Petrucha
Type of Field	Oil & Gas	Gas	Gas	Gas
Total Number of Producing Wells as of 12/31/83 (1)	5	6	0	2
Total Production (2)	(G)33,200 (3) (O)2,913,734	(G)30,521 (O) None	(G)945.5 (4) (O) None	(G)16,487 (O) None
Storage Facilities	Storage Tanks	None	None	None
Transportation Method	Pipeline	Pipeline	----	Pipeline

7

1. Well counts are reported by producing horizon; therefore actual number of wells in a field may be less.
2. Gas production (G) in million cubic feet and oil production (O) in barrels.
3. Cane Island Field was shut down March 9, 1972.
4. Approximation.

2.5 HYDROLOGY

In accordance with the discussion in the Introduction to Regulatory Guide 4.2, Revision 2, pertaining to the "Applicant's Environmental Report--Operating License Stage," this section is not addressed except to note the following changes, since no updating of the corresponding material presented in the Environmental Report--Construction Permit Stage (ER-CP) was necessary.

2.5.1.1.4 River Chemical Characteristics. As part of the South Texas Project, a biological and water sampling program was initiated in June 1973. Methodology is discussed in Section 6.1.1 and sampling station locations are shown in Figure 6.1-1. All biological and water resources (quality) data generated from the sampling program have been tabulated and are presented in Reference 2.5-2. Biological data collected during the ongoing investigation are summarized in Section 2.7.

2.5.1.1.5 River Water Temperature. Table 2.5-23 of the ER-CP presented temperatures of the water in the Colorado River based on data from the USGS gage near Wharton, Texas through September 12, 1966. Data for the period October 11, 1966, through September 27, 1976, have been obtained (Ref. 2.5-1) and are presented in Table 2.5-1. These data do not alter any environmental conclusions of this report.

2.5.1.2 Little Robbins Slough

Data previously presented in Table 2.5-26 of the ER-CP have been expanded and are presented in Table 2.5-2. These data are merely supplemental to previously reported data and do not alter any environmental conclusions of this report.

2.5.3 WATER QUALITY STANDARDS

Effective September 1, 1977, the Texas Water Quality Board was abolished. Its duties and jurisdiction were, effective September 1, 1977, vested in the Texas Department of Water Resources.

In Appendix 2.5.B of the ER-CP, a copy of the "Texas Water Quality Standards, October 1973" was included. This set of standards was the basis of issuance of the permit from the State of Texas regarding water quality. Since the issue of that permit, Texas has issued another set of standards entitled "Texas Water Quality Standards, April, 1981." These standards, as they apply to the STP area, are essentially the same as the 1973 standards, except that the pH range was changed from 6.7-8.5 in the 1973 standards to 6.5-8.5 in the 1976 standards. This change results in less stringent requirements in the 1976 standards and does not alter any environmental conclusions of this report. |7

2.6 METEOROLOGY

The material presented in Section 2.6 of the "Environmental Report-- Construction Permit Stage" requires no updating except as discussed herein. The onsite meteorological data base has been updated to cover the period July 21, 1973, through September 30, 1977. The period from July 21, 1976, through September 30, 1976, (inclusive) has been omitted because of limited maintenance performed on the data collecting equipment during that period.

The four-year composite joint frequency distributions of wind speed, wind direction, and stability are presented in Tables 2.6-1 through 2.6-8. The composite four-year wind rose is presented in Figure 2.6-1. Data on wind speed and wind direction persistence are presented in Tables 2.6-9 through 2.6-24. Seasonal and annual stability indices for Victoria and Corpus Christi are presented in Table 2.6-26. The four-year composite wind roses for Victoria and Corpus Christi are presented in Figures 2.6-2 and 2.6-3, respectively. These data indicate that the four years of data are representative of the long-term data record. 7

7

TABLE 2.6-1

OBSERVATIONS PER DAY - 24
OBSERVATIONS PER INPUT FIELD - 1
TIME CORRECTION IN HOURS - 0.00
WIND SPEED INPUT IN MPH
WIND DIRECTION INPUT IN DEGREES

DATA PERIOD - JUL 21, 1973 THROUGH SEP 30, 1977
MONTHS CONSIDERED - JAN THROUGH DEC
HOURS CONSIDERED - 0 TO 2400
ANEMOMETER HEIGHT - 10 METERS
ALL OBSERVATIONS

WIND FREQUENCY DISTRIBUTION
FREQUENCY IN PERCENT
OF TOTAL OBSERVATIONS

WIND SPEED CLASS (MPH)

WIND SECTOR	0.76 TO 2.00	2.01 TO 3.00	3.01 TO 4.00	4.01 TO 5.00	5.01 TO 7.00	7.01 TO 10.00	10.01 TO 15.00	GREATER THAN 15.00	TOTAL	MEAN SPEED
NNE	0.09	0.19	0.36	0.55	1.14	1.72	2.03	0.96	7.05	9.77
NE	0.07	0.15	0.47	0.92	1.76	1.91	1.55	0.51	7.34	8.36
ENE	0.07	0.20	0.47	0.71	1.45	1.22	1.02	0.29	5.42	7.81
E	0.12	0.22	0.50	0.71	1.39	1.04	1.11	0.65	5.74	8.56
ESE	0.10	0.25	0.46	0.50	1.29	1.27	1.52	1.05	6.44	9.68
SE	0.12	0.25	0.41	0.59	1.87	3.00	4.11	3.18	13.52	11.42
SSE	0.07	0.21	0.31	0.49	2.02	3.43	4.54	4.15	15.22	12.05
S	0.13	0.18	0.30	0.38	1.17	2.39	4.12	3.87	12.55	12.68
SSW	0.04	0.09	0.16	0.24	0.53	1.02	1.55	1.14	4.77	11.64
SW	0.08	0.10	0.15	0.21	0.40	0.55	0.49	0.30	2.28	9.28
WSW	0.05	0.11	0.10	0.11	0.23	0.30	0.16	0.05	1.10	7.22
W	0.08	0.13	0.15	0.17	0.33	0.29	0.16	0.03	1.34	6.61
WNW	0.06	0.07	0.12	0.13	0.28	0.32	0.17	0.16	1.32	8.46
NW	0.05	0.13	0.20	0.23	0.40	0.51	0.34	0.43	2.28	9.71
NNW	0.07	0.12	0.21	0.33	0.66	1.08	1.42	1.73	5.62	12.25
N	0.07	0.12	0.32	0.36	0.87	1.32	2.17	2.46	7.69	12.32
CALM									0.32	
TOTAL	1.26	2.51	4.71	6.64	15.80	21.37	26.46	20.95	100.00	10.71

NUMBERS BELOW BASED ON ALL OBSERVATIONS
NUMBER OF INVALID OBSERVATIONS = 439
NUMBER OF VALID OBSERVATIONS =34574

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OBSERVATIONS PER DAY - 24
OBSERVATIONS PER INPUT FIELD - 1
TIME CORRECTION IN HOURS - 0.00
WIND SPEED INPUT IN MPH
WIND DIRECTION INPUT IN DEGREES
STABILITY INPUT AS DELTA-T (DEG F)

TABLE 2.6-2

DATA PERIOD - JUL 21, 1973 THROUGH SEP 30, 1977
MONTHS CONSIDERED - JAN THROUGH DEC
HOURS CONSIDERED - 0 TO 2400
ANEMOMETER HEIGHT - 10 METERS
DELTA-T LEVELS - 10.0 TO 60.0 METERS
STABILITY CLASS - A (EXTREMELY UNSTABLE)

WIND FREQUENCY DISTRIBUTION
FREQUENCY IN PERCENT
OF TOTAL OBSERVATIONS

WIND SPEED CLASS (MPH)

WIND SECTOR	0.76 TO 2.00	2.01 TO 3.00	3.01 TO 4.00	4.01 TO 5.00	5.01 TO 7.00	7.01 TO 10.00	10.01 TO 15.00	GREATER THAN 15.00	TOTAL	MEAN SPEED
NNE	0.00	0.00	0.00	0.02	0.03	0.08	0.10	0.08	0.29	11.55
NE	0.00	0.00	0.00	0.02	0.04	0.06	0.10	0.03	0.26	10.52
ENE	0.00	0.01	0.00	0.01	0.05	0.04	0.06	0.02	0.18	9.49
E	0.00	0.00	0.01	0.00	0.02	0.02	0.04	0.06	0.15	13.37
ESE	0.00	0.00	0.00	0.00	0.03	0.02	0.08	0.13	0.26	15.16
SE	0.00	0.00	0.02	0.01	0.03	0.11	0.40	0.41	0.97	14.55
SSE	0.00	0.01	0.01	0.01	0.05	0.14	0.42	0.74	1.36	15.90
S	0.00	0.00	0.00	0.01	0.06	0.14	0.66	0.94	1.79	16.34
SSW	0.00	0.00	0.01	0.01	0.03	0.08	0.32	0.39	0.83	15.17
SW	0.00	0.00	0.01	0.01	0.03	0.04	0.12	0.10	0.30	13.73
WSW	0.00	0.01	0.00	0.00	0.02	0.03	0.03	0.00	0.11	8.70
W	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.00	0.08	8.95
WNW	0.00	0.00	0.01	0.01	0.02	0.03	0.02	0.02	0.11	11.38
NW	0.00	0.00	0.01	0.02	0.03	0.05	0.01	0.10	0.21	14.58
NNW	0.00	0.00	0.01	0.01	0.03	0.02	0.07	0.16	0.29	15.56
N	0.00	0.00	0.00	0.02	0.02	0.03	0.09	0.25	0.40	16.08
CALM									0.00	
TOTAL	0.00	0.03	0.09	0.15	0.48	0.91	2.52	3.41	7.59	14.81

NUMBERS BELOW BASED ON ALL OBSERVATIONS
NUMBER OF INVALID OBSERVATIONS = 481
NUMBER OF VALID OBSERVATIONS =34542

OBSERVATIONS PER DAY - 24
OBSERVATIONS PER INPUT FIELD - 1
TIME CORRECTION IN HOURS - 0.00
WIND SPEED INPUT IN MPH
WIND DIRECTION INPUT IN DEGREES
STABILITY INPUT AS DELTA-T (DEG F)

TABLE 2.6-3

DATA PERIOD - JUL 21, 1973 THROUGH SEP 30, 1977
MONTHS CONSIDERED - JAN THROUGH DEC
HOURS CONSIDERED - 0 TO 2400
ANEMOMETER HEIGHT - 10 METERS
DELTA-T LEVELS - 10.0 TO 60.0 METERS
STABILITY CLASS - B (MODERATELY UNSTABLE)

WIND FREQUENCY DISTRIBUTION
FREQUENCY IN PERCENT
OF TOTAL OBSERVATIONS

	WIND SPEED CLASS (MPH)									
WIND SECTOR	0.76 TO 2.00	2.01 TO 3.00	3.01 TO 4.00	4.01 TO 5.00	5.01 TO 7.00	7.01 TO 10.00	10.01 TO 15.00	GREATER THAN 15.00	TOTAL	MEAN SPEED
NNE	0.00	0.00	0.01	0.01	0.03	0.04	0.12	0.04	0.25	11.50
NE	0.00	0.00	0.01	0.02	0.02	0.08	0.09	0.04	0.27	10.59
ENE	0.00	0.00	0.01	0.01	0.03	0.06	0.09	0.02	0.21	10.19
E	0.00	0.01	0.01	0.02	0.02	0.02	0.04	0.04	0.15	11.11
ESE	0.00	0.01	0.01	0.01	0.02	0.04	0.08	0.11	0.28	13.76
SE	0.00	0.00	0.01	0.01	0.02	0.10	0.32	0.25	0.71	14.17
SSE	0.00	0.00	0.01	0.01	0.06	0.07	0.39	0.58	1.11	16.01
S	0.00	0.00	0.00	0.00	0.02	0.10	0.46	0.67	1.25	16.10
SSW	0.00	0.00	0.00	0.00	0.02	0.05	0.18	0.20	0.45	14.54
SW	0.00	0.00	0.00	0.01	0.03	0.08	0.06	0.05	0.23	12.00
WSW	0.00	0.01	0.00	0.01	0.03	0.01	0.03	0.01	0.09	8.82
W	0.00	0.01	0.00	0.01	0.03	0.01	0.01	0.00	0.06	7.46
WNW	0.00	0.00	0.01	0.00	0.03	0.02	0.01	0.02	0.09	9.98
NW	0.00	0.01	0.01	0.01	0.02	0.03	0.03	0.05	0.14	13.05
NNW	0.00	0.00	0.01	0.01	0.01	0.03	0.06	0.19	0.30	16.44
N	0.00	0.01	0.00	0.01	0.03	0.05	0.14	0.16	0.40	14.33
CALM									0.00	
TOTAL	0.00	0.04	0.09	0.14	0.41	0.79	2.11	2.42	6.00	14.24

NUMBERS BELOW BASED ON ALL OBSERVATIONS
NUMBER OF INVALID OBSERVATIONS = 481
NUMBER OF VALID OBSERVATIONS =34542

7

OBSERVATIONS PER DAY - 24
OBSERVATIONS PER INPUT FIELD - 1
TIME CORRECTION IN HOURS - 0.00
WIND SPEED INPUT IN MPH
WIND DIRECTION INPUT IN DEGREES
STABILITY INPUT AS DELTA-T (DEG F)

TABLE 2.6-4

DATA PERIOD - JUL 21, 1973 THROUGH SEP 30, 1977
MONTHS CONSIDERED - JAN THROUGH DEC
HOURS CONSIDERED - 0 TO 2400
ANEMOMETER HEIGHT - 10 METERS
DELTA-T LEVELS - 10.0 TO 60.0 METERS
STABILITY CLASS - C (SLIGHTLY UNSTABLE)

WIND FREQUENCY DISTRIBUTION
FREQUENCY IN PERCENT
OF TOTAL OBSERVATIONS

	WIND SPEED CLASS (MPH)									
WIND SECTOR	0.76 TO 2.00	2.01 TO 3.00	3.01 TO 4.00	4.01 TO 5.00	5.01 TO 7.00	7.01 TO 10.00	10.01 TO 15.00	GREATER THAN 15.00	TOTAL	MEAN SPEED
NNE	0.00	0.00	0.01	0.01	0.02	0.08	0.17	0.05	0.34	11.38
NE	0.00	0.00	0.01	0.02	0.05	0.10	0.14	0.06	0.37	10.75
ENE	0.00	0.00	0.01	0.01	0.02	0.07	0.12	0.03	0.27	11.08
E	0.00	0.01	0.02	0.01	0.03	0.05	0.09	0.07	0.27	12.00
ESE	0.00	0.00	0.02	0.01	0.03	0.04	0.14	0.14	0.38	13.31
SE	0.00	0.01	0.01	0.02	0.03	0.19	0.45	0.39	1.08	13.91
SSE	0.00	0.01	0.01	0.01	0.03	0.11	0.42	0.43	1.03	14.82
S	0.00	0.01	0.01	0.01	0.04	0.10	0.52	0.54	1.22	14.91
SSW	0.00	0.00	0.00	0.01	0.03	0.05	0.25	0.17	0.51	14.41
SW	0.00	0.00	0.01	0.00	0.03	0.03	0.05	0.05	0.18	12.11
WSW	0.00	0.00	0.00	0.01	0.01	0.03	0.02	0.01	0.08	10.19
W	0.01	0.00	0.01	0.01	0.01	0.03	0.01	0.01	0.10	7.92
WNW	0.00	0.00	0.01	0.00	0.01	0.05	0.01	0.02	0.11	9.87
NW	0.01	0.00	0.00	0.01	0.03	0.02	0.03	0.06	0.15	12.45
NNW	0.00	0.01	0.00	0.00	0.02	0.03	0.09	0.17	0.32	15.42
N	0.00	0.00	0.01	0.01	0.03	0.05	0.17	0.23	0.51	14.34
CALM									0.00	
TOTAL	0.02	0.04	0.13	0.15	0.44	1.04	2.69	2.42	6.93	13.58

NUMBERS BELOW BASED ON ALL OBSERVATIONS
NUMBER OF INVALID OBSERVATIONS = 481
NUMBER OF VALID OBSERVATIONS =34542

7

OBSERVATIONS PER DAY - 24
OBSERVATIONS PER INPUT FIELD - 1
TIME CORRECTION IN HOURS - 0.00
WIND SPEED INPUT IN MPH
WIND DIRECTION INPUT IN DEGREES
STABILITY INPUT AS DELTA-T (DEG F)

TABLE 2.6-5

DATA PERIOD - JUL 21, 1973 THROUGH SEP 30, 1977
MONTHS CONSIDERED - JAN THROUGH DEC
HOURS CONSIDERED - 0 TO 2400
ANEMOMETER HEIGHT - 10 METERS
DELTA-T LEVELS - 10.0 TO 60.0 METERS
STABILITY CLASS - D (NEUTRAL)

WIND FREQUENCY DISTRIBUTION
FREQUENCY IN PERCENT
OF TOTAL OBSERVATIONS

WIND SECTOR	WIND SPEED CLASS (MPH) 0.76 TO 2.00	2.01 TO 3.00	3.01 TO 4.00	4.01 TO 5.00	5.01 TO 7.00	7.01 TO 10.00	10.01 TO 15.00	GREATER THAN 15.00	TOTAL	MEAN SPEED
NNE	0.01	0.02	0.04	0.05	0.23	0.58	1.14	0.73	2.80	12.34
NE	0.01	0.01	0.04	0.09	0.22	0.66	0.80	0.34	2.16	10.84
ENE	0.01	0.02	0.03	0.06	0.16	0.44	0.54	0.19	1.46	10.56
E	0.00	0.02	0.03	0.06	0.13	0.25	0.66	0.45	1.61	12.44
ESE	0.01	0.03	0.03	0.03	0.15	0.36	0.83	0.61	2.06	12.74
SE	0.00	0.02	0.03	0.05	0.21	0.69	1.90	1.87	4.78	14.11
SSE	0.01	0.01	0.03	0.04	0.17	0.66	1.66	1.96	4.54	14.52
S	0.01	0.01	0.02	0.03	0.14	0.44	1.29	1.25	3.20	14.13
SSW	0.00	0.01	0.02	0.02	0.07	0.21	0.47	0.31	1.10	12.88
SW	0.01	0.01	0.01	0.03	0.06	0.12	0.16	0.08	0.47	10.64
WSW	0.01	0.01	0.02	0.03	0.05	0.10	0.06	0.02	0.30	8.60
W	0.01	0.01	0.03	0.03	0.10	0.08	0.08	0.02	0.36	8.07
WNW	0.01	0.01	0.02	0.03	0.04	0.09	0.06	0.07	0.34	10.38
NW	0.01	0.03	0.04	0.04	0.10	0.16	0.17	0.18	0.74	11.40
NNW	0.00	0.03	0.06	0.05	0.13	0.39	0.72	1.09	2.46	14.74
N	0.01	0.01	0.04	0.08	0.22	0.60	1.23	1.64	3.83	14.18
CALM									0.01	
TOTAL	0.09	0.26	0.51	0.73	2.18	5.84	11.78	10.82	32.22	13.20

NUMBERS BELOW BASED ON ALL OBSERVATIONS
NUMBER OF INVALID OBSERVATIONS = 481
NUMBER OF VALID OBSERVATIONS =34542

7

OBSERVATIONS PER DAY - 24
OBSERVATIONS PER INPUT FIELD - 1
TIME CORRECTION IN HOURS - 0.00
WIND SPEED INPUT IN MPH
WIND DIRECTION INPUT IN DEGREES
STABILITY INPUT AS DELTA-T (DEG F)

TABLE 2.6-6

DATA PERIOD - JUL 21, 1973 THROUGH SEP 30, 1977
MONTHS CONSIDERED - JAN THROUGH DEC
HOURS CONSIDERED - 0 TO 2400
ANEMOMETER HEIGHT - 10 METERS
DELTA-T LEVELS - 10.0 TO 60.0 METERS
STABILITY CLASS - E (SLIGHTLY STABLE)

WIND FREQUENCY DISTRIBUTION
FREQUENCY IN PERCENT
OF TOTAL OBSERVATIONS

WIND SPEED CLASS (MPH)

WIND SECTOR	0.76 TO 2.00	2.01 TO 3.00	3.01 TO 4.00	4.01 TO 5.00	5.01 TO 7.00	7.01 TO 10.00	10.01 TO 15.00	GREATER THAN 15.00	TOTAL	MEAN SPEED
NNE	0.01	0.04	0.06	0.09	0.23	0.45	0.40	0.06	1.35	8.94
NE	0.01	0.01	0.06	0.11	0.34	0.49	0.31	0.04	1.38	8.36
ENE	0.00	0.02	0.07	0.10	0.30	0.36	0.15	0.03	1.04	7.68
E	0.01	0.03	0.10	0.11	0.32	0.38	0.26	0.02	1.23	7.87
ESE	0.03	0.05	0.09	0.09	0.34	0.48	0.39	0.06	1.53	8.48
SE	0.02	0.03	0.10	0.14	0.76	1.28	1.01	0.25	3.59	9.37
SSE	0.01	0.03	0.08	0.11	0.85	1.76	1.54	0.44	4.81	9.93
S	0.00	0.04	0.06	0.10	0.34	1.04	1.09	0.47	3.14	10.82
SSW	0.01	0.01	0.04	0.05	0.14	0.34	0.28	0.08	0.94	9.5[illegible]
SW	0.01	0.02	0.03	0.03	0.09	0.12	0.10	0.02	0.42	8.33
WSW	0.01	0.01	0.02	0.02	0.06	0.06	0.01	0.01	0.21	6.75
W	0.01	0.03	0.04	0.03	0.05	0.06	0.02	0.00	0.24	6.14
WNW	0.02	0.02	0.02	0.02	0.05	0.08	0.03	0.03	0.26	8.24
NW	0.01	0.03	0.04	0.05	0.06	0.11	0.06	0.04	0.39	8.27
NNW	0.01	0.01	0.04	0.07	0.16	0.32	0.40	0.12	1.13	9.85
N	0.01	0.01	0.06	0.07	0.21	0.33	0.50	0.18	1.37	10.26
CALM									0.05	
TOTAL	0.17	0.41	0.89	1.21	4.29	7.67	6.56	1.83	23.08	9.34

NUMBERS BELOW BASED ON ALL OBSERVATIONS
NUMBER OF INVALID OBSERVATIONS = 481
NUMBER OF VALID OBSERVATIONS =34542

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TABLE 2.6-7

OBSERVATIONS PER DAY - 24
OBSERVATIONS PER INPUT FIELD - 1
TIME CORRECTION IN HOURS - 0.00
WIND SPEED INPUT IN MPH
WIND DIRECTION INPUT IN DEGREES
STABILITY INPUT AS DELTA-T (DEG F)

DATA PERIOD - JUL 21, 1973 THROUGH SEP 30, 1977
MONTHS CONSIDERED - JAN THROUGH DEC
HOURS CONSIDERED - 0 TO 2400
ANEMOMETER HEIGHT - 10 METERS
DELTA-T LEVELS - 10.0 TO 60.0 METERS
STABILITY CLASS - F(MODERATELY STABLE)

WIND FREQUENCY DISTRIBUTION
FREQUENCY IN PERCENT
OF TOTAL OBSERVATIONS

WIND SECTOR	WIND SPEED CLASS (MPH) 0.76 TO 2.00	2.01 TO 3.00	3.01 TO 4.00	4.01 TO 5.00	5.01 TO 7.00	7.01 TO 10.00	10.01 TO 15.00	GREATER THAN 15.00	TOTAL	MEAN SPEED
NNE	0.03	0.07	0.13	0.13	0.30	0.29	0.09	0.00	1.03	6.34
NE	0.03	0.08	0.14	0.25	0.40	0.24	0.09	0.00	1.24	6.01
ENE	0.04	0.08	0.17	0.24	0.30	0.14	0.02	0.00	0.98	5.22
E	0.06	0.09	0.22	0.23	0.42	0.17	0.01	0.00	1.20	5.30
ESE	0.04	0.10	0.23	0.23	0.46	0.22	0.01	0.00	1.28	5.37
SE	0.06	0.13	0.19	0.26	0.63	0.51	0.03	0.00	1.81	6.00
SSE	0.03	0.12	0.14	0.26	0.68	0.55	0.08	0.00	1.87	6.35
S	0.08	0.08	0.14	0.16	0.43	0.40	0.10	0.00	1.38	6.35
SSW	0.02	0.04	0.05	0.08	0.15	0.21	0.04	0.00	0.61	6.48
SW	0.02	0.03	0.04	0.06	0.09	0.08	0.01	0.00	0.33	5.67
WSW	0.01	0.02	0.02	0.02	0.03	0.03	0.00	0.00	0.14	5.08
W	0.02	0.05	0.04	0.05	0.04	0.01	0.01	0.00	0.22	4.39
WNW	0.02	0.02	0.03	0.04	0.04	0.01	0.02	0.00	0.19	5.37
NW	0.01	0.02	0.05	0.04	0.08	0.08	0.02	0.01	0.30	6.18
NNW	0.02	0.04	0.03	0.08	0.16	0.23	0.08	0.00	0.64	6.92
N	0.02	0.04	0.09	0.09	0.23	0.15	0.04	0.00	0.66	6.18
CALM									0.17	
TOTAL	0.53	1.01	1.72	2.21	4.43	3.33	0.64	0.02	14.06	5.89

NUMBERS BELOW BASED ON ALL OBSERVATIONS
NUMBER OF INVALID OBSERVATIONS = 481
NUMBER OF VALID OBSERVATIONS =34542

7

TABLE 2.6-8

OBSERVATIONS PER DAY - 24
OBSERVATIONS PER INPUT FIELD - 1
TIME CORRECTION IN HOURS - 0.00
WIND SPEED INPUT IN MPH
WIND DIRECTION INPUT IN DEGREES
STABILITY INPUT AS DELTA-T (DEG F)

DATA PERIOD - JUL 21, 1973 THROUGH SEP 30, 1977
MONTHS CONSIDERED - JAN THROUGH DEC
HOURS CONSIDERED - 0 TO 2400
ANEMOMETER HEIGHT - 10 METERS
DELTA-T LEVELS - 10.0 TO 60.0 METERS
STABILITY CLASS - G (EXTREMELY STABLE)

WIND FREQUENCY DISTRIBUTION
FREQUENCY IN PERCENT
OF TOTAL OBSERVATIONS

WIND SECTOR	WIND SPEED CLASS (MPH) 0.76 TO 2.00	2.01 TO 3.00	3.01 TO 4.00	4.01 TO 5.00	5.01 TO 7.00	7.01 TO 10.00	10.01 TO 15.00	GREATER THAN 15.00	TOTAL	MEAN SPEED
NNE	0.04	0.06	0.12	0.24	0.31	0.20	0.02	0.00	0.98	5.67
NE	0.02	0.04	0.21	0.42	0.68	0.29	0.02	0.00	1.69	5.70
ENE	0.02	0.07	0.19	0.27	0.59	0.11	0.03	0.00	1.29	5.47
E	0.05	0.07	0.11	0.28	0.45	0.15	0.01	0.00	1.12	5.40
ESE	0.02	0.07	0.08	0.12	0.26	0.11	0.00	0.00	0.66	5.35
SE	0.03	0.06	0.06	0.11	0.19	0.13	0.00	0.00	0.58	5.52
SSE	0.03	0.03	0.04	0.06	0.19	0.14	0.01	0.00	0.48	6.10
S	0.04	0.05	0.07	0.07	0.15	0.16	0.02	0.00	0.56	5.88
SSW	0.01	0.03	0.05	0.06	0.10	0.07	0.00	0.00	0.32	5.37
SW	0.04	0.04	0.05	0.07	0.08	0.07	0.01	0.00	0.36	5.23
WSW	0.02	0.05	0.03	0.03	0.03	0.02	0.00	0.00	0.18	4.19
W	0.02	0.03	0.04	0.04	0.08	0.05	0.01	0.00	0.26	5.43
WNW	0.02	0.01	0.02	0.03	0.09	0.05	0.01	0.00	0.23	5.78
NW	0.02	0.04	0.05	0.06	0.10	0.07	0.01	0.00	0.35	5.41
NNW	0.03	0.04	0.06	0.10	0.14	0.08	0.01	0.00	0.46	5.33
N	0.03	0.05	0.11	0.09	0.13	0.11	0.01	0.00	0.52	5.34
CALM									0.08	
TOTAL	0.44	0.72	1.29	2.06	3.58	1.80	0.16	0.00	10.13	5.48

NUMBERS BELOW BASED ON ALL OBSERVATIONS
NUMBER OF INVALID OBSERVATIONS = 481
NUMBER OF VALID OBSERVATIONS =34542

7

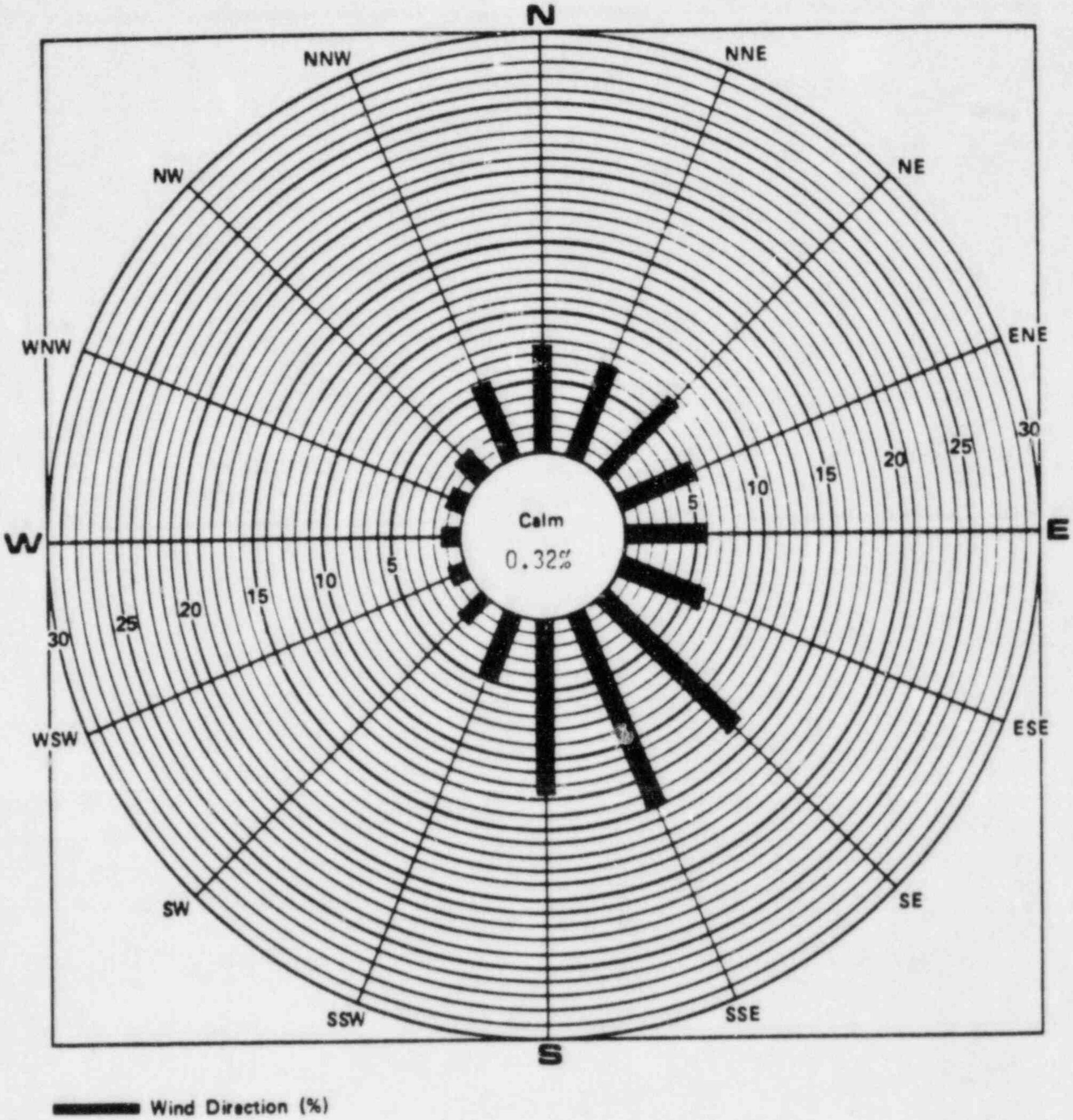
Table 2.6-25 has
been deleted.

TABLE 2.6-27 has
been deleted.

Table 2.6-28 has been deleted.

Table 2.6-29 has
been deleted.

Table 2.6-30 has
been deleted.



July 21, 1973 - July 20, 1976;
October 1, 1976 - September 30, 1977

SOUTH TEXAS PROJECT
UNITS 1 & 2

FIGURE 2.6-1

SOUTH TEXAS PROJECT
GROSS WIND ROSE
10 meter level

Amendment 7

Figure 2.7-7

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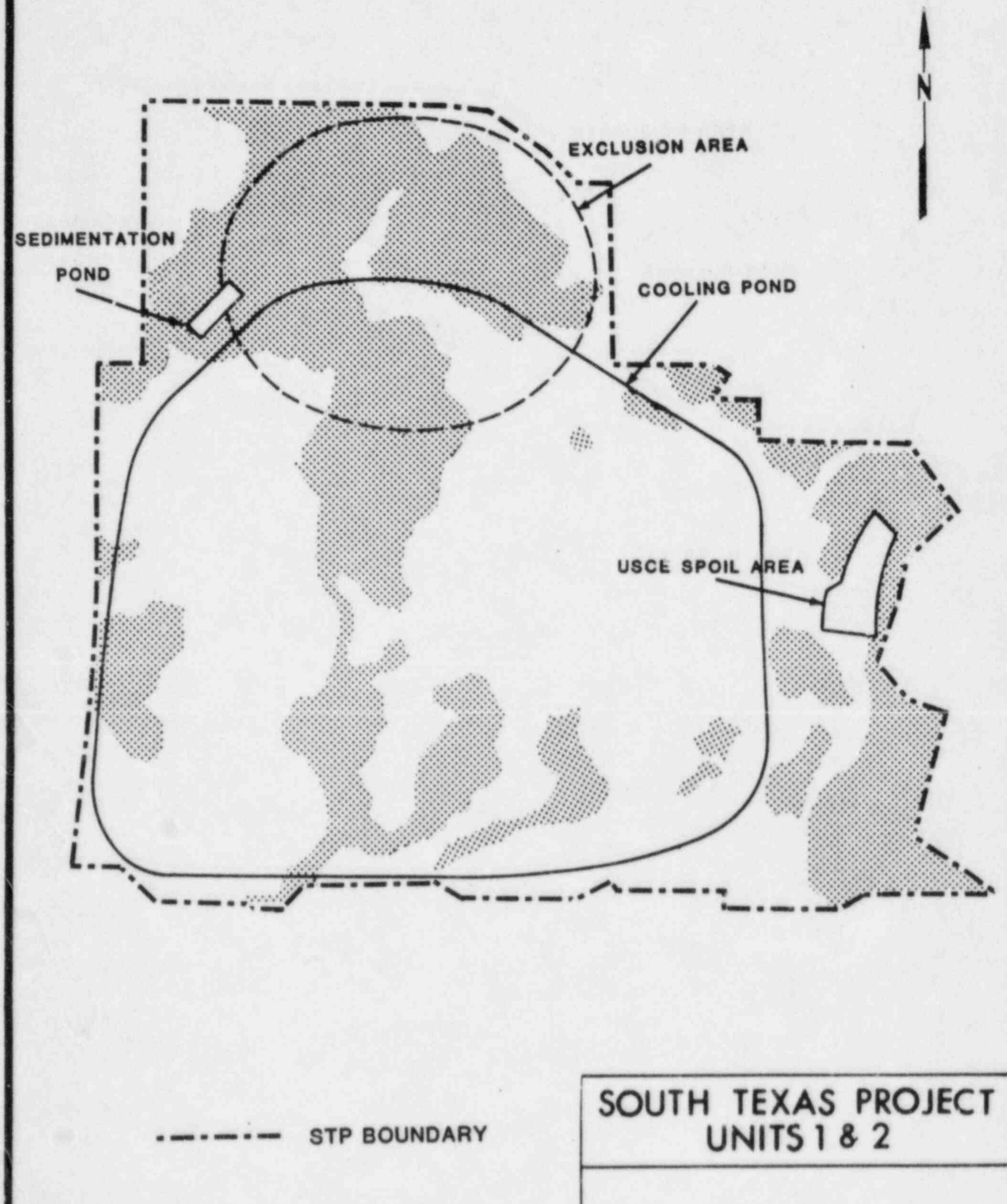


SOUTH TEXAS PROJECT
UNITS 1 & 2

PRIME FARMLAND SOILS

FIGURE 2.7-8

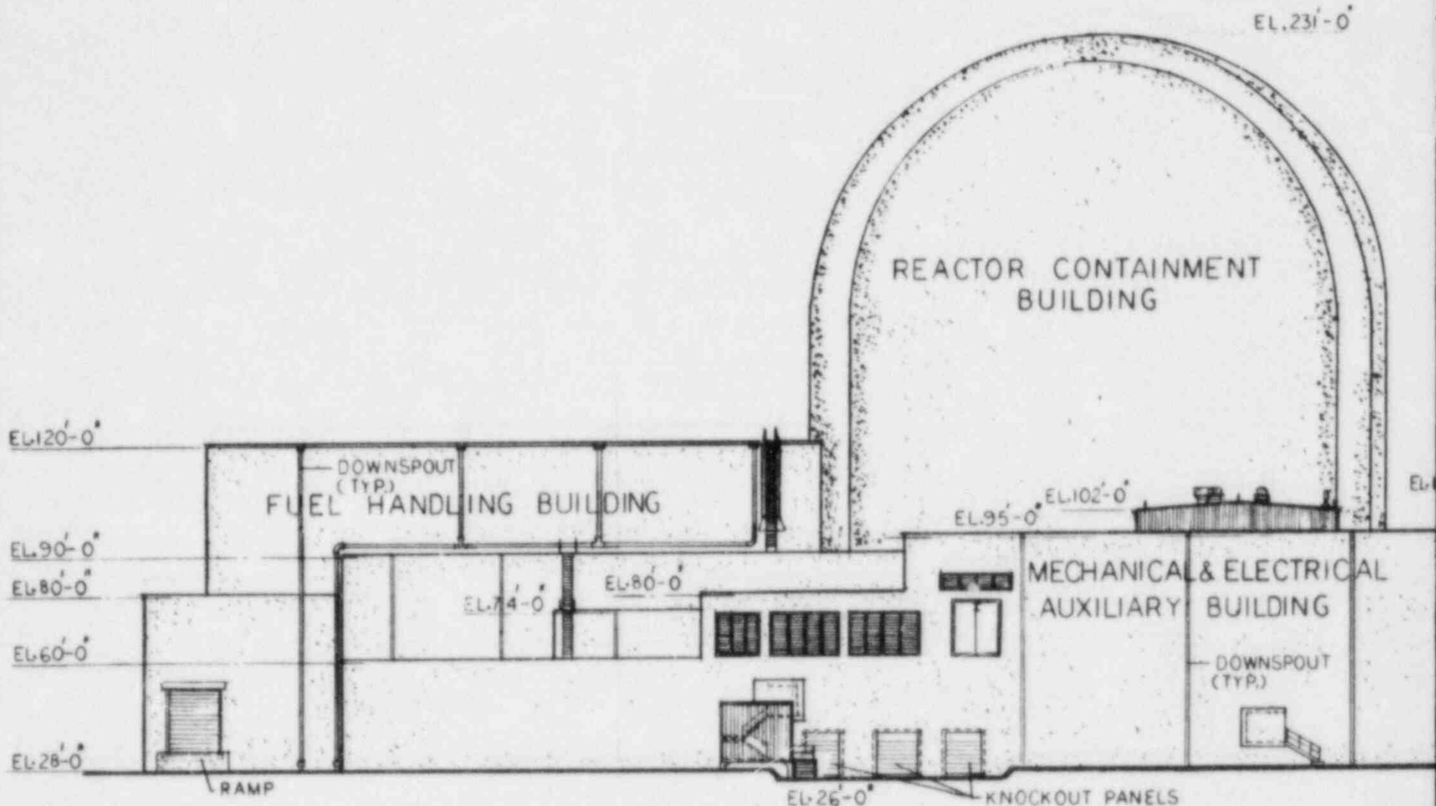
Amendment 7

CHAPTER 3

THE PLANT

3.1 EXTERNAL APPEARANCE

The external appearance of the plant is governed by the size, shape, and function of the plant components. Architectural treatment of building exteriors is designed to minimize visual impact. The plant's exterior consists of gray concrete and neutral-colored metal siding. Seeding of prominent areas enhances the appearance of the facility. Exterior elevation drawings of STP Units 1 and 2 appear on Figures 3.1-1 through 3.1-4. The STP site is located in Matagorda County as shown on Figure 3.1-5. A plot plan of the facility showing the arrangement of the buildings with exhaust release points and their respective elevations is shown on Figure 3.1-6. 7



EL.231'-0"
REACTOR CONTAINMENT BUILDING
EL.120'-0"
DOWNSPOUT (TYP.)
FUEL HANDLING BUILDING
EL.102'-0"
EL.95'-0"
EL.90'-0"
EL.80'-0"
EL.74'-0"
EL.80'-0"
MECHANICAL & ELECTRICAL AUXILIARY BUILDING
EL.60'-0"
DOWNSPOUT (TYP.)
EL.28'-0"
RAMP
EL.26'-0"
KNOCKOUT PANELS

EAST ELEVA

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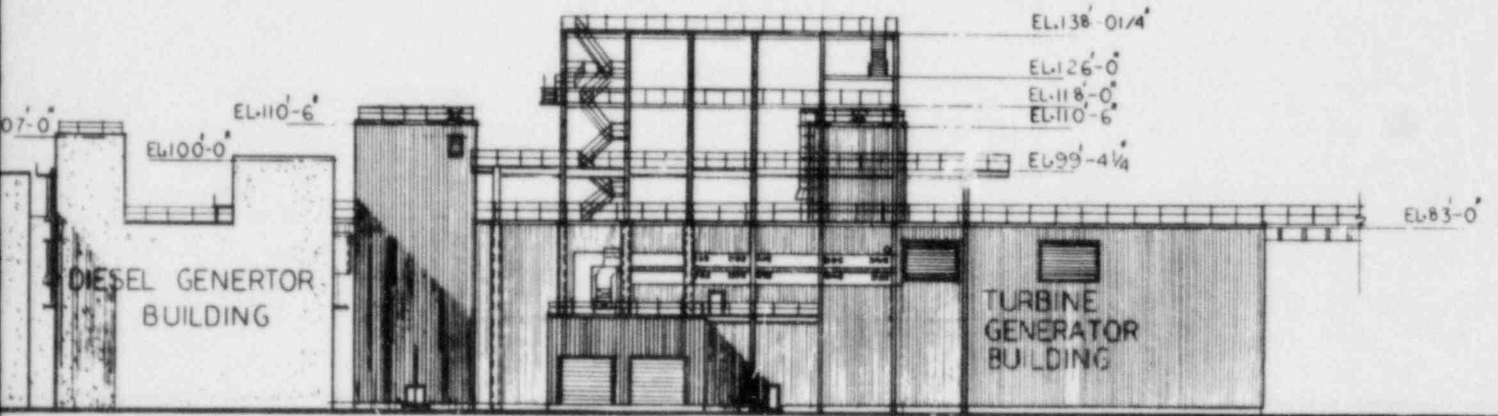

TION

SOUTH TEXAS PROJECT
UNITS 1 & 2

PLANT PROFILE
EAST ELEVATION

Figure 3.1-1

SCALE: 1" = 30'-0"

AMENDMENT 7

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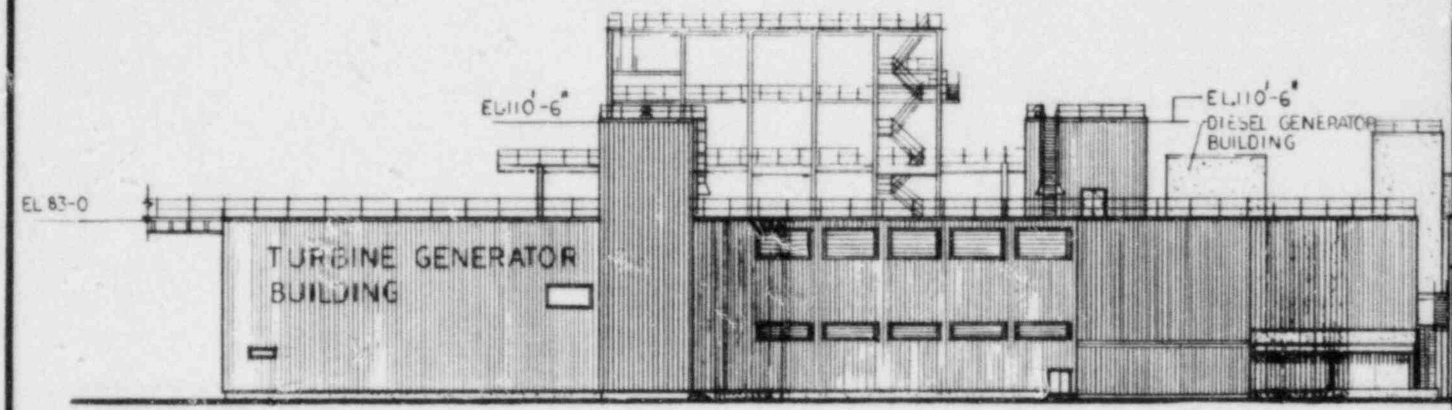
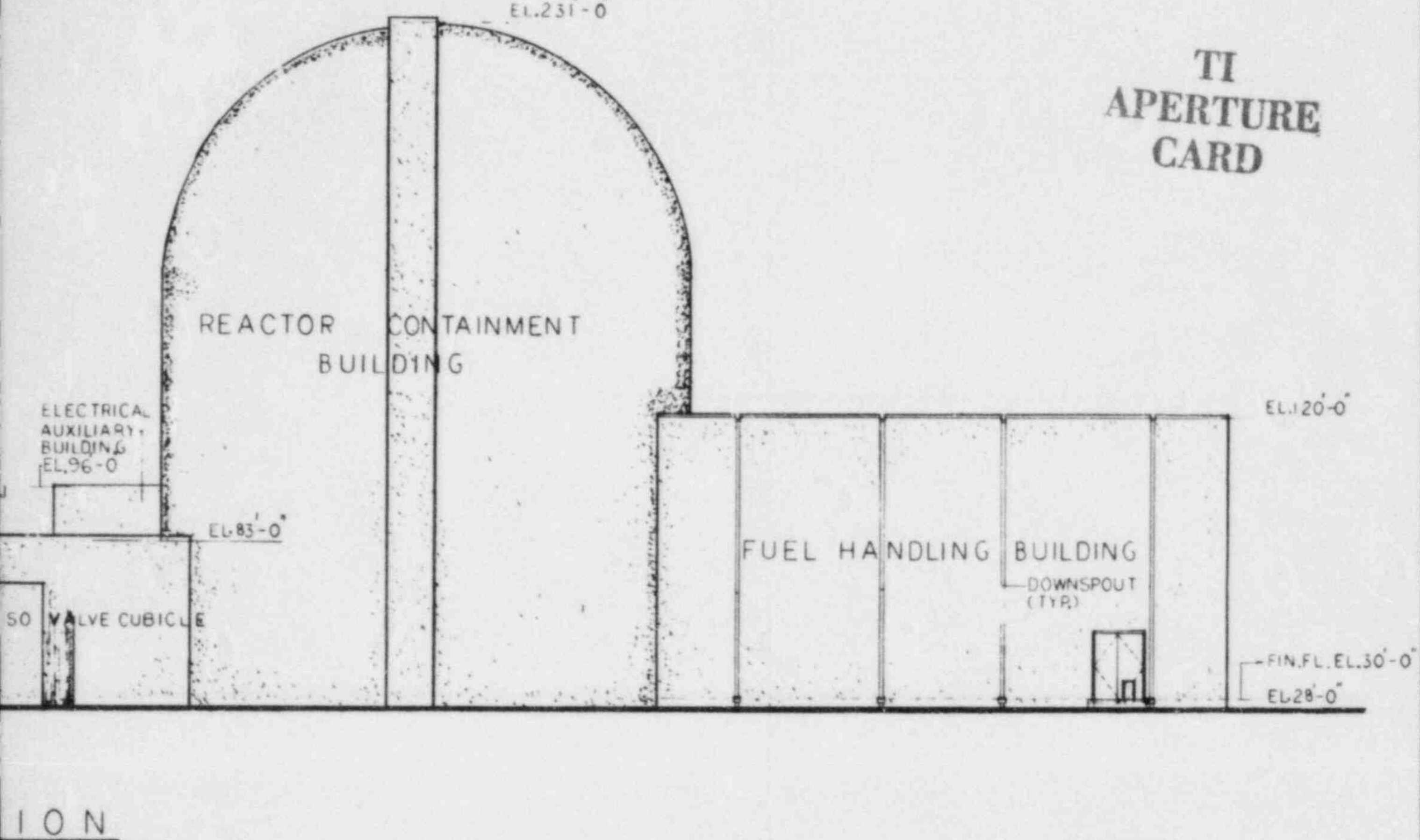

EL110'-6"
EL 83-0
TURBINE GENERATOR
BUILDING
EL110'-6"
DIESEL GENERATOR
BUILDING

WEST ELEVAT



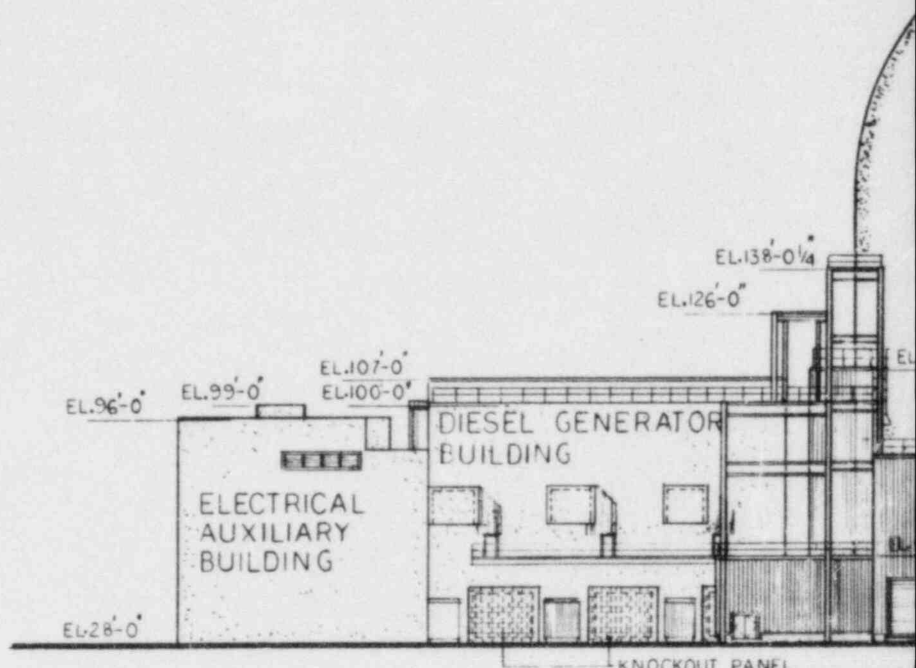
SOUTH TEXAS PROJECT
UNITS 1 & 2

PLANT PROFILE
WEST ELEVATION

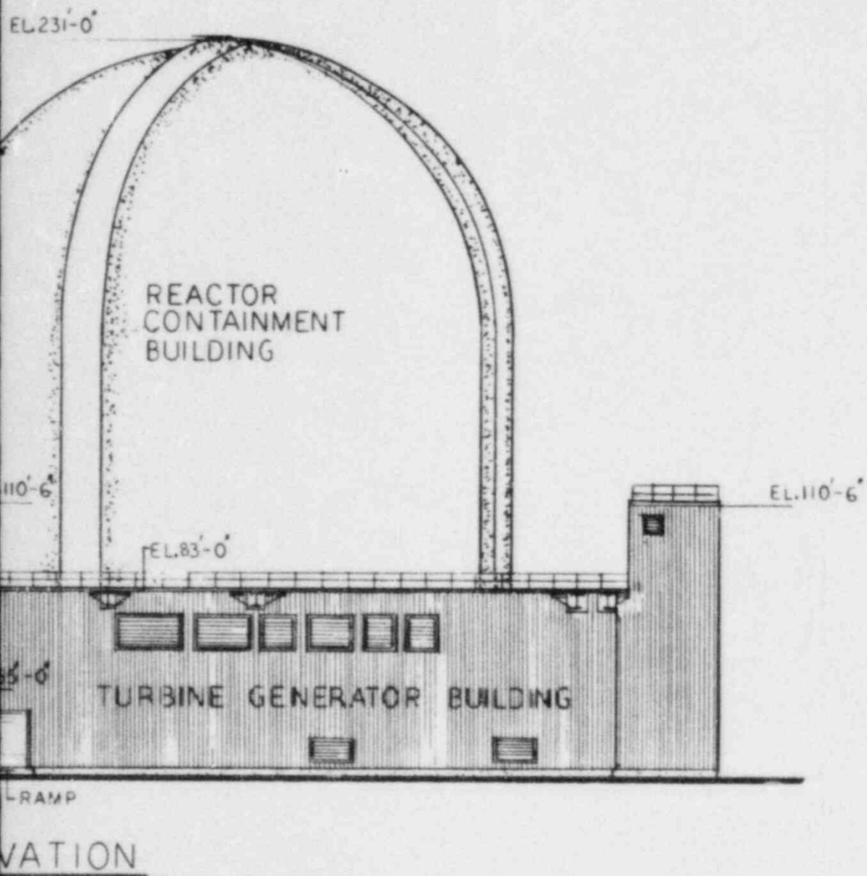
Figure 3.1-2

SCALE: 1" = 30'-0"

AMENDMENT 7


EL.138'-0 1/4"
EL.126'-0"
EL.107'-0"
EL.100'-0"
EL.99'-0"
EL.96'-0"
DIESEL GENERATOR BUILDING
ELECTRICAL AUXILIARY BUILDING
EL.28'-0"
KNOCKOUT PANEL

NORTH ELE



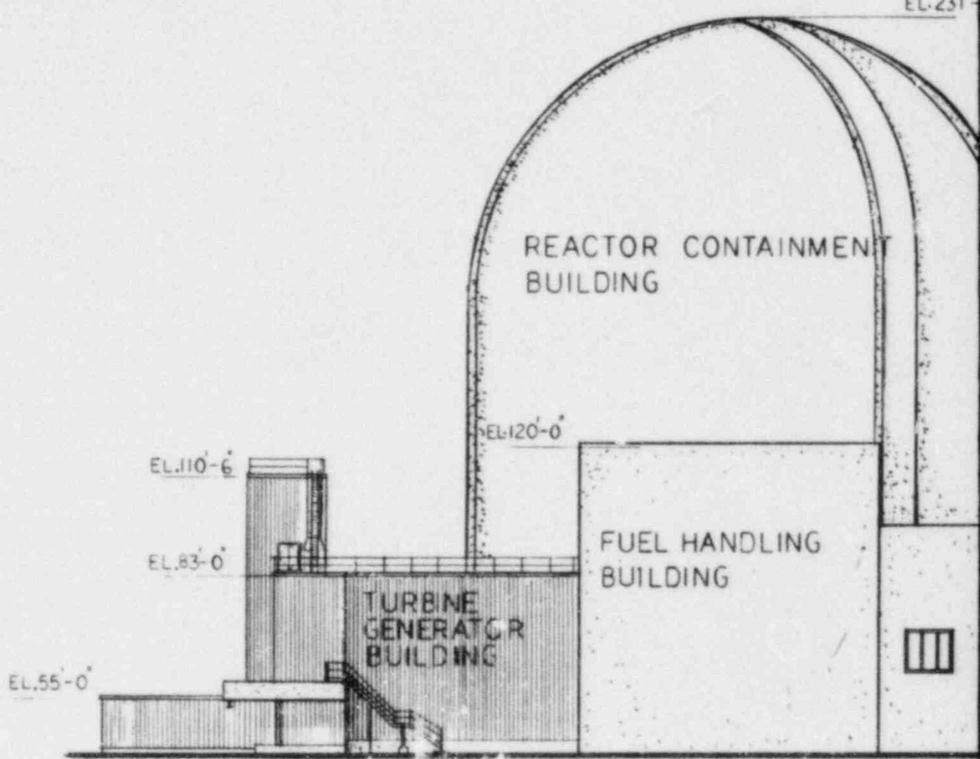
SOUTH TEXAS PROJECT
UNITS 1 & 2

PLANT PROFILE
NORTH ELEVATION

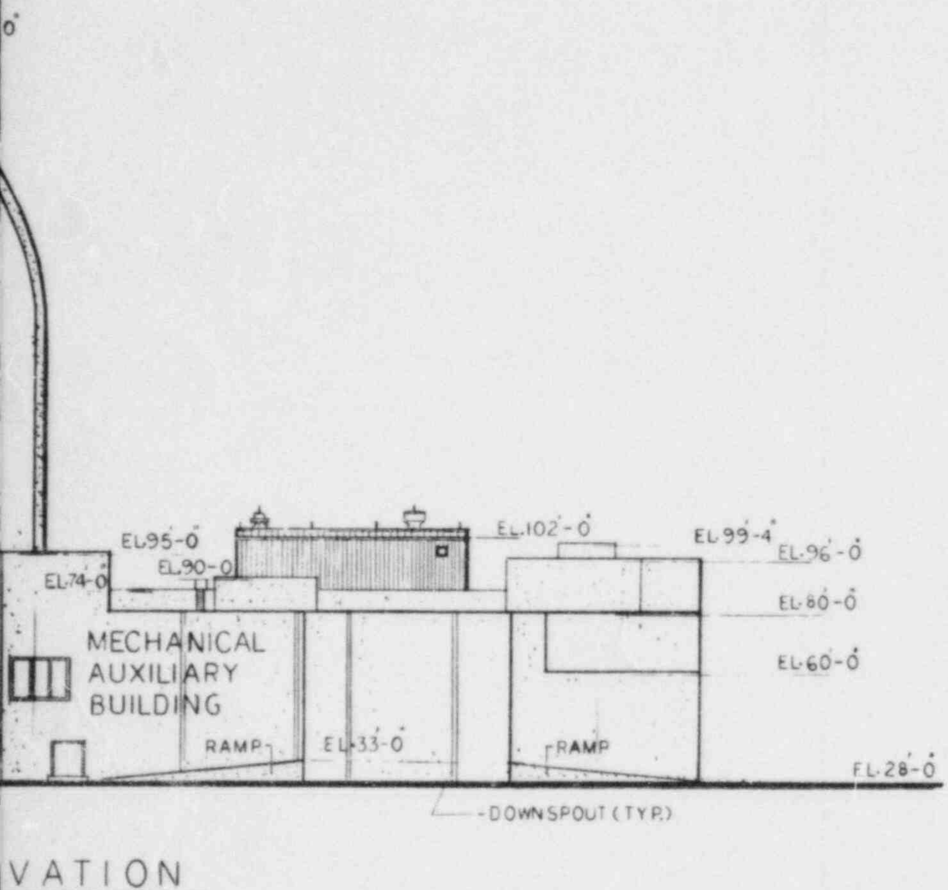
Figure 3.1-3

SCALE: 1"=30'-0"

AMENDMENT 7


EL.231'-
REACTOR CONTAINMENT
BUILDING
EL.120'-0"
EL.110'-6"
EL.83'-0"
FUEL HANDLING
BUILDING
TURBINE
GENERATOR
BUILDING
EL.55'-0"

SOUTH ELE



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SOUTH TEXAS PROJECT UNITS 1 & 2

PLANT PROFILE
SOUTH ELEVATION

Figure 3.1-4

SCALE: 1" = 30'-0"

AMENDMENT 7

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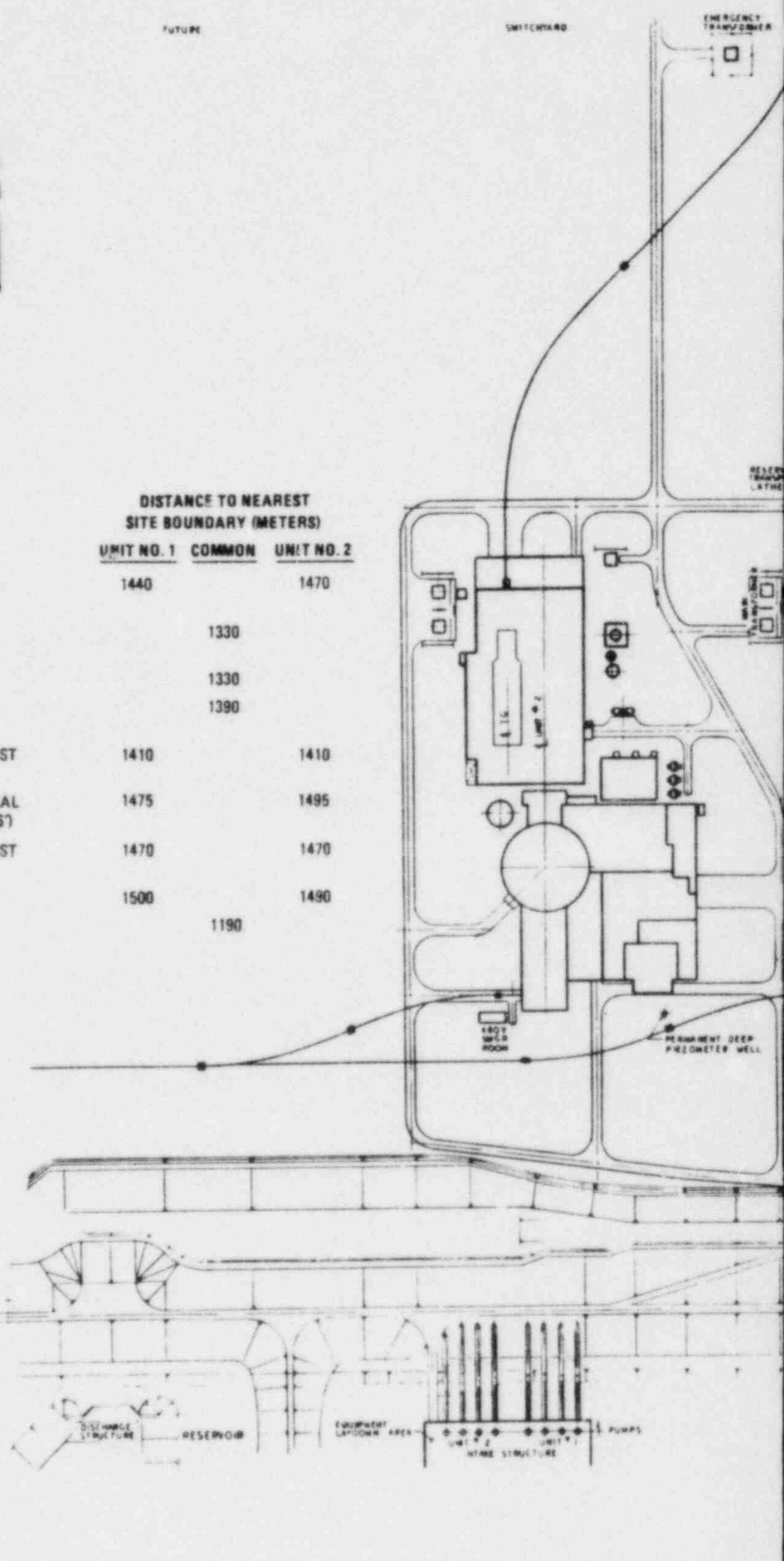
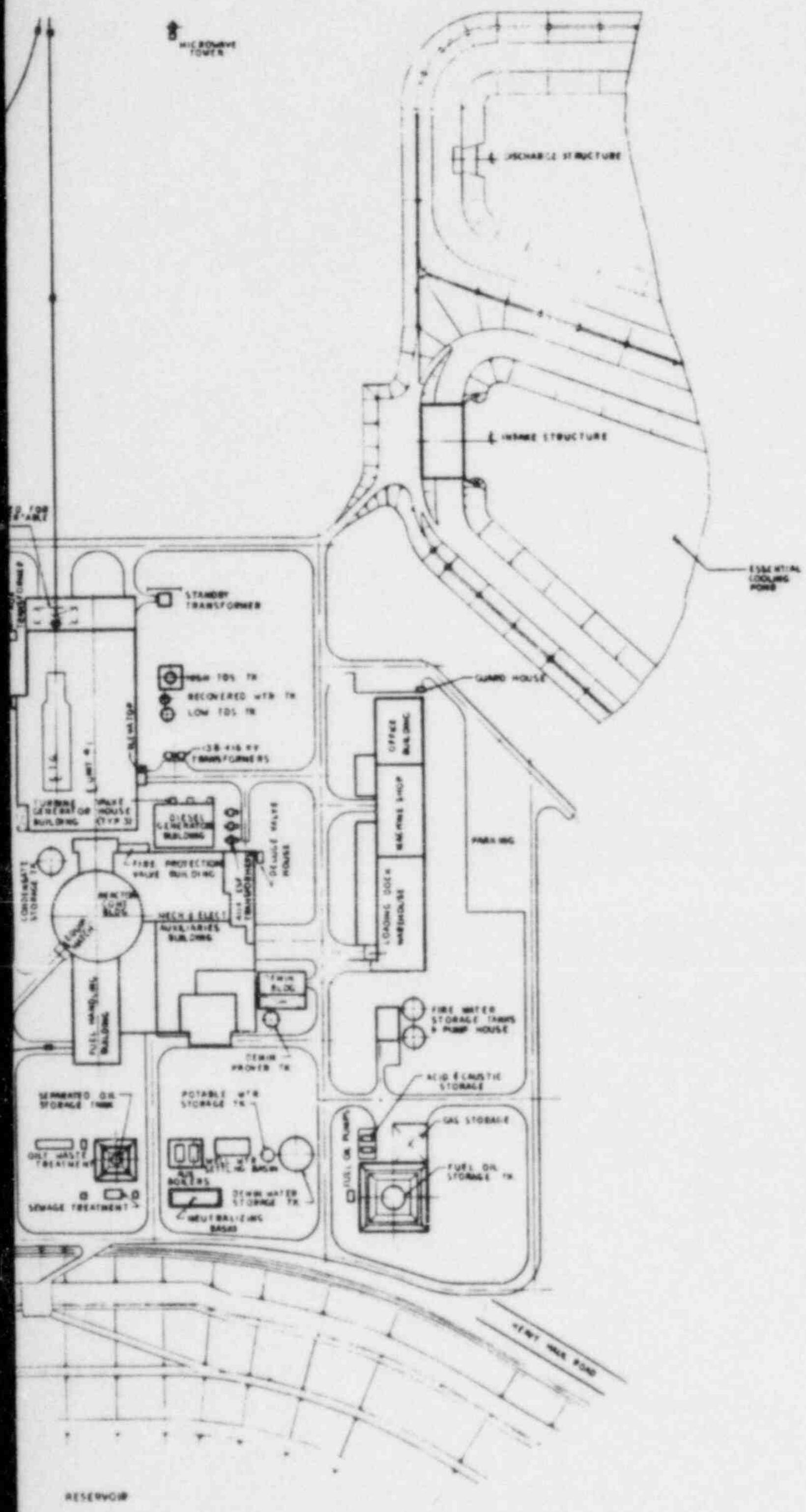
POINTS AND ELEVATIONS ABOVE GRADE OF GASEOUS AND LIQUID RELEASES	DISTANCE TO NEAREST SITE BOUNDARY (METERS) UNIT NO. 1	COMMON	UNIT NO. 2
1. DIESEL GENERATOR COMBUSTION AND VENTILATION EXHAUST (EL. 95')	1440		1470
2. ADMINISTRATION BUILDING VENTILATION EXHAUST (EL. 50')		1330	
3. WAREHOUSE VENTILATION EXHAUST (EL. 50')		1330	
4. DEMINERALIZER BUILDING VENTILATION EXHAUST (EL. 37', 39')		1390	
5. TURBINE GENERATOR BUILDING VENTILATION EXHAUST (EL. 29', 55')	1410		1410
6. ELECTRICAL PORTION OF MECHANICAL AND ELECTRICAL AUXILIARIES BUILDING VENTILATION EXHAUST (EL. 96')	1475		1495
7. MAIN STEAM VALVE STRUCTURE VENTILATION EXHAUST (EL. 85')	1470		1470
8. PLANT MAIN EXHAUST DUCT (EL. 96')	1500		1490
9. ALL LIQUID DISCHARGES EL. 0')		1190	





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SOUTH TEXAS PROJECT
UNITS 1 & 2

PLOT PLAN

FIGURE 3.1-6 AMENDMENT 7

8412280081-08

3.2 REACTOR AND STEAM ELECTRIC SYSTEM

Each unit utilizes a four-loop, pressurized water reactor (PWR) Nuclear Steam Supply System (NSSS) and supporting auxiliary systems designed by Westinghouse Electric Corporation. The rated core thermal power of each unit is 3,800 MWt, which corresponds to an NSSS thermal output of 3,817 MWt and a unit net electrical power output of 1,250 MWe at 3.4 in. Hg abs. backpressure.

The reactor is fueled with uranium dioxide sintered fuel pellets in sealed zircaloy-4 fuel rod tubes. There are 193 fuel assemblies, each with a 17 x 17 rod array consisting of 264 fuel rods, 24 control rod guide tubes, and one thimble instrumentation tube. The initial core consists of three regions. Region 1, the center region, is 1.[illegible] weight percent (U235/U238) enriched; region 2 is 2.2 weight percent enriched; and region 3, the outermost core region, is 2.9 weight percent enriched. Approximately one-third of the core will be reloaded at approximately annual intervals with 2.8 to 3.3 weight percent enriched fuel.

The thermal energy released from the core is transported by the reactor coolant system to the steam generators which use this energy to produce saturated steam that drives the turbine generator. A flow diagram for the NSSS is shown on Figure 3.2-1. Exhaust steam from the turbine generator and other miscellaneous flows from the cycle are condensed in the main condenser, and the condensate is pumped through the feedwater heaters back to the steam generators.

The maximum guaranteed heat balance from the steam and power conversion system, based on 3.5 in. Hg abs. condenser backpressure, is shown on Figure 3.2-2. Station heat rates for 75 percent and 50 percent unit loads (also based on 3.5 in. Hg abs. condenser backpressure) are shown in Table 3.2-1.

Water for condensing the steam in the condenser is taken from the cooling reservoir and returned to the cooling reservoir through a system of pumps and piping as described in Section 3.4.

The plant main exhaust is 96 feet above mean sea level (see Figure 3.1-4); grade is 28 feet above mean sea level.

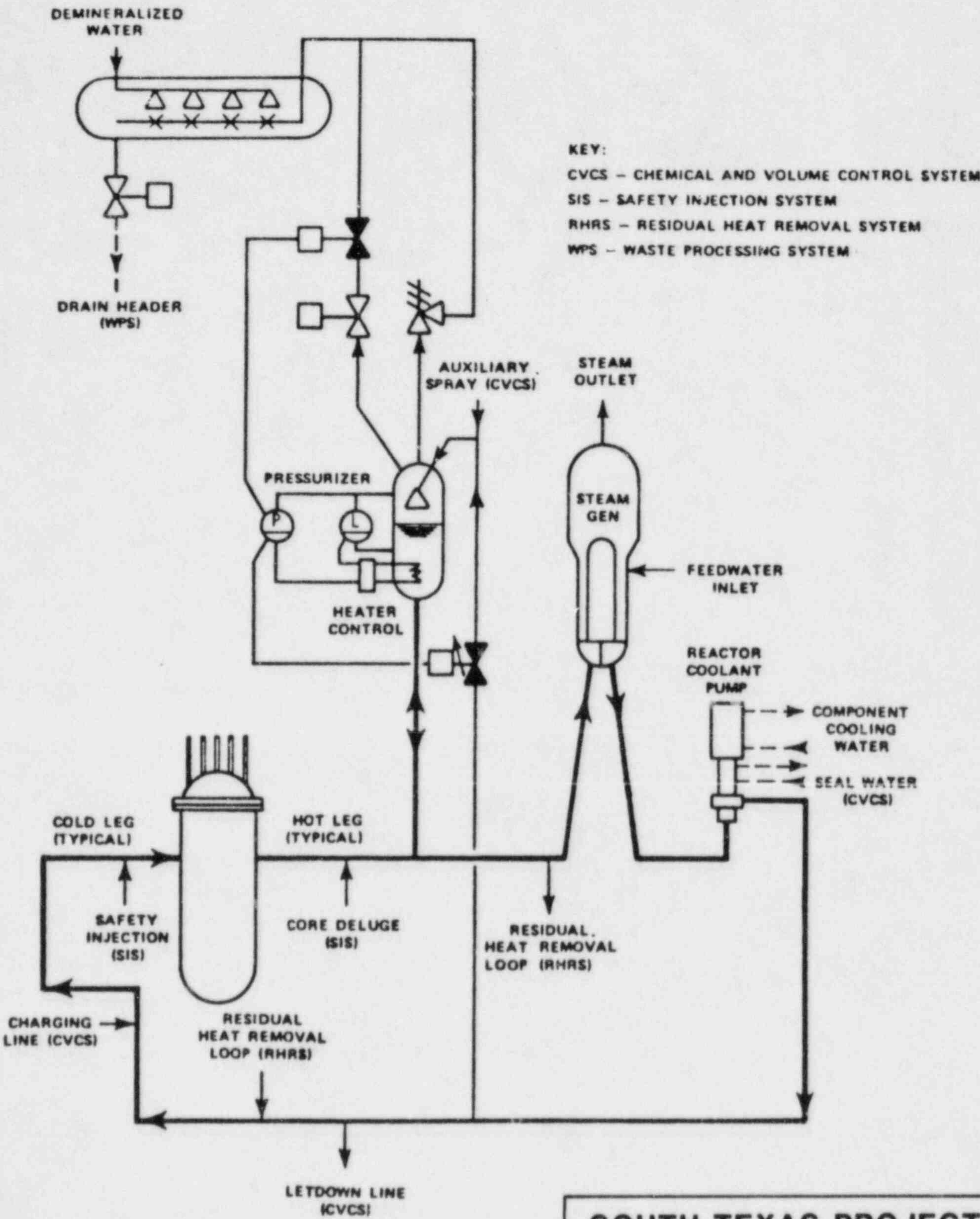
TABLE 3.2-1

PARTIAL LOAD UNIT HEAT RATES[1]

75% Unit load: Net heat rate = 11,092 $\frac{Btu}{Kwh}$

50% Unit load: Net heat rate = 12,527 $\frac{Btu}{Kwh}$ 7

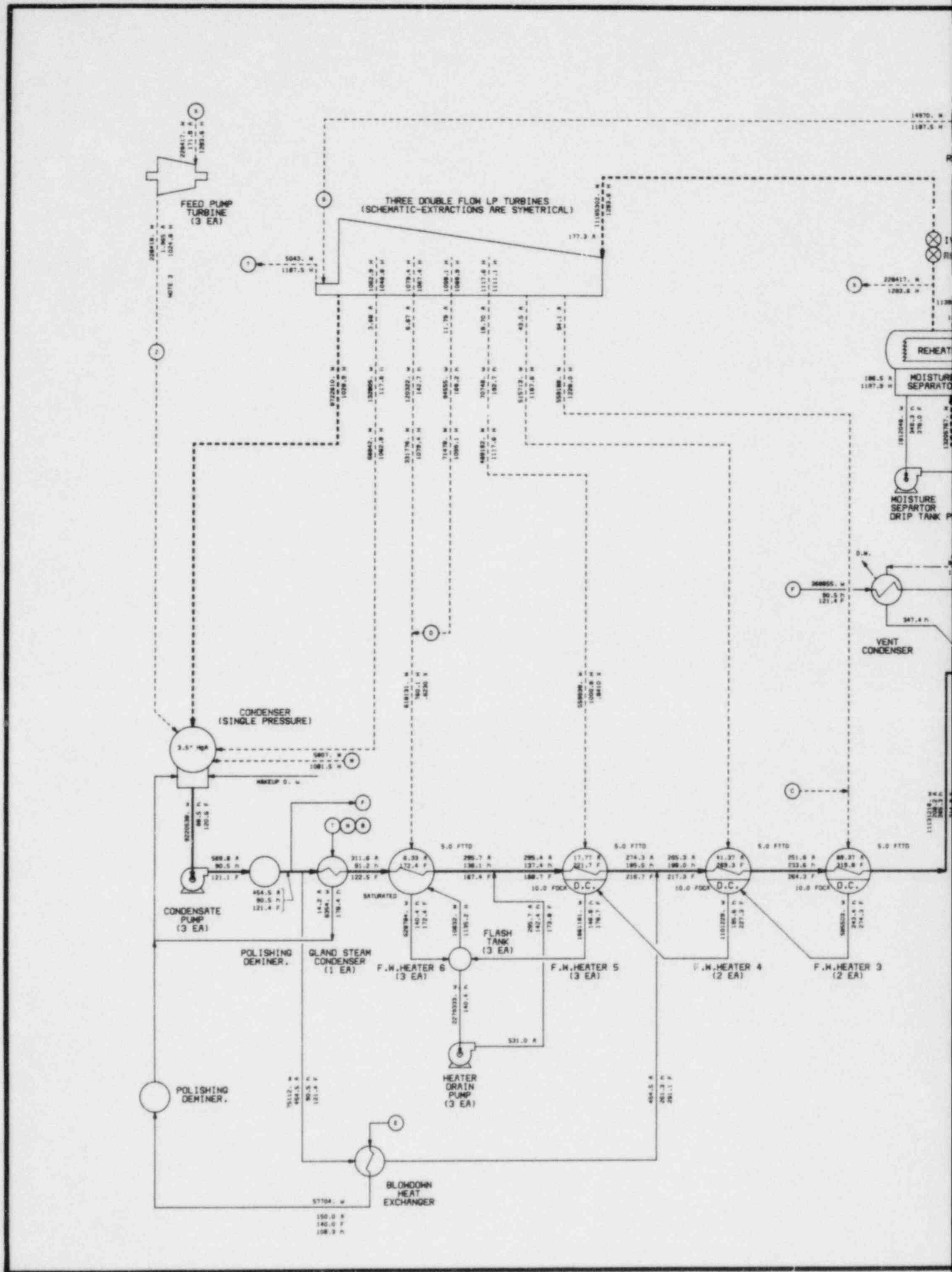
[1]Heat rates based on 3.5 in. Hg. abs. condenser backpressure.

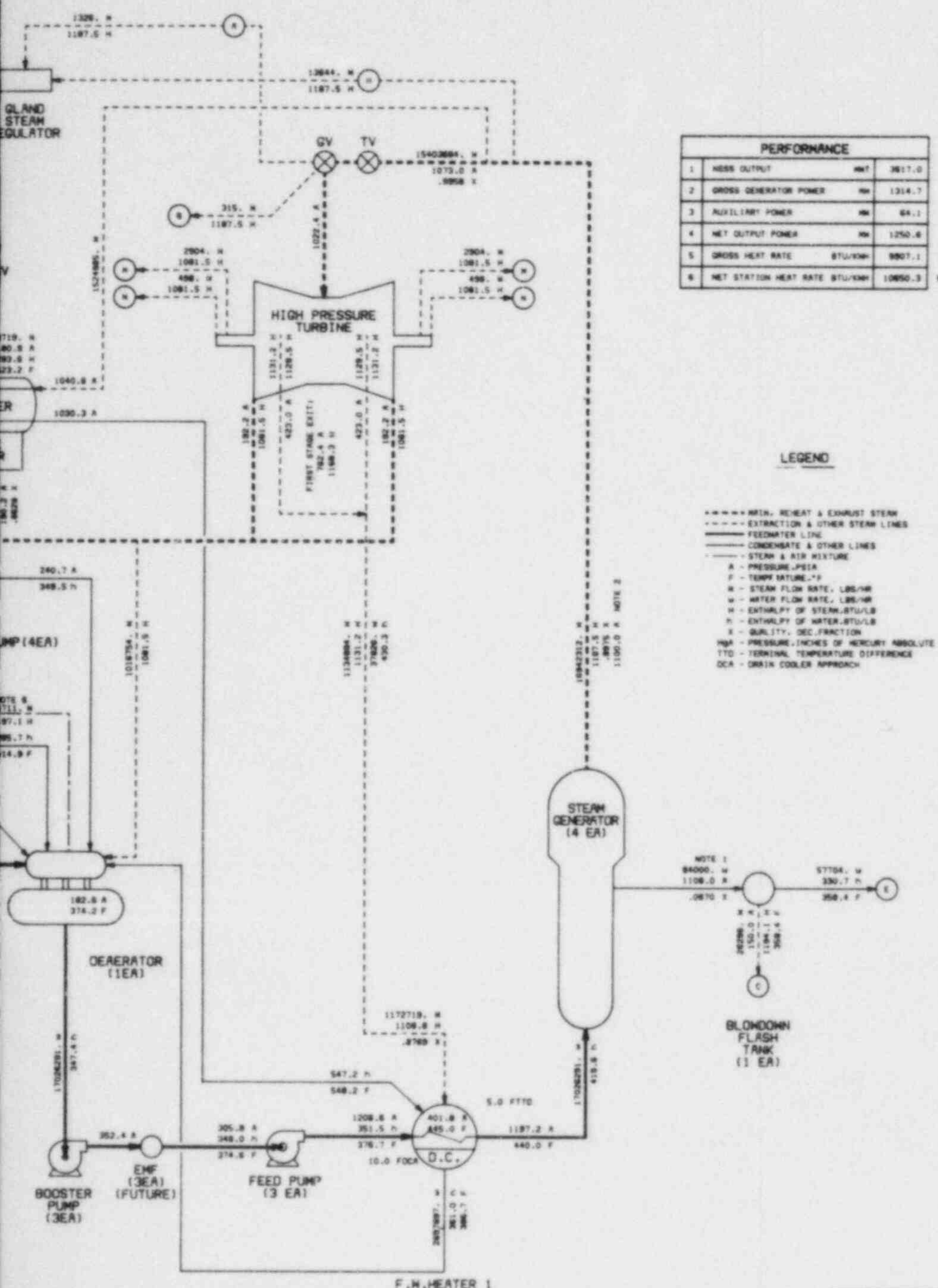


SOUTH TEXAS PROJECT
UNITS 1 & 2

NUCLEAR STEAM SUPPLY SYSTEM
FLOW DIAGRAM

Figure 3.2-1 Amendment 7


FEED PUMP
TURBINE
(3 EA)
THREE DOUBLE FLOW LP TURBINES
(SCHEMATIC-EXTRACTIONS ARE SYMETRICAL)
REHEAT
MOISTURE
SEPARATOR
MOISTURE
SEPARATOR
DRIP TANK P
VENT
CONDENSER
CONDENSER
(SINGLE PRESSURE)
MAKEUP 0. w
CONDENSATE
PUMP
(3 EA)
POLISHING
DEMINER.
GLAND STEAM
CONDENSER
(1 EA)
F.W.HEATER 6
(3 EA)
FLASH
TANK
(3 EA)
F.W.HEATER 5
(3 EA)
F.W.HEATER 4
(2 EA)
F.W.HEATER 3
(2 EA)
HEATER
DRAIN
PUMP
(3 EA)
POLISHING
DEMINER.
BLOWDOWN
HEAT
EXCHANGER
5.0 FTTD
10.0 FDCA
D.C.
SATURATED



PERFORMANCE			
1	NSSS OUTPUT	MWT	3817.0
2	GROSS GENERATOR POWER	MW	1314.7
3	AUXILIARY POWER	MW	64.1
4	NET OUTPUT POWER	MW	1250.6
5	GROSS HEAT RATE	BTU/KWH	9907.1
6	NET STATION HEAT RATE BTU/KWH		10850.3 NOTE 5

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NOTES:

1. BLOWDOWN BASED ON WESTINGHOUSE CURVES SSE-1421, SSE-1417, SSE-1447.
2. STEAM GENERATOR OUTLET PRESSURE BASED ON WESTINGHOUSE CURVE SSE-1204. PRESSURE DROP TO THROTTLE IS 30 PSI AT MAX. CALC. VWO. (SQUARE LAW FOR LOWER LOADS).
3. EXHAUST ENTHALPY OF AUXILARY TURBINE IS FROM WESTINGHOUSE PROPOSAL (B&R SPEC., ATTACHMENT A, DOCUMENT 8S109MS033-E)
4. TTD'S AND DCA'S BASED ON B&R CURVES, DOCUMENTS 9S139XQ482PAF THRU 9S139XQ487PAF
5. NET STATION HEAT RATE BASED ON REACTOR AND PRIMARY LOOP EFFICIENCY=99.75%, STEAM GENERATOR EFFICIENCY =99.5%, TOTAL HEAT LOSSES IN THE TURBINE CYCLE=1.2%, AUX. POWER AS SHOWN PERFORMANCE ITEM 3.
6. VENT STEAM FLOW TO VENT CONDENSER EQUAL 0.005 LB/LB OF DEAERATOR FLOW.

SOUTH TEXAS PROJECT UNITS 1 & 2

RATED POWER HEAT BALANCE

Dwg. No. 9S019F22512 Rev. A

Figure 3.2-2

AMENDMENT 7

8412280081-09

TABLE 3.3-1 3

PLANT WATER USE FOR TWO UNITS[a]
(Flow in gpm)

Figure 3.3-1 Line Number	System	Flow
1	Well Water Supply	Norm. 750
2	RMS Seal Water	Min. 72
3	Water Treatment	c
4	Fire Protection Tank[b]	c
5	Potable	Norm. 45
5a	Sewage Treatment	c
5b	Leaks	c
6	Demineralization	Norm. 225
7	Secondary Plant Use	c
7a	Intermittent Systems	c
7b	Condensate Polisher	Norm. 225
8	Reactor Plant Use	c
9	Building Drains	c
10	Radwaste	c

7

[a] All values and loads are based on an expected average year.

[b] As required.

[c] Will be provided later. 7

3.4 HEAT DISSIPATION SYSTEM

In accordance with the discussion in the Introduction to Regulatory Guide 4.2, Revision 2, pertaining to the "Applicant's Environmental Report- Operating License Stage," this section is not addressed except to note the following changes, since no updating of the corresponding material presented in the Environmental Report--Construction Permit Stage (ER-CP) was necessary.

3.4.1.2 Essential Cooling Pond

The maximum flood elevation in the essential cooling pond was increased from 28.8 to 31.0 ft. This increase resulted from a change in the normal maximum operating elevation from 25.0 feet above mean sea level, previously, to 26.0 feet above mean sea level and from a revision in the Probable Maximum Precipitation (PMP) estimate. The change in normal maximum operating level was due to a refinement in design which permits the normal operating range, i.e., between elevations 26.0 and 26.6, to stay above the elevation at which plant shutdown is initiated, i.e., elevation 25.5. This change does not alter any of the environmental conclusions discussed in the ER-CP Stage. 7

3.4.1.3 Spillway for the Cooling Reservoir

The maximum design flow rate for the reservoir spillway was previously indicated as 4,300 cubic feet per second. The final design is 4,200 cubic feet per second. This difference results from a refinement in design. The change is not considered environmentally significant.

In the ER-CP Stage, Section 3.4.1.3, a discussion of an excavated channel to divert flood flows in the west branch of the Colorado River through the spillway discharge channel was presented. In the final design, this channel was omitted since, during times of high flow in the Colorado River, it would cause waters to back through the spillway channel and inundate the west branch. Under the final design, flood flows in the west branch will create a backwater effect until water overtops the north portion of the spillway discharge channel where it crosses the west branch. These floods, however, usually correspond to floods in the Colorado River which result in high water levels in the spillway discharge channel as well. No significant environmental impact is expected to result from this change.

3.4.1.5 Reservoir Makeup Facilities

Final design of the makeup pumping facilities resulted in some changes to the number of traveling screens, width of traveling screens, and design of trash racks. These changes do not alter any of the environmental conclusions discussed in the ER-CP.

The reservoir makeup facilities are required to divert water from the Colorado River into the cooling reservoir to make up water lost to evaporation, blowdown, and seepage and to offset storage loss due to the intermittent operation of the station. The location of the makeup facilities, shown in Figure 3.4-1, is the same as that described in the ER-CP. The facilities consist of 7 a traveling water screen intake structure, a sharp crested weir, and a 538,800 gallon-per-minute (1,200 cfs) capacity pump station. The reservoir makeup facilities are shown on Figure 3.4-2. The screened intake structure consists of coarse trash racks, stop log guides, and 24 sets of 10-foot wide traveling

water screens. The mesh size for the traveling water screens is 3/8 inch. The trays on the screens collect the trash while traveling upward. They are cleaned by water jets from the screen wash pumps which wash the collections in the trays down to a sluice.

The trash rack on the upstream side of the screen intake structure is a coarse bar screen for the purpose of excluding large objects, such as floating logs, from the vicinity of the traveling water screens. This trash rack consists of a series of bays 12.5 feet in width extending from elevation -10.1 to elevation 21.0 feet mean sea level with an incline from the river toward the structure of 2.1 horizontal units to 12 vertical units. The trash rack will be supported on each side of each bay by a slotted beam and on the bottom by the concrete foundation of the screen intake structure. As shown on Figure 3.4-2, there are 28 complete trash rack bays. The racks consist of 3/8-inch steel bars at 3-3/8-inch centers held vertically by steel support framing on the back. They are assembled in sections (four sections to a bay) for ease of placement. The spacing of the bars is uninterrupted in the vertical plane sufficient to permit the "teeth" of the trash rake to pass from the bottom to top in its removal of trash.

The traveling screens are placed inside the area cordoned by the trash racks and are aligned parallel to river flow along the west bank of the Colorado River as shown on Figure 3.4-2. A typical traveling screen is shown on Figure 3.4-3. Figure 3.4-4 shows the trays placed at the fore front of the concrete sidewall supports to allow free passage of fish at the face of the upstream tray. As can be seen on Figure 3.4-2, 24 screens with 3/8-inch mesh are provided with their bottom elevation at -10.0 feet mean sea level and the base on the equipment housing for the head terminal at elevation 21.0 feet mean sea level. The effective area of a 10-foot width of traveling screens is 67.9 percent of the gross area of the screen. Consequently, for 24 sets of traveling screens and a water surface elevation in the Colorado River at the makeup pumping facilities of -1.0 foot mean sea level, the net area will be 1,230 square feet. |7

The operation of the traveling water screens will be intermittent since the operation of the makeup pumping station is intermittent. The sluice which receives debris is capable of being diverted either to the river or to the trash baskets located at each end of the structure. During times of collection of excessive amounts of debris, the trash basket will be used. During times of collection of excessive numbers of fish, fish collected on the screens will be returned by way of the sluice back to the river. The design of the intake structure complies with criteria of the Environmental Protection Agency in that it provides free passage for fish. The maximum design approach velocity to the traveling screens is 0.50 feet per second based on a maximum pumping rate of 538,800 gallons per minute and a corresponding minimum elevation of -0.95 feet mean sea level. |7 Elevation -0.95 feet mean sea level is determined by assuming a water surface elevation of -1 foot mean sea level at the crossing of the Gulf Intracoastal Waterway (GIWW) and the Colorado River with an upstream freshwater inflow of 2,480 cubic feet per second passing through the Bay City gage. This is the minimum riverflow required to permit 538,800 gallons per minute to be pumped. Figure 2.5-12 of the ER-CP indicates that 99.98 percent of the time, the water surface elevation at the GIWW is above -0.95 feet mean sea level; or the water surface elevation at the GIWW is elevation -1.0 foot mean sea level or lower 0.02 percent of the time. In addition, by examining Figure 2.5-5 of the ER-CP, it can be seen that a river

flow of 2,480 cubic feet per second is equalled or exceeded about 21% of the time. The probability of occurrence of a flow of 2,480 cubic feet per second during the 0.02 percent of time which produces the design maximum approach velocity of 0.50 feet per second is therefore concluded to be inconsequential. 7

A sharp-crested weir, 300 feet long, is located between the screen intake structure and the pumping structure. The crest elevation is set at elevation -2.2 feet mean sea level which would allow inflow of the upper strata of river flow to ensure the best available quality of intake water. Two siltation basins, one on each side of the weir (Figure 3.4-2), are constructed to provide a quiescent zone where settleable sediment conveyed by the makeup water can settle out. The basin will be subject to periodic dredging. Dredgings from the siltation basin will be disposed of on site in the vicinity of the cooling reservoir makeup intake pump facility.

The pump station consists of four pumps with a capacity of 107,760 gallons per minute (240 cfs) and four pumps with a capacity of 26,940 gallons per minute (60 cfs). Each pump occupies an individual sump to avoid flow interference with other pump operations. The flow will be discharged into header manifolds connecting to two 1.2-mile long, 108-inch-diameter pipe lines leading to a discharge structure in the reservoir. The makeup discharge structure has a protected apron and baffle blocks to dissipate the energy of the makeup pump discharge prior to its entry into the reservoir (Figure 3.4-5). The invert of the 108-inch lines passing through the embankment is placed above the maximum level for standard project flood at 50.5 feet above mean sea level to prevent backflow during high reservoir water levels. The water discharges into a plunge pool which dissipates the energy and distributes the flow evenly across the 30-foot width of the apron. The water then passes over the approach weir to the apron and flows between and over the baffles, down the apron located on the interior slope of the embankment to the reservoir water surface.

None of the above described changes are considered to have changed the environmental conclusions of the ER-CP.

The circulating water discharge structure was indicated in the ER-CP as being 750 feet west of the circulating water intake structure. The final design indicates this to be 740 feet. Similarly, the invert elevation of the discharge levies was indicated as 7 feet above mean sea level in the ER-CP. Final design has located them at 8.25 feet above mean sea level. All of the above changes are the result of refinements in design and do not alter the environmental acceptability of the structure.

3.6 CHEMICAL AND BIOCIDE WASTES

3.6.1 CHEMICAL WASTE SYSTEMS

Nonradioactive chemical wastes are produced by the following major systems:

1. Makeup demineralizer water system (MDWS)
2. Chemical cleaning wastes (startup)
3. Condensate polishing demineralizer system (CPDS)
4. Auxiliary boiler blowdown
5. Oily waste treatment
6. Circulating water system (CWS)

Wastes released by the six systems listed above are produced by chemical additives used in the particular process.

The wastes discharged from these systems fall into three basic categories as follows:

1. Floating materials such as oils, grease, and other solids that are lighter than water are treated in the oily waste treatment unit as described in Subsection 3.6.1.5.

2. Suspended matter consists of insoluble material that results in turbidity or coloring of system waste effluents, for example, that which might result from backwashing the demineralization system or from chemical cleaning.

3. Dissolved solids make up the greatest part of the chemical wastes discharged by the above systems. The greatest producers of dissolved substances are the MDWS and CPDS which use acid and caustic in the process.

No significant quantity of sludge is produced by the MDWS because the water is supplied from wells and will not require pretreatment, chemical precipitation, or clarification. Biocide treatment of the condenser's circulating cooling water is discussed in Section 3.6.2.

3.6.1.1 Makeup Demineralizer Water System

The MDWS provides high quality make-up water primarily to the steam cycles of the plant's two power units. The MDWS consists of two sodium cation softeners, three cartridge filters and four reverse osmosis banks followed by two 7
parallel demineralizer trains, each having a cation bed, an anion bed, and a mixed bed. The two demineralizer trains share a vacuum degasifier and acid and caustic regeneration systems. The two sodium cation softeners have a capacity of 400 gallons per minutes each and supply softened feed water to the reverse osmosis system. The reverse osmosis system has a product capacity of 7
468 gallons per minute and a maximum brine flow of 144 gallons per minute corresponding to a 75-percent recovery. Each demineralizer train has an operating capacity of 220 gallons per minute. The degasifier has a maximum capacity of 440 gallons per minute and reduces the carbon dioxide concentration to 10 parts per million (as CO_2). Each cation unit contains 173 cubic feet of strongly acidic cation resin. The cation resin is regenerated with sulfuric acid. Each anion unit contains 99 cubic feet of strongly basic 7
anion resin. The anion resin is regenerated with 4-percent sodium hydroxide. Each mixed-bed unit contains 30 cubic feet of macroporous cation resin and 30 cubic feet of macroporous anion resin. The mixed-bed units are regenerated in place.

Regenerant rinse from sodium cation softeners and the brine flow from the
reverse osmosis unit are routed to the plant neutralization basin. 7

At normal operating condition, reverse osmosis product water is treated by one
demineralizer train. Under this condition, each cation unit will produce
1,300,000 gallons of water per service run and will require regeneration every
98 hours. Each anion unit will produce approximately 590,000 gallons of water 7
per service run and require regeneration every 45 hours. The mixed-bed unit
is regenerated periodically.

The maximum amount of waste water produced when each train is regenerated is
about 49,500 gallons. The brine waste from the reverse osmosis system is
approximately 210,000 gallons per day maximum. 7

The maximum production of regenerant waste occurs when the reverse osmosis
unit is out of service. Under this condition, the sodium cation softeners, 7
the cation and anion demineralizers remove the majority of the ionic impurities from the well water and are followed by the mixed-bed demineralizer,
which produces the required effluent quality. However, because of the increase
in dissolved solids loading, the cation and anion unit service runs are
reduced to 6 and 11 hours, respectively. The mixed-bed unit requires regeneration every 75 hours. The maximum amount of waste water produced, both
primary trains and one mixed-bed unit being regenerated, is 49,500 gallons.

The reverse osmosis product analysis on which the design of the MDWS was based
shows that the main constituent of the influent cations is sodium, which
necessitates the use of countercurrent regeneration when regenerating the
primary cation units. The analysis also shows that over half of the total
anions are made up of bicarbonate alkalinity which is economically removed as
carbon dioxide by the degasifier, thereby reducing the volume of anion resin
required in the primary units. The resulting backwash, spent regenerant, and
rinse wastes are collected in the makeup demineralizer equalization pit. At 7
the regenerant dosages specified above and based on a normal day's regeneration schedule, the resulting day's waste solution has a pH between 10.0 and
11.0. Wastes are equalized and neutralized to a pH of 6 to 8 in the neutralization pit. The neutralized waste is pumped from the neutralization pit to
the plant neutralization basin prior to sending it to the circulating water
outfall. This process is represented schematically on Figure 3.6-1.

The well water fed to the reverse osmosis unit requires acidification to prevent $CaCO^{3}$ precipitation in the reverse osmosis module due to the concentration effect. The acid dosage is 0.54 pounds of 66°B sulfuric acid per 1,000 7
gallons of feedwater. For one day's operation at 360 gallons per minute of
feedwater, 280 pounds of acid are used. The quantities of chemicals used per 7
regeneration are 1,038 pounds of 66°B sulfuric acid for the cation unit, 594
pounds of 100-percent sodium hydroxide for the anion unit, 180 pounds each of
66°B sulfuric acid and 100-percent sodium hydroxide for the mixed bed unit.
Therefore, under normal operating conditions, the quantities of chemicals used
per day for regeneration average 1,100 pounds of 66°B sulfuric acid and 650
pounds of 100-percent sodium hydroxide. Total sulfuric acid used per day by
the MDWS is about 1,382 pounds. 7

There is no seasonal variation in the amount or quality of wastes discharged
by the MDWS. The primary cause of variation in the discharge quantity and
quality is operational demand.

Table 3.6-1 lists the volumetric waste water flows resulting from each step in the regeneration schedule for one regeneration of a train consisting of cation bed, anion bed, and mixed bed.

Table 3.6-2 presents an approximate waste water analysis resulting from a day's maximum regeneration schedule.

3.6.1.2 Chemical Cleaning Wastes (Startup)

Before initial plant startup, and before any radioactive material is introduced into the reactor, the internal surfaces of the reactor vessel and all piping and equipment of the primary coolant system are subjected to flushing and the secondary feedwater condensate system is subjected to hot alkaline cleaning to ensure removal of any grease, oil, and other preservatives that might be present in the condensate feedwater and shell sides of heaters. Cleaning of the reactor and primary coolant system is in accordance with Westinghouse specification PS597760. All piping and components of the reactor core are flushed with water. Initial flushing removes nondissolvable material such as metal chips, turnings, dust, cloth, or like material.

The condensate feedwater system is subjected to alkaline cleaning with a solution of demineralized water containing the following chemicals:

1. 6% chelant solution.

2. Ammoniated EDTA (ethylene diamine tetra acetic acid) with 0.2% to 0.3% inhibitor and 0.5% surfactant.

The cleaning temperature will be 180°F to 200°F. The solution will be recirculated through the contractor's heat exchanger to maintain the cleaning temperature. The cleaning solution will remove iron oxide, oils and protective coatings that may be present in the condensate, feedwater and shell-sides of the heaters. The inhibitor and surfactant are biodegradable and the constituents are not considered to be hazardous material.

The chemical wastes, rinses and passivating solutions will be routed, to the organics basin and chemical-cleaning waste pond. The chemical wastes will be processed in the metal cleaning waste section of the non-radioactive chemical waste system for removal of iron and the resultant solution will be neutralized in the neutralization basin. The neutralized solution will be pumped to the main cooling reservoir. 7

The auxiliary boiler will be subjected to alkaline cleaning with a solution of demineralized water containing the following chemicals:

1. 2,000 ppm trisodium phosphate (2,000 ppm $Na_3 PO_4$ or 4,600 ppm $Na_3 PO_4 . 12 H_2O$)

2. 1,000 ppm disodium phosphate ($Na_2 HPO_4$)

3. Compatible wetting agent

The alkaline cleaning solution contains a 0.1-percent wetting agent, which is a biodegradable detergent surfactant such as Halliburton's Pen-Six, or equal.

Flushing water will be treated and sampled prior to discharge to the reservoir to ensure that water quality standards are met. If water quality standards are not met, flushing water will be trucked off-site. 7

3.6.1.3 Condensate Polishing Demineralizer System

The function of the CPDS is to remove impurities from the condensate stream and to produce a high-quality effluent capable of meeting chemistry specifications for feedwater to the steam generator.

The CPDS is located between the condensate pump discharge and the gland steam
condenser and consists of seven cation bed demineralizers followed by seven 7
mixed bed demineralizers and their associated regeneration equipment. A
bypass valve is provided to allow manual routing of the condensate flow around
the CPDS during startup or with the occurrence of high differential pressure
across the CPDS. 7

Equipment is provided for external regeneration of the demineralizer resins.
The regenerant waste is collected and monitored for radioactivity. If radioactivity in excess of prescribed limits is detected, the wastes are neutralized and transferred to the collection tank in the liquid waste processing
system (LWPS). When the radioactivity concentration in the regenerant wastes
is below prescribed limits, the wastes are transferred to the plant neutral- 1
ization basin.

The normal operating condition is with the mixed bed in the hydrogenated form, 7
no primary-to-secondary steam generator leakage and acceptable condenser
inleakage. Under this condition, the frequency of regeneration is twelve
cation charges and six mixed bed charges per day. However, the minimum rate
of regeneration will be limited to about one-half of these values by the time
required to sample and transfer the regenerate waste. The waste volumes are 7
as follows:

- cation bed - 26,800 gallons
- mixed bed - 42,000 gallons

For two-unit operation, the maximum number of polisher vessel regenerations
per day that the external regeneration system can complete is two cation resin
charges per day and one mix bed charge per week. 7

3.6.1.4 Auxiliary Boiler Blowdown

The plant has two oil-fired auxiliary boilers. Each boiler is able to produce
145,000 pounds of steam per hour. Makeup water for the boilers is taken from
the plant demineralized water storage tank. Since this makeup water is
extremely low in solids, not more than 9 gallons of blowdown per minute from
each boiler is expected. 7

3.6.1.5 Oily Waste Treatment

Small amounts of oily wastes may occasionally result from the normal operation
of equipment in the turbine-generator building, diesel generator building,
machine shop, firewater pumping building, and lighting diesel generator 7
building. The floor drains of that building are therefore connected to an
oily waste surge tank. The surge tank content is routinely processed through
a gravity oil separator, and skimmer. This system also serves to contain 7
spills which may result from equipment failures, although the probability of
such failures is remote.

In the event of a power transformer failure, any oil spilled will be collected
in the curbed transformer area. The oil or oil-water mixture is transferred
by gravity to the oily waste surge tank. The oil-water mixture is transferred
by pump to a gravity separator and skimmer along with an air floatation unit 7
to reduce the total oil content to less than 15 milligrams per liter. The
effluent water is pumped to the plant cooling reservoir. The separated oil is
transferred to a storage tank and disposed of offsite by a licensed con-
tractor.

3.6.1.6 Circulating Water System

Each of the plant's two units is served by a condenser having 96,234 titanium 7
tubes. No corrosion inhibitors are added to the circulating water stream.
Tube fouling by biological growths is treated by sodium hypochlorite injection
and is discussed below.

3.6.1.7 Steam Generator Blowdown System

During power plant operation the steam generator blowdown is routed back to
the condenser hotwell through filters and mixed bed demineralizers. The mixed 7
bed resins are not regenerated. Depleted resin is replaced with a fresh
charge and disposed of as a potentially radioactive solid waste.

3.6.2 BIOCIDE WASTE SYSTEM

Each unit is served by a three-shell condenser and uses the cooling reservoir to supply circulating water. Four circulating pumps are interconnected by a common discharge header serving the condenser. The effluent from the three shells is discharged through a common effluent header into the cooling reservoir.

The actual operating chlorine dosage is determined by a residual chlorine
monitor located in the condenser's effluent header. When the free chlorine
residual reaches 0.2 parts per million, an alarm is sounded. Thus the chlo- 7
rine dosage is controlled so that a chlorine residual of no more than 0.2
parts per million remains in the condenser effluent being discharged to the
cooling reservoir.

Chlorine in the form of a sodium hypochlorite solution is applied periodically
to the circulating water intake structure and the essential cooling water
system pump intake structure to control slime growth in the condenser tubes 1
and in the circulating water lines. Shock treating is performed three times a
day using 20-minute chlorination periods. The interconnection of the circu-
lating water pumps necessitates shock treatment of all three of the condenser

shells at once. The shock chlorination of the total 907,400 gallons per minute circulating water, 52,500 gallons per minute essential cooling water and 23,294 gallons per minute auxiliary cooling water flow is accomplished with a maximum dosage of 6 parts per million for three 20-minute periods a day by the onsite sodium hypochlorite generation system. With two units in operation, the amount of hypochlorite solution required will be doubled.

The total residual chlorine present in the condenser effluent being discharged to the reservoir is the sum of the free available chlorine and the combined available chlorine, which is chlorine in chemical combination with ammonia or organic nitrogen compounds. The total Kjeldahl nitrogen (total organic nitrogen plus ammonia) of the Colorado River fluctuates throughout the year from 0.37 to 0.69 milligrams per liter as nitrogen at the point along the river where the reservoir makeup is taken. The fraction of the concentrated reservoir Kjeldahl nitrogen which combines with the sodium hypochlorite during each 20-minute cooling water treatment period cannot be established.

The hypochlorite solution from the hypochlorination system is diffused into the intake bay of each pump.

The actual chlorine dosage is subject to seasonal variation. During the summer months, with the increased chlorine demand, the maximum dosage of 6 parts per million may be required whereas in the cooler winter months, a lesser chlorine dosage may suffice.

TABLE 3.6-3

SUMMARY OF PLANT NONRADIOACTIVE CHEMICAL WASTE FLOWS

Chemical Composition (ppm as substance)	Reservoir at Four Cycles Concentrations	Plant Makeup Demineralization	Chemical Cleaning** Waste After Treatment (Plant Initial Startup)	Condensate Polishing Demineralizer	Effluent of Oily Waste Treatment
Na^+	Later	1,027	--	Later	--
Ca^{2+}	--	22.4	--	--	--
Mg^{2+}	--	5.8	--	--	--
HCO_3^-	--	122	--	--	--
Cl^-	--	118.6	--	--	--
SO_4^{2-}	--	1,753	--	--	--
PO_4^{3-}	--	--	--	--	--
Suspended solids	--	--	--	--	$\angle$10ppm***
TDS	--	3,078	--	--	--
pH	--	6-8	--	--	--
Flowrate	--	--	--	--	--
Maximum	--	49,500 gal	--	--	--
Minimum	--	44,155	Later		
Discharge schedule	--	Once daily	Once before each unit startup		

7

** Will be trucked off-site.

*** Solids present in the insoluble oil.

Unit 2 is scheduled for startup 24 months after Unit 1.

3.7 SANITARY AND OTHER WASTE SYSTEMS 7

3.7.1 DESCRIPTION OF SANITARY WASTES

The design operating population of the two-unit plant is 500 persons. The quantity of discharges is based on an average flow of 30 gallons per day per
capita. This rate of flow, which complies with the standards of the Texas 7
Department of Health, results in a flow of approximately 15,000 gallons per day for a two-unit plant when an allowance for groundwater infiltration is included. The organic content is estimated to create 0.07 pounds of biochemical oxygen demand (BOD_5) per capita per day, resulting in an overall daily load of approximately 35 pounds of BOD_5. The raw sewage is expected to have approximately the composition listed in Table 3.7-1.

No poisonous, toxic, or radioactive matter or heavy metals are expected in the effluent, with the exception of the chlorine used for disinfection.

3.7.2 DESCRIPTION OF SANITARY WASTE SYSTEM

The sewage permanent collection system will consist of about 2,000 linear feet 7
of 6-inch diameter vitrified clay pipe. This gravity line will terminate at the wet-well of the lift station which pumps waste to the sewage treatment
plant. Effluent from the treatment plant is pumped into the cooling 7
reservoir.

1. Lift Station

   The lift station consists of a precast reinforced concrete structure
   which serves as a wet-well for the duplex centrifugal lift pumps. Each 7
   pump has a capacity of 100 gallons per minute.

2. Equalization Tank

   The lift station transfers the waste to a 5,000-gallon equalization tank 7
   in order to provide a regulated flow to the treatment unit. The sewage will then be transferred from the equalization tank to the aeration tank by a pneumatic ejector at a constant rate. The equaliza- tion tank will be a part of the aeration tank.

3. Aeration Tank

   Four 5,000 aeration tanks provide 32 hours of aerated detention of the
   average flow. The tanks are equipped to supply air at a rate of 140 7
   cubic feet per minute by means of blowers and submerged diffusers.

4. Clarifier

   Sedimentation is accomplished in a 5,200 gallon hopper clarifier with an 7
   overflow rate of less than 600 gallons per day per square foot.

5. Chlorination Basin

   The clarifier effluent is chlorinated during a contact period of at least 20 minutes to retain a minimum free residual of 1 part per million of chlorine as required by the Texas Department of Water Resources. Less than 1 pound of chlorine per day is the expected requirement.

6. Sludge Storage Tank/Digester

Excess sludge is wasted to a storage tank/aerobic digester, with an approximately 750 cubic foot capacity, to which air is supplied at a rate of at least 20 cubic feet per minute. The digested sludge is collected by scavenger once or twice annually and disposed onsite or offsite in accordance with applicable state, federal, and local environmental regulations. 7

3.7.3 STANDBY DIESEL ENGINE EXHAUST

Three standby diesel engines per unit are maintained at the power station for emergency use should the offsite power supply to the station be lost. Each standby diesel engine is normally operated for 1 to 2 hours per month to ensure operability should an emergency situation arise. 7

The standby diesel engines exhaust to the atmosphere through muffler systems. Effluents associated with the operation of these engines generally consist of particulates, unburned hydrocarbons, nitric oxides, various oxygenated compounds, and carbon monoxide. No treatment is planned for the effluents from the emergency diesels because of the relatively low emission quantities plus the short periods of operation required for periodic testing and for providing power when the normal power supply system is not available. The estimated discharges of sulfur dioxide and nitric oxides from the diesel engine gaseous effluent (in lbs/1,000 gal fuel) are 75 and 518 respectively. Each diesel engine burns about 300 gallons of no. 2 diesel oil per hour at its continuous rating. The opacity of the exhaust is not expected to exceed 5 percent based upon 15 second Bacharach reading at rated load.

3.7.4 AUXILIARY BOILERS

An auxiliary steam supply is required to furnish steam for the main deaerator, 7 the turbine gland seals, and waste processing when steam is not available from the nuclear steam supply system. The source of this auxiliary steam will be two oil-fired auxiliary steam boilers. The boilers will operate for approximately 720 hours per year. The maximum permitted heat input of each boiler is 185 MBtu per hour. Stack gases will discharged directly to the environment. 7

Based on firing no. 2 fuel oil with 0.5 percent sulfur, by weight, the anticipated release of SO^2 at maximum rated load is 92.5 pounds mass per hour. 7

3.7.5 NONRADIOACTIVE SOLID WASTES

Normal domestic solid wastes resulting from the plant operation will be disposed of in a manner consistent with state, federal, and local environmental regulations.

TABLE 3.7-1

EXPECTED COMPOSITION OF RAW SEWAGE

Constituent	Concentration, mg/liter
Solids, total	525
Dissolved	375
Suspended, total	150
Fixed	40
Volatile	110
Settleable solids, mg/liter	7
Biochemical oxygen demand, 5-day, 20'C	150
Total organic carbon	150
Chemical oxygen demand	350
Nitrogen (total as N)	30
Organic	12
Free ammonia	18
Phosphorus (total as P)	8
Organic	3
Inorganic	5
Chlorides	40
Alkalinity (as $CaCO_3$) (excess over-carriage water)	75

3.8 REPORTING OF READIOACTIVE MATERIAL MOVEMENT 7

The environmental impacts of transporting radioactive materials to and from nuclear power plants are presented in Summary Table S-4 of 10CFR51. 7

TABLE 3.8-1

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TABLE 3.8-2

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TABLE 3.8-3
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FIGURE 3.8-1

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CHAPTER 4

ENVIRONMENTAL EFFECTS OF SITE PREPARATION, PLANT AND TRANSMISSION FACILITIES CONSTRUCTION

4.1 SITE PREPARATION AND PLANT CONSTRUCTION

Any construction activity, regardless of the size or the extent of mitigative measures employed, will result in some degree of environmental impact or change. The impact may be temporary or permanent. Temporary impact implies that some form of restoration of the area is possible; permanent impact implies a change in the area for the life of the facilities.

Environmental impact may be further classified as adverse or beneficial. It may be beneficial to the extent that the change creates an improved environment. It may be adverse to the extent that irretrievable or irreversible changes have occurred which make the resulting environment less desirable.

The intent of this section is to address STP construction activities, to identify mitigative measures, and to assess the type and extent of the resulting impact. The construction activities discussed in this section commenced in September 1975 following issuance of the Limited Work Authorization and will continue until commercial operation of Unit 2 in June 1989. 7

4.1.1 LAND RESOURCES

The land resources affected by construction activity refer primarily to the nominal 12,300-acre site area. Site area construction will be addressed in terms of construction methods and mitigative measures as well as the effects on vegetation and wildlife.

In addition to the site area, however, impacts resulting from construction activities must also include the effects on surrounding areas in terms of transportation, noise, aesthetic, and social impacts. The presence of construction workers and attendant equipment during the period of peak construction will also be examined.

4.1.1.1 Construction Activities and Mitigative Measures

Construction facilities at the STP site are categorized as either station-related facilities or construction support facilities. Some standard construction practices which apply to all areas of construction are also presented in the following discussion.

4.1.1.1.1 Standard Construction Practices

1. Runoff and Erosion Control

   During the initial phases of construction, existing vegetation was removed to facilitate the grading of the site to design elevations. The magnitude of clearing and grading activities required a significant effort to control runoff and erosion. Generally, surface drainage from cuts, fills, spoil areas, etc., was controlled and directed to appropriate treatment areas by ditches, dikes, or berms. Drainage ditches were excavated at gradients which made their sides less conducive to erosion.

In an effort to further minimize the transportation of suspended solids to natural waterways, the following measures were implemented: (1) construction areas were cleared of vegetative cover on an as-needed basis, (2) runoff from undisturbed areas was allowed to flow naturally, and (3) parking, shop, and storage areas and long-term construction roads were stabilized with lime, gravel, shell, and/or limestone.

2. Dewatering

Because of the need to excavate below the natural water table, dewatering was required in the area of the power block, makeup structures, spillway discharge structure, circulating water structures, and major pipelines. Dewatering has caused a drawdown in the pervious zone in the immediate area around each facility; however, it was limited to the shallow aquifer which is used locally for livestock watering in areas offsite. 7

Dewatering for Units 1 and 2 commenced in November 1975 and will extend through October 1989. Discharged water from this system is directed into 7
drainage ditches for use in dust control, and well-jetting, while the remaining flow is directed into the Colorado River. The zone of dewatering influence has extended approximately to the perimeter of the power 7
block. Once design and construction requirements are satisfied, the groundwater around the facility will be raised to normal elevations in a controlled manner.

3. Excavation

Excavated materials were hauled to designated stockpile, spoil, or fill areas. Suitable material excavated from the power block and construction support facilities was used to build up the shop area, plant roads, and the railroad. The balance of the material was spoiled and graded while plans were made to seed the spoil with grasses to minimize erosion. Excavated material from the reservoir was used either to construct the embankment and dikes or spoiled.

4. Vehicle Washdown

Wastewater from washing vehicles and equipment is normally collected in basins located in the concrete production area and in the reservoir and then used for dust control by dispersion over construction roads. When it is unfeasible to bring heavy equipment from remote locations to the assigned washdown areas, portable blast cleaners are dispatched to the field and allowed to clean those parts of the equipment encumbered by mud. In this case, the wastewater is directed over land before entering natural or man-made drainage channels.

5. Waste Disposition

Solid wastes generated during construction activities are collected, stored, and sorted for salvageable items. Merchantable scrap is hauled from the site and sold to scrap dealers. Combustible solid wastes (paper, wood, vegetation) are burned using methods approved by the Texas Air Control Board's (TACB) Regulation I and applicable permit. The ashes from burning operations along with nonmerchantable scrap (concrete,

polyvinyl chloride pipe) are land-filled onsite in accordance with Texas Department of Water Resources (TDWR) Registration No. 30651. 7

Sanitary waste during STP construction is treated at an extended aeration treatment plant operated by a Texas Department of Health (TDH) certified operator. 7 The treated effluent is discharged to the Colorado River after meeting requirements for federal and state permits.

Chemical wastes (such as paint thinner) used during construction activities at the STP are collected and disposed of in accordance with TDWR Industrial Solid Waste Rules. 7

Waste oil is sold to a commercial operator for recovery.

6. Dust Control

Dust caused by the movement of construction vehicles is controlled by periodically spraying unpaved roads with water provided by runoff basins, 7 dewater discharge, and washdown wastewater. The frequencies of spraying and the quantity of water sprayed are determined by visual inspections and existing weather conditions.

Equipment which emits large quantities of dust, e.g., the batch plant, and storage silos, are equipped with filter bags and/or water spray systems as required by applicable TACB permits.

7. Noise Control

Mufflers are used wherever practical to reduce noise from construction equipment. They are inspected and maintained by mechanics at regular intervals. Additionally, pile driving associated with construction of the barge slip and makeup structures was performed only during daylight 7 hours.

8. Fuel and Oil Storage

As required by 40CFR112, the STP has a Spill Prevention Control and Counter- measure Plan for the construction period. According to the plan, bulk quantities of gasoline, diesel, fuel oil, waste oil, and lubricants are stored within berms capable of containing potential leaks from the storage containers.

9. Landscape Restoration

Cleanup and restoration of areas affected by construction activities are conducted when all other activities have been completed. The disturbed areas are graded to the natural contour of the land or as shown on approved drawings. The entire area to be seeded is cultivated to a depth of 2 to 4 inches by discing. Cultivating is performed parallel to the line of embankment or ditches to minimize erosion. Fertilizer is applied prior to preparation of the seedbed at rates and types recommended by a consulting agronomist. Grass seed is distributed uniformly over the moistened seedbed and rolled. After seeding, an inspection of the seeded area is made; areas not showing sufficient growth to prevent erosion are reseeded. Additional inspections, reseeding, and fertilizing are performed until good growth is attained.

10. Construction Period Environmental Protection

A program for environmental protection was initiated at the STP to establish construction practices and onsite monitoring to minimize the negative impacts that may be caused by construction activities. Additionally, the control program was instituted to ensure that construction activities conform to the environmental protection commitments set forth in the Final Environmental Statement and applicable federal, state, and local environmental laws.

Implementation of the control program is the responsibility of HL&P. 7
Responsibility for monitoring, documenting, and reporting to ensure compliance to the program is assigned to the site environmental coordinator. He is also responsible for providing the HL&P Environmental Protection Department with evaluations of the environmental impact of construction activities, coordinating sampling and reporting required by federal and state permits, and consulting with the primary contractor when resolution or interpretation of commitments of the control program is needed.

4.1.1.1.2 Station-Related Facilities. Construction practices and mitigative measures which are specific to selected station-related facilities are included in the following discussion.

1. Power Block and Related Facilities

Construction of the power block required excavation to approximately 75 feet below the existing elevation, while the side slopes of this excavation were designed to minimize surface erosion. The flow of water down the side slope surfaces was controlled by berms with ditches which transport the water to sumps and from there to ditches which carry the water to appropriate treatment areas and then to the Colorado River.

2. Reservoir

The construction of the reservoir embankment and dikes necessitated the excavation, hauling, dumping, and compacting of approximately 23 million cubic yards of dirt. Borrow areas were designated within the confines of the embankment to minimize disturbance of the remainder of the site. The embankment fill material was wetted to the proper moisture content to aid compaction and reduce dust. Outer slope surfaces were seeded to reduce erosion; interior slopes were protected against wave erosion by the use of soil cement which also served to prevent erosion by storm runoff. Runoff from disturbed areas within the reservoir was directed to ditches and detention ponds where sedimentation took place before the runoff was discharged to the Colorado River.

3. River Makeup Pump Station and Screening Structure

Construction of this facility required the installation of a sheetpile wall tied between dolphin cells for approximately 500 feet along the river. Excavation for the cofferdam was by dragline and/or clamshell directly into the river to aid in setting the sheet piles. The installation of this structure has prevented additional siltation or slough-off losses to the river. Water seeping or trapped behind the wall was pumped 7
into a nearby ditch and flows back into the river. No waste construction
materials or dirt was dumped into the river. 7

4. Discharge Spillway, Pipeline, and Blowdown Structures

Construction of the discharge facilities required the clearing of approximately 65 acres of land which was primarily covered by mixed broadleaf-evergreen deciduous forest. Accumulated slash was burned according to TACB Regulation I. Following the clearing operation, the spillway was excavated below the natural ground level from the reservoir embankment to the Colorado River. Where the spillway intersects the west branch of the Colorado River, underground pipe was installed to maintain flow from the project to the east end of West Matagorda Bay. Slopes along the spillway were excavated at gradients which make them less conductive to erosion. All areas disturbed by these construction activities were seeded to stabilize the soil and minimize erosion.

5. Heavy Haul Road and Makeup Pipeline

Construction of the haul road and makeup pipeline necessitated the removal of approximately 43 acres of land from crop production and pasture. Inverted siphons were installed under the roadbed to maintain flow through the sloughs feeding the west branch of the Colorado River.

6. Relocation of Farm-to-Market Road (FM) 521

The relocation of FM 521 from within the reservoir required the removal of 5 acres of cropland beyond that originally purchased as plant site. The roadbed was designed so that vegetation stripping and grading was limited primarily to the right-of-way. Drainage from the tributaries of Little Robbins Slough was maintained by installing culverts under the roadbed. Suspended solids in the runoff were controlled by the use of straw bale filters.

4.1.1.1.3 Construction Support Facilities. Facilities used to support the construction of station-related facilities are categorized as the construction support facilities. These facilities include the shops, offices, parking lots, concrete production area, temporary roads, and the barge slip. When construction activities are completed, temporary parking lots, temporary roads, and the land occupied by the concrete batch plant will be cleared and relandscaped to conform to the surroundings.

1. Main Plant Construction Support

Building material used during the construction of the power block and related facilities, together with permanent plant equipment, requires enclosed storage and a large open storage area. The warehouses, shops, laydown areas, concrete production area, and parking areas occupy approximately 130 acres adjacent to and west of Unit 2.

The open storage area, long-term construction roads and parking areas have been stabilized with lime and surfaced with gravel or shell, as required, to minimize erosion.

2. Reservoir Construction Support

The office, parking area, and shops required for construction of the 7,000-acre reservoir are located at the east intersection of FM 521 and

the relocated FM 521. The area has been stabilized to reduce erosion, and runoff is routed along the heavy haul road to the Colorado River.

3. Barge Slip Construction Support

Construction of the barge slip required the driving of sheet pile along the perimeter of each slip. Excavation was carried out by dragline and clam-shell to reduce siltation to the Colorado River. Clearing of trees and vegetation was confined to a small area of the riverbank.

4.1.1.2 Effects on Terrestrial Biota and Agricultural Productivity

4.1.1.2.1 Agricultural Productivity. Preemption of the 12,300 acres of land will result in an average annual loss of approximately 3,000 acres of rice production (approximately 6.5 percent of the annual yield for Matagorda County). The remainder of the nonforested upland (7,214 acres) represents small losses in sorghum, soybean, hay, and pasture; however, these acreages are relatively minor percentages of the acreage under similar use in the county.

4.1.1.2.2 Disturbance of Wildlife: Alteration and Loss of Habitats. Disruption of the normal behavior patterns of fauna will occur as a result of the movement of men and equipment during peak periods of site preparation and construction. Noise could interfere with the nesting behavior, antipredatory behavior, and general intraspecific auditory communication of some wildlife species (Ref. 4.1-3). Where possible, periods of peak construction activity have been timed to coincide with less sensitive phases in the life cycles of the more important animals on the site.

The greatest effect on wildlife populations, however, is due to alteration and losses of habitat. Most losses of habitat have been in vegetative types typical of upland areas, principally cropland, pasture, and the interlacing system of canals, ditches, and sloughs. Minor losses have been experienced in the bottomland habitats, principally forests.

4.1.1.3 Effects on Local Populations 7

Implications of STP construction on nearby populations and their environs have been examined in terms of noise, traffic, impact on the educational system, impact on housing markets, and accessibility to natural or historic landmarks.

4.1.1.3.1 Construction Noise. Land surrounding the STP is primarily agricultural; within a 10-mile radius of the site, there are no incorporated communities and the nearest unincorporated settlement is approximately 3 miles southeast on Selkirk Island. 7

In an effort to identify the impact of noise from construction activities, a sound survey was conducted in November 1977. Sound measurements were taken at the seven locations shown on Figure 4.1-3. The results of the survey are presented in Table 4.1-1.

4.1.1.3.2 Traffic. FM 521 is a two-lane paved highway that currently serves as the primary access road to STP. FM 521 intersects with State Highway 60 on 7
the east and State Highway 35 on the west. State Highways 60 and 35 and FM 521 serve as the major carriers of vehicular traffic to and from the site. Alternative routes to and from the site consist of several farm-to-market

roads which allow access to FM 521. These alternative routes are FM 2668, FM
2078, FM 3057, FM 459, FM 2853, FM 1468, FM 1469, and FM 1095. Road traffic 7
counts conducted by the Texas Department of Transportation indicate a significant increase in 24-hour annualized traffic counts over the roads in proximity to STP. The traffic counts are summarized in Table 4.1-2.

Several measures have been taken to mitigate traffic congestion in the vicinity of the STP. A traffic light was installed at the main entrance to
ease traffic flow into and out of the plant area. Staggered working hours 7
between major site areas eases traffic conjestion at shift changes. Construction workers have utilized a substantial amount of car, van and bus pooling. In addition, the State of Texas has installed additional signals at various intersections in Matagorda County and has widened certain highways to accommodate traffic.

Rail traffic to the STP has begun and will continue through the remainder of the construction period. Inconvenience from the railroad traffic will be limited to the residents of Buckeye where the spur ties into the main line and
along relocated FM 521 where the track crosses the roadbed. The inconvenience 7
will be trains blocking cross-traffic.

4.1.1.3.3 <u>Housing</u>. A survey of construction work force personnel conducted in February 1980 indicated that approximately 73 percent of the respondents to the survey identified a place of residence in Matagorda County, with approximately 36 percent of these Matagorda County residents having residency in Bay
City and approximately 25 percent having residency in Palacios (Ref. 4.1-15). 7
A survey of housing units in Matagorda County by the Houston-Galveston Area Council of Governments conducted with the help of local officials identified a total of 5,316 housing units in Bay City and 1,237 housing units in Palacios for 1976 (Ref. 4.1-6). The vacancy rate for these total units as reported within the same survey for these two jurisdictions was 0 percent. Within the rural area of Matagorda County, the same survey identified a total of 3,633 housing units with a vacancy rate of 4.6 percent. Surveys conducted during 1977, 1978, and the first part of 1980 indicate that several new units of housing were constructed, or were in the process of being constructed within the Bay City/Matagorda County area. The Deputy Tax Assessor-Collector of Bay City reported that in 1976 building permits were issued for 94 single-family homes and 306 apartment units, while in 1977 building permits were issued for 132 single-family homes and 180 apartment units (Ref. 4.1-7). For 1978, building permits for 147 new single-family homes, 18 townhouses, and 286 apartment units were issued in Bay City alone. During 1979, approximately 91 permits were issued for single-family homes, and permits for 53 multifamily units were issued (Ref. 4.1-13). Bay City is the only governmental entity requiring building permits for construction. A survey of building contractors in January of 1980 identified a significant number of new housing units to be constructed outside of Bay City. New housing has kept pace with the demand,
although the housing market is described as "tight". 7

4.1.1.3.4 <u>Public Education</u>. The five independent school districts within Matagorda County have experienced enrollment increases during the construction
of the STP. Through the addition of classroom capacity and the hiring of 7
additional faculty members, the school districts have accommodated the enrollment increases.

4.1.1.3.5 Other Effects. The site area has adequate police and fire protection and hospitals. Fresh water is plentiful within the county in the form of groundwater, with most of the county residences using septic tanks as their primary form of sewage treatment. 7

Bay City has adequate sewage treatment and an ample water supply. Palacios has a new wastewater treatment facility with the capability of doubling this capacity without major new construction due to its design. Palacios has four wells for water supply. Major jurisdictions (cities and towns) surveyed indicate the capability to supply water and sewage treatment services to handle additional population (Ref. 4.1-8). 7

4.1.2 WATER RESOURCES

Construction activities at the STP site which may have impacted the Colorado River and Little Robbins Slough include construction of the barge slip, makeup structures, discharge structure and spillway; construction and filling of the reservoir; discharge of wastes; and relocation of a segment of the Little Robbins Slough.

4.1.2.1 Impacts on the Colorado River

1. Barge Slip

   The major impact associated with construction of the barge slips was the excavation of approximately 5,000 square feet of riverbottom resulting in the loss of previously existing aquatic habitats and sessile organisms within the immediate bank and shallow water areas. Additionally, periodic maintenance excavation requires the disturbance of the restructured aquatic habitats. Excavation, furthermore, produced a temporary increase in turbidity in the immediate area of the barge slip and for a short distance downstream. Excavation activities are not expected to have any significant effect on the Colorado River when compared to the general characteristics of the river and the effects of floods and Corps of Engineer dredging activities. (A grab sample taken from the Colorado River during high water conditions in December 1976, exhibited a total suspended solids (TSS) concentration of 1697 ppm.)

2. Makeup Structures

   The effects of the construction of these structures on the Colorado River are similar to effects previously identified from the barge slip except that the excavation of approximately 74,000 square feet of riverbottom for construction of a cofferdam resulted in greater increases in siltation and turbidity downstream and destruction of riverbottom habitats. Siltation and turbidity are temporary effects coinciding with the initial excavation, installation and removal of the cofferdam and also final grading around the permanent structures. Destruction of aquatic habitats is permanent in those shallow water areas covered by foundations for trash racks, traveling screens, and retaining walls. However, these structures will, potentially, provide new habitats for other aquatic organisms.

3. Discharge Structures and Cooling Reservoir Spillway

Construction of the spillway and blowdown structures resulted in increases in turbidity and habitat losses at the point of entry of 7 underground outlets into the river. Removal of the earthen plug where the spillway joins the Colorado River resulted in the immediate loss of an insignificant amount of aquatic habitat and a slight increase in water turbidity. Effects of siltation from both construction activities are temporary. Habitat destruction at the discharge outlets will be permanent, while the spillway will immediately provide an increase in shallow water habitats suitable for colonization by aquatic organisms.

4. Cooling Reservoir

During construction of the cooling reservoir, the major source of impact on the Colorado River is discharge of runoff water from the disturbed areas through the spillway. To reduce the TSS concentration of the runoff, ditches and basins were excavated within the cooling reservoir to allow sedimentation to occur. In addition, a weir and a manually operated stopgate were installed to control the flow of water to the
river. The quality of the discharge, varied with the amount of rainfall | 7
and the detention time within the cooling reservoir. In order to check the ability of the system to reduce the TSS, 5 weekly grab samples were taken at the weir. Based on the results (TSS = 7 to 179 ppm), the impact of runoff discharges to the river was determined to be insignificant.

The 7,000-acre cooling reservoir will be filled with Colorado River water during the preoperational construction period of Unit 1. During filling the cooling reservoir will, initially, become populated by aquatic organisms primarily entrained from freshwater and estuarine-marine assemblages of the Colorado River. The losses of the organisms from the Colorado River are considered to reduce the productivity of the river in the area of the makeup structures; however, these losses should be offset, in part, by the shallow water aquatic habitats in the spillway. These losses, in any case, are expected to be insignificant relative to the overall aquatic population size and productivity of the river.

5. Discharge of Construction Waste

Wastewater from a construction phase sewage treatment plant and dewatering is discharged to the Colorado River. Prior to discharge, sewage is treated in accordance with federal, state, and local laws; daily maximum limits on the discharge are: biochemical oxygen demand (BOD)$_5$ - 45
ppm, TSS - 45 ppm. Groundwater is pumped from around Units 1 and 2 and | 7
discharged to the Colorado River at maximum rates of 2,500 gallons per minute. In addition the effluent is allowed a daily maximum limitation of 20 ppm by federal and state permits for oil and grease. These discharges are expected to have no significant effect on water quality or ecology of the Colorado River.

4.1.2.2 Impacts on Little Robbins Slough

1. Effects of Relocation

Little Robbins Slough was relocated from its preconstruction location within the reservoir to outside the west embankment. The relocation has resulted in the following: the replacement of 3.5 miles of meandering stream with approximately 4 miles of channel; the loss of existing stream habitats; loss of aquatic organisms from the Slough complex; and temporary degradation of water quality. Degradation of water quality was in the form of increased turbidity and siltation in the relocated channel and immediately downstream. The loss of aquatic organisms has taken two forms: incorporation into the developing reservoir ecosystem, or destruction by construction activities or silt deposition during filling.

2. Effects of Reservoir Construction

Reservoir construction affected the Little Robbins Slough complex by immediately reducing the annual freshwater supply and nutrient input, reducing freshwater marsh beginning approximately three-fourths of a mile below STP, and increasing turbidity and siltation below the project. The losses in freshwater and marsh are due to decreased rainfall runoff and irrigation runoff attributable to acreage consumed by reservoir construction. Turbidity and siltation are a direct result of reservoir construction activities and are considered to be temporary effects.

The existing open-water marsh, compared to the estaurine environment of East and West Matagorda Bays, plays a minor role in providing nursery areas to aquatic organisms of the Colorado River/Tres Palacios River/West Matagorda Bay ecosystem. Similarly, the impacts associated with reduced freshwater flow will have no significant effect on the ecosystem.

REFERENCES

Section 4.1:

4.1-1 U. S. Department of the Army, Corps of Engineers, 1976, Waterborne Commerce of the United States, Calendar Year 1976 Part 2, Waterway and Harbors Gulf Coast, Mississippi River System, and Antilles, pp. 177.

4.1-2 1970 Census of Population - Number of Inhabitants, Texas, U. S. Department of Commerce, Bureau of the Census.

4.1-3 Memphis State University, Effects of Noise on Wildlife and Other Animals, prepared for the Environmental Protec- tion Agency (1971) pp. 13-206.

4.1-4 Socioeconomic survey conducted during October 1977 by Brown & Root, Inc., Houston, Texas.

4.1-5 Deleted | 7

4.1-6 Houston-Galveston Area Council, Housing Conditions and Needs in the H-GAC Region, November, 1976, Houston, Texas.

4.1-7 Telephone conversation between Clinton Twilley, Brown & Root, Inc., and Martha Erie, Matagorda County Deputy Tax Assessor-Collector January 9, 1978.

4.1-8 NUS Corporation, An Assessment of Socioeconomic Conditions at STP, March 1978.

4.1-9 DELETED

4.1-10 Telephone conversation between Irv Samec, NUS Corporation, and H. Hausman, Texas Department of Highways and Public Transportation, December 14, 1979.

4.1-11 Telephone conversation between Irv Samec, NUS Corporation, and Martin Brown, Texas Department of Highways and Public Transportation, December 14, 1979. | 3

4.1-12 Deleted | 7

4.1-13 Telephone conversation between Irv Samec, NUS Corporation, and Mrs. Edison, Bay City Building Department, December 14, 1979. | 3

4.1-14 Telephone conversation between Irv Samec, NUS Corporation, and Rose A. Baum, Bay City Independent School District, December 14, 1979.

4.1-15 Deleted | 7

TABLE 4.1-1

RESULTS OF CONSTRUCTION SOUND LEVEL SURVEY, NOVEMBER 1977

Location No.	Sound Level, db(a)
1	42
2	54
3	51
4	45
5	42
6	39
7	35

TABLE 4.1-2

COMPARISON OF 1976, 1977, AND 1978 TRAFFIC COUNTS

Location	1976 24-hr Annualized Counts	1977 24-hr Annualized Counts	1978 24-hr* Annualized Counts
Highway 60 South of FM 2668	2,420	3,280	3,390
Highway 35 North of FM 521	2,160	2,890	2,900
Highway 35 South of FM 521	2,460	3,060	3,620
FM 521 and Highway 35	920	1,700	1,650
FM 2668 North of FM 521	870	1,2[illegible]0	1,190

* Data from Ref. 4.1-10.

3

Figure 4.1-1 has
been deleted.

Figure 4.1-2 has
been deleted.

4.2 TRANSMISSION FACILITIES CONSTRUCTION

The purpose of this section is to describe the anticipated effects of construction of the modified STP transmission line routes described in Section 3.9.

The STP transmission line system is composed of five separate route sections. These sections (including the modified routes) and their corresponding mileage are presented in Table 4.2-1.

4.2.1 GENERAL OVERVIEW

The general overview presented in Section 4.2.1 of the Environmental Report--Construction Permit Stage required no updating except to note the following change.

The formerly proposed site to Lon Hill Substation line of CPL traversed minimal spans of urban areas as the line approached Lon Hill Substation. As described in Section 3.9, this route has been modified to go from the site to Blessing Substation. The modified route traverses no urban areas.

In addition a 2500 foot 345 kV transmission line will run from the STP switchyard to the HVDC terminal described in Section 2.2.3. This additional line will be completely contained within the STP site. 6

4.2.2 EFFECTS OF CONSTRUCTION ON PLANT AND ANIMAL LIFE

The discussion of the effects of construction on plant and animal life presented in Section 4.2.2 of the Environmental Report--Construction Permit Stage is applicable to the modified transmission line routes except for changes in the acreages of woodland, marsh, and open field which will be affected. The total acreage of woodland to be affected by transmission line rights-of-way is about 830 acres (Table 4.2-2). About 9 acres of woodland will be disturbed along the modified route from the site to Blessing Substation (Figure 4.2-2). Another 47 acres of woodland will be disturbed along the modified route from the tie point at Danevang to Holman Substation (Figures 4.2-3a-c). A summary of land classification along the modified transmission line routes is presented in Table 4.2-3. Q TE

The modified transmission line routes do not traverse any marshland. The total amount of marshland crossed by STP transmission line rights-of-way is about 118 acres.

4.2.3 ECOLOGICALLY SENSITIVE AREAS

Ecologically sensitive areas are those areas which could experience significant impacts from construction along the transmission route. One of the primary ecological considerations along the transmission routes is modification in habitat, particularly in woodlands, forested areas, and marshland. Construction of the modified transmission line routes is not expected to greatly affect migrant or transient endangered bird species which could occur in the vicinity during migration periods.

4.2.3.1 Endangered Species

The modified transmission line routes do not traverse areas where endangered species are known to exist.

4.2.3.2 Sensitive Habitat--Site to Blessing

Sensitive habitat along this modified segment of the transmission system consists of a small area of woodland near Blessing Substation (Figure 4.2-2).

4.2.3.3 Sensitive Habitat--Danevang to Holman

This segment of the proposed transmission system lies primarily within open field habitat. The line crosses six small areas of live oak forest, the largest (about 1 mile in length) is 6 miles southeast of Glidden. This woodland comprises about 4 percent of the vegetation crossed by the proposed route (see Figures 4.2-3a, b, and c).

4.2.4 NUMBER AND LENGTH OF NEW ACCESS AND SERVICE ROADS REQUIRED

Access to the rights-of-way of all transmission lines associated with the STP will be provided by private or public roads. In some areas, private roads may require improvement to accommodate the use of heavy construction equipment. In some cases, improvement will be made to private roads at the request of the landowner. Generally, in these cases, grading and placing of shell will be the extent of the improvement. Q 340 .17

A limited number of improvements will be made along transmission line rights-of-way to allow accessibility. In most areas, the placement of culverts in drainageways (including roadside ditches), and gates in fences crossing the rights-of-way will be the extent of improvements made. In especially boggy areas, it may be necessary to install a temporary plank road or to place fill.

4.2.5 EROSION DIRECTLY TRACEABLE TO CONSTRUCTION ACTIVITIES (POWER TRANSMISSION FACILITIES)

In accordance with the discussion in the Introduction to Regulatory Guide 4.2, Revision 2, pertaining to the "Applicant's Environmental Report--Operating License Stage," this section is not addressed since no updating of the corresponding material presented in the Environmental Report--Construction Permit Stage was necessary.

4.2.6 EFFECTS ON AGRICULTURAL PRODUCTIVITY

Adverse effects on agriculture resulting from the construction of the modified transmission lines are negligible.

The construction period for the transmission system allows sufficient time for scheduling most construction activities to avoid disturbance to unharvested fields. This feature minimizes crop damage from construction.

As previously indicated, the land owner is free to use all available land within the right-of-way, providing his use does not conflict with the interests of the applicant. Agricultural productivity, therefore, will be disturbed only to the extent that land at the base of the transmission towers is taken out of use. The bases of the towers occupy an average of 0.01 acre. Table 3.9-1 shows that of the total 304.3 miles in the STP transmission system, 90.4 miles will cross agricultural cropland. Tables 3.9-2 and 3.9-3 7
indicate that the modified routes account for 40.1 of the 90.4 miles. Applying the design specification that the average span distance between towers will be about 1,000 feet (800-1,200 feet), there will be a total of 478 transmission towers constructed on agricultural land. The modified routes account for 212 of the 478 towers.

The total productive acreage lost as a result of the transmission system construction is 4.78 acres (0.01 x 478). The modified routes will cause the loss of about 2.12 acres of productive acreage (0.01 x 212).

4.2.7 MITIGATING MEASURES TO LIMIT ENVIRONMENTAL IMPACT DURING CONSTRUCTION 7

This section is not addressed since no updating of the corresponding material presented in the Environmental Report--Construction Permit Stage is necessary.

4.3 RESOURCES COMMITTED

In the construction and operation of any electric generating station few resources are irretrievably committed to the facility for other than its operational life. The commitments made may be separated into four categories: construction materials, land, vegetation and wildlife, and water resources. These commitments are discussed within the following sections.

4.3.1 PLANT CONSTRUCTION MATERIAL COMMITMENTS

Construction of the power plant requires large quantities of building materials. Of the major materials used, only concrete and reinforcing steel are considered nonrecyclable at this time. At the time of plant decommissioning, about the year 2025, advanced technology and the increased cost of materials 7 may require the recycling of essentially all building materials. Table 4.3-1 presents the estimated quantities of the major materials required for construction of the STP power plant.

4.3.2 LAND COMMITMENTS

The construction of STP requires a significant commitment of land resources. Land uses include the plant and related facilities, i.e., the reservoir and embankment, spillway channel, the essential cooling pond, roads and rail connections, and transmission lines.

The single largest commitment of land is the cooling reservoir which occupies about 7,000 acres of the nominal 12,300 acres located within the site boundaries (not including railroad right-of-way). The reservoir embankment requires approximately another 493 acres. This embankment was constructed of rolled earth fill removed primarily from the reservoir area so that little outlying earth removal was required. The plant and plant facilities occupy about 103 acres of the surrounding land, and an additional 79 acres are used for the essential cooling pond.

A portion of FM 521 was rerouted through the northern portion of the site, but outside the site boundary the road maintains its original route. The rerouting of FM 521 required an additional 50 acres. An access road on the east side of the plant connects FM 521 and the plant. A heavy haul road from the plant to the barge slip required clearing of approximately 43 acres.

A railroad spur right-of-way leading from the plant to the northwest corner of the site and extending north from the boundary of the site was cleared for construction. The spur occupies about 10 acres of land.

Makeup and blowdown lines from the reservoir to the Colorado River required about 10 acres of clearing and trenching. The soil was replaced after construction of the pipelines.

Transmission lines travel east, west, and north from the plant. A total of approximately 74 acres are required for the transmission corridor and switchyard within the site boundary. 7

A total of about 8,250 acres has been cleared or excavated for STP. Of this acreage, the only land considered irretrievable is that under the reactor containment building and other structures which will probably remain after decommissioning.

Approximately 1,700 acres located between the east embankment of the reservoir and the west bank of the Colorado River are to remain as a natural lowland habitat. The remaining 2,350 acres of land within the site boundary not being used for the reservoir, the plant structures and support facilities, and the natural lowland habitat will be left in its natural state as much as possible. The land immediately surrounding the major plant structures will be seeded to give the surroundings an aesthetically pleasing appearance. 6

4.3.3 VEGETATION AND WILDLIFE

The material presented in Section 4.3.4 of the applicant's "Environmental Report--Construction Permit Stage" requires no updating except as discussed below.

A survey completed in the summer of 1974 (Ref. 4.3-1) estimated that a total of 32 alligators were on the site. The study noted, however, that suitable habitat for nest construction was limited outside of the Robbin's marsh area below and outside the site.

4.3.4 COMMITMENT OF WATER RESOURCES

The construction of STP has required the use of three onsite water wells, which have a maximum capacity of 600 gallons per minute each. The wells are used to fulfill potable water needs, to supply water to two fire protection storage tanks, and to supply water to the concrete batch plant. 6

TABLE 4.3-1

MAJOR CONSTRUCTION MATERIALS*

Lumber, ft^2	4,840,000
Rebar, lb	132,000,000
Steel, lb	38,000,000
Concrete, yd^3	455,000

7

* Quantities of other materials such as copper, lead, and plastic are used to a lesser extent. The materials listed represent the best estimates of the amounts of each required to complete both units.

5.1 EFFECTS OF OPERATION OF THE HEAT DISSIPATION SYSTEM 7

This section is not addressed except to note the following changes, since no updating of the corresponding material presented in the Environmental Report--Construction Permit Stage was necessary.

5.1.4 EFFECT ON GROUNDWATER

Groundwater at STP occurs in two principal aquifers: a deep aquifer which is 7
confined under artesian pressure by more than 150 feet of predominantly clay sediments, and a shallow aquifer consisting of upper and lower portions, which appear to be separated hydraulically except in the immediate area of the plant.

The deep aquifer zone, which is confined and lies at depths in excess of 300 feet below the ground surface, is not expected to be influenced by activities or construction in the site area. The only effect results from some pumping from wells located in the plant area; the effect of this pumpage is addressed in Section 2.5 of the Environmental Report-- Construction Permit Stage.

Piezometric levels in the upper and lower shallow aquifers will be affected somewhat by construction of the cooling reservoir and filling of the reservoir
to a normal maximum operating level of elevation 49.0 feet. The differential 7
head created by reservoir loading produces seepage from the reservoir through
the upper shallow aquifer. Approximately 68 percent of this seepage is inter- 7
cepted by 669 relief wells and discharged as surface flow through a system of drainage ditches constructed at the downstream toe of the embankment. The remaining seepage flow, about 32 percent (or 1,850 of a total of 5,700 af/yr) of the total seepage, is expected to remain in the upper shallow aquifer and flow to the southeast.

The design of the relief well system and the associated seepage calculations (Ref. 5.1-1) were directed at reducing the hydraulic gradient at the toe of the embankment to less than 0.65 and to ensuring that the maximum piezometric level in the upper shallow aquifer would not exceed elevation 27 feet (MSL). Therefore, the effect of reservoir loading on the piezometric levels in the shallow aquifer would be minimal. It is expected that the piezometric levels in the upper shallow aquifer would be increased slightly near the southern area of the reservoir but that this influence would be limited to areas close to the reservoir. The deeper lower shallow aquifer would also experience some increase in piezometric level, but since it is confined in the site area and is located up to depths in excess of 100 feet below ground surface, the effects are expected to be minimal.

5.4 EFFECTS OF CHEMICAL AND BIOCIDE DISCHARGES

Nonradioactive chemical wastes in the plant effluent will result from the makeup demineralization system, chemical cleaning wastes at startup, auxiliary boiler blowdown, sanitary waste treatment, and the biocide waste system. These systems are described in Subsections 3.6.1.1, 3.6.1.2, 3.6.1.4, 3.7.1, and 3.6.2, respectively. The effect of the sanitary waste discharge is discussed in Section 5.5.

5.4.1 DISSOLVED SOLIDS

Dissolved solids will form the the greatest part of the chemical wastes discharges into the cooling reservoir. The largest producer will be the makeup demineralization system. The maximum amount of waste water produced per day by the demineralizer system will be 88,455 gallons. Table 3.6-1 gives a volumetric breakdown of waste water flows resulting from each step in the regeneration schedule for one regeneration of a cation-anion mixed-bed train.

An approximate waste water analysis resulting from one day of maximum regeneration of the demineralizer is presented in Table 3.6-2. A tabulation of this analysis with ambient conditions of the river at the reservoir makeup pump station location (determined during a study conducted from June through October 1973 and with projected maximum concentration in the cooling reservoir at the end of the first year of operation and with Texas Department of Water Resources (TDWR) standards for the Colorado River, is presented in Table 5.4-1. A comparison of the regenerative wastes with ambient river concentrations indicates that only sodium chloride, sulfate, and excess sodium hydroxide will be present in higher concentrations in the regenerative waste discharge than those values measured in the Colorado River. Discharge to the cooling reservoir over the operating life of the station will result in the accumulation of the wastes over and above ambient concentrations in the amounts listed in Table 5.4-1. Effects of reservoir blowdown on the Colorado River are felt to be insignificant since the incremental increases due to regeneration waste discharges are within the ranges recorded for ambient river conditions.

5.4.2 CLEANING WASTES

Prior to operational startup, internal surfaces of the reactor vessel and all piping and equipment of the primary coolant and secondary feedwater circuits will be chemically cleaned as described in Subsection 3.6.1.2. Initial flushing will remove nondissolvable material. The condensate feedwater system will be subjected to alkaline cleaning with a solution of trisodium and disodium phosphate. The heated solution will be treated and discharged to the 7
reservoir or removed from the site by a licensed waste handler. The auxiliary boiler will also be subjected to alkaline cleaning. The waste waters associated with this cleaning will be handled as described in Section 5.4.1. 7

5.4.3 BIOCIDE SYSTEM

The biocide system for controlling slime growth in condenser tubes and circulating water lines is described in Section 3.6.2.

Chlorine in the form of a sodium hypochlorite solution will be applied periodically to the circulating water intake structure and the essential cooling pond. Shock treating will be performed three times a day using 20-minute chlorination periods. The interconnection of the circulating water pumps necessitates shock treatment of all three of the condenser shell at once.

The actual operating chlorine dosage will be determined by a residual chlorine monitor located in the condenser's effluent header. The chlorine dosage will be controlled so that a chlorine residual of no more than 0.2 parts per million remains in the condenser effluent being discharged into the cooling reservoir. 7

5.4.4 EFFECTS

5.4.4.1 Surface Water Effects

The effects of water temperatures, turbulence, and additional chlorine demand in the cooling reservoir will result in rapid depletion of the chlorine residual. Therefore, the chlorine residual resulting from biocide treatment is expected to have negligible effect on the cooling reservoir. It is expected that there will be minor effects on biota in the immediate area of the discharge outfall into the cooling reservoir. Approximately 5,000 pounds of 3 weight percent sodium chloride solution will be discharged to the reservoir daily as a by-product of the sodium hypochlorite generation process. This addition will not significantly affect the sodium chloride concentration of the reservoir. 7

Blowdown water will be discharged from the cooling reservoir to the Colorado River. At these times, the Colorado River flowrate will be at least eight times that of the blowdown. This will result in excess concentrations less than or equal to one-ninth of the discharge excess concentrations during that portion of the time at which discharge occurs. At these concentrations, the discharges from the reservoir will meet the requirements of the TWQB for this portion of the Colorado River and will not affect the use of water downstream. 7

Seasonal variation in concentrations within the cooling reservoir will be due to variations in ambient intake water conditions, evaporation rates, and makeup and blowdown schedules for the cooling reservoir since the STP site is located along tidal reaches of the Colorado River. Intake concentrations of major chemical components will vary considerably with salinities of the intake water. Comparisons made in this section between plant waste discharges and ambient conditions were based on data taken when concentrations of major chemical components in the Colorado River should be near their lowest values because of the high river flow at the time of the study. Therefore, during periods when river flow is low and chemical concentrations of the intake water are much greater, there will be even less effect due to the waste discharges.

The aquatic biota near the plant site is typified by both fresh water and estuarine forms, most of which are tolerant of the stressful conditions characteristic of that area. Those that are not tolerant can be classified as temporary or occasional inhabitants and will not be found under all environmental conditions. Because most inhabitants of the Colorado River near the plant site are adapted to the natural stressful conditions present, the chemical discharges from the plant are anticipated to have no adverse environmental effect on them since these contributions will be minor compared to ambient conditions and natural variations of these conditions.

5.4.4.2 Groundwater Effects

The concentrations of the chemical and biocide wastes in the reservoir are presented in Table 3.6-3. The groundwater seepage dispersion characteristics discussed in Section 5.1 indicate that the reservoir seepage should not have a significant effect on the groundwater system.

5.5 EFFECTS OF SANITARY AND OTHER WASTE DISCHARGES

5.5.1 EFFECTS OF SANITARY WASTE

Sanitary wastes will be collected and treated in an onsite sewage treatment plant, the design of which will meet requirements of the Texas Department of Water Resources (TDWR), formerly the Texas Water Quality Board, and Texas Department of Health (TDH). The sanitary waste treatment plant will be of the extended-aeration type, with facilities for effluent disinfection by postchlorination. Descriptions of the sanitary waste load and the waste treatment system are presented in Section 3.7.1 and Section 3.7.2, respectively.

Expected volumes of sanitary waste for a two-unit plant are as follows:

Number of Units	Population	gpd/Person	gpd
2	500	30	15,000

The treated sewage effluent will be discharged to the main cooling reservoir. 7

The activated sludge process is expected to result in an 87 percent reduction in biochemical oxygen demand (BOD_5) concentration from 150 ppm in the effluent resulting in a level of 20 ppm. A similar reduction in total suspended solids 7
will result in a concentration of 20 ppm in the effluent. A free chlorine residual of 1 ppm as required by the TDWR will be maintained in the effluent. This free chlorine residual will be further reduced when the flow is commingled in the main cooling reservoir. 7

BOD_5 data obtained at the intake site (station 2) in the aquatic ecology study ranged from 1 to 2 ppm. It is expected that the contribution to the total BOD_5 load by the sewage effluent will be an insignificant portion of the total BOD_5 of the reservoir. Blowdown of the cooling reservoir will result in further mixing by the Colorado River.

The large volume of water available for mixing contained in the cooling reservoir, warm seasonal water temperatures, and constant low BOD_5 input will likely disallow any seasonal buildup in BOD_5 concentrations. The extensive mixing of the sanitary waste effluent in the cooling reservoir will also result in an insignificant buildup of other sewage constituents.

The sanitary waste effluent will contribute some nutrients to the cooling reservoir, but, because of the relatively small quantities involved, the effect on aquatic life will be negligible. There will be no adverse environmental impact due to sewage effluent on the cooling reservoir or the Colorado River.

5.5.2 EFFECTS OF OTHER WASTE DISCHARGES (GASEOUS EFFLUENTS)

Gaseous products of combustion will be periodically released to the atmosphere by the emergency diesel generators, diesel driven fire pumps, and auxiliary boilers, as discussed in Section [illegible]

The effects of exhaust emissions from testing these units will be minimal. 7

5.8 RESOURCES COMMITTED

The corresponding material presented in Environmental Report--Construction Permit Stage requires no updating except as discussed herein.

As described in Section 3.2, the STP will be powered by two Westinghouse Electric pressurized-water reactors. The reactor fuel consists of uranium dioxide (UO_2) in the form of sintered pellets contained in Zircaloy-4 fuel rods. Once operation has started, consumption of uranium (per unit) is as follows:

	U as Enriched UO_2 (tons)	U_3O_8 Requirements (tons)	
Initial load	115	534	
Annual reload	28	186	7
Over 40-year life	1,197	7,608	

5.9 DECOMMISSIONING AND DISMANTLING

No specific plan for decommissioning the STP has been developed. Before the end of the plant's life, the South Texas Project will submit a proposed decommissioning plan to the NRC for review. The plan will comply with NRC decommissioning requirements in effect at that time. The NRC is currently conducting rulemaking proceedings that will develope a more explicit overall policy for decommissioning commercial nuclear facilities.

It is expected that the STP will be decommissioned by one or a combination of the following methods described in reference 5.9-1.

A. Immediate Dismantlement (DECON)

The removal of all radioactive materials and complete site decontamination within approximately 4 years after cessation of plant operation.

B. Safe Storage with Deferred Dismantlement (SAFSTOR)

The security of radioactive materials and contaminated areas for an extended period of time after the cessation of plant operation to allow time for short-lived radioisotopes to decay. Under this option, dismantlement is deferred for up to 100 years. 7

C. Permanent Entombment (ENTOMB)

The removal of radioactive liquids, spent fuel, and certain highly radioactive components (such as reactor internals) followed by the permanent sealing of the structures to prevent future access. An appropriate and continuing surveillance program is then placed into operation to ensure the entombment integrity is indefinitely maintained.

Although the sizes of the facilities decommissioned to date have been significantly smaller than the STP, the experience gained reinforces the conclusion that the STP can be decommissioned while protecting the health and safety of the public.

The ultimate cost of decommissioning the STP will depend on the method utilized. Reference 5.9-1 estimates the costs for the decommissioning methods identified above for each unit the size of the STP units as follows:

Immediate Dismantlement	$33.3 million (1978 dollars)
Safe Storage with Deferred Dismantlement	$41.2 - 42.8 million (1978 dollars)
Permanent Entombment	$21 - $27 million (1978 dollars) plus $40,000 per year maintenance

REFERENCES

Section 5.9:

5.9-1 Feldman, C., et al., Draft Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, U.S. Nuclear Regulatory Commission, NUREG 0586, January 1981. 7

CHAPTER 6

EFFLUENT AND ENVIRONMENTAL MEASUREMENT AND MONITORING PROGRAMS

This chapter provides a description of the means used in obtaining the baseline data presented in Chapter 2, and presents plans and programs for monitoring the environmental impacts of site preparation and plant construction, and of plant operation. The two major subsections of this chapter concern the applicant's preoperational environmental programs and the proposed operational monitoring programs as planned at this time. The proposed monitoring programs must be considered flexible in that field experience may suggest changes in instrumentation, incorporation of modifications such as the addition or deletion of certain parameters, adjustment in the number and location of sampling stations, and alterations of frequency of observations and number of replications.

6.1 APPLICANT'S PREOPERATIONAL ENVIRONMENTAL PROGRAMS

6.1.1 SURFACE WATERS

To adequately predict and evaluate the environmental impact of South Texas Project (STP) Units 1 and 2 on associated surface waters, a program designed to provide pertinent chemical, physical, and biological baseline data was initiated in June 1973 and continued until March 1976. This program involved an intensive effort to gather previously existing data and a field survey program to supplement existing data. Available information from various state and federal agencies and from scientific literature relative to the STP site and the surrounding region are reviewed in Sections 2.5 and 2.7.

Data gathered through this program provided the bases for estimating environmental impact of various plant systems, when operational, on ecological parameter of associated surface waters.

The following discussion addresses methods used in the field study program and procedures used in evaluating data obtained.

6.1.1.1 Physical and Chemical Characteristics

Water survey sampling was divided into two schedules. Major physical and chemical water quality characterization surveys (see Table 6.1-1) were conducted on a quarterly basis and minor physical and chemical water quality characterization surveys (see Table 6.1-2) at monthly intervals between major surveys. All stations shown on Figure 6.1-1 and discussed in Section 2.7 of this report were sampled during both major and minor surveys, with the exception of station 16, which was sampled only during major surveys. Two water quality parameters not listed in Tables 6.1-1 and 6.1-2, bacteria and chlorophyll _a_, were scheduled for major surveys only. However, during June-September (1973), bacteria samples were taken on a monthly basis.

Although station 15 (open Gulf) was scheduled for monthly surveys, it was not possible to sample this station during June or September due to unfavorable weather conditions and/or interruption of boat traffic from the Colorado River to the Gulf by the buildup of sand bars at the mouth of the river and subsequent filling of the river channel.

6.1.1.1.1 Physical Parameters Physical parameters measured during major and minor physical and chemical water quality characterization surveys included water temperature, specific conductance, pH, dissolved oxygen, turbidity, color, and odor.

Odor was measured only during major surveys; all other physical parameters were measured during both major and minor surveys. Color and odor were determined in the laboratory from water samples collected in the field. Turbidity was determined in the laboratory each month and also in the field during major aquatic surveys. Specific conductance, salinity, pH, temperature, and dissolved oxygen were determined in the field at each sampling station at two depths (surface and bottom). Additional measurements of specific conductance and salinity, at vertical intervals of approximately 3 feet, were taken when the presence of a saltwater tidal wedge was noted. This is indicated by wide ranges in conductivity and salinity between surface and bottom measurements.

Specific conductance was measured with a Beckman Solu-Bridge conductivity meter, model RB3-334I ($\pm$ 2 percent). This instrument, equipped with conductivity probe, model CEL-VS02-2VH20-KP-X10, provides temperature- compensated (to 25°C) conductivity measurements over the range 40 to 400,000 micromhos/cm. The conductivity cell was calibrated with standard solutions before and after each field survey to determine drift.

Salinity was determined with a Beckman Electrodeless Induction Salinometer, model RS5-3. This instrument provides salinity measurements over the range 0-40°/oo($\pm$0.3°/oo); conductivity measurements over the range 0-60 millimhos/cm ($\pm$0.5 millimhos/cm); and temperature measurements over the range 0-40°C ($\pm$0.5°C).

Periodic checks on calibration of the instrument were made in the field with a fixed resistor. Before and after each field survey the instrument was calibrated against known standards.

The pH was determined using a Leeds & Northrup model 7417 pH/Specific Ion/mV meter (±0.1 units). This instrument was field calibrated daily with standard buffer solutions. Subsurface water samples were obtained using an all-plastic Kemmerer water sampler.

Dissolved oxygen was measured at the time of water chemistry sample collection using a YSI (model 51A) DO meter and probe (±0.2 ppm). This instrument was field calibrated daily using Hach chemistry for modified Winkler technique and a mercury thermometer.

In addition to the above instruments, a portable water quality monitor was used during major surveys. This instrument was a model RM925 Robot Monitor manufactured by the Schneider Instrument Company, Cincinnati, Ohio. This instrument was used to measure the following parameters on a continuous horizontal basis.

1. Temperature
2. DO
3. pH
4. Turbidity
5. Chloride
6. Conductivity

Water was pumped separately from two depths, surface then bottom, through the monitor to obtain measurements of the above parameters.

Additional measurements of surface and bottom water temperature, specific conductance and dissolved oxygen and surface pH were obtained monthly during the biological sampling at each station.

6.1.1.1.2 Chemical Parameters. Triplicated water samples for chemical analysis of parameters indicated in Table 6.1-3 were acquired at each sampling

station from two depths, surface and bottom, with a submersible pump. Exceptions exist at stations 12 and 13 where very shallow water (° 4 feet) frequently dictated that only surface samples be taken. It is assumed that complete mixing of the water column occurs at these shallow water stations due to turbulence generated by tidal currents and wave action. Three 6.5-gallon plastic carboys were filled one at a time as the research vessel made three consecutive passes along the transect.

All water chemistry samples were obtained on the same date during September, October, January, March, April and May. Two consecutive days were required during June, July, December and February, while three consecutive days were required in August and November.

Station 13 (Figure 2.7-5) is located in Matagorda Bay at the mouth of a narrow (30 ft.), shallow (1-4 ft.) outlet from Parker's Cut to Matagorda Bay. A small channel extends into the bay for a short distance before shallow water is reached. Samples were taken in the channel proper as low tides frequently result in complete drainage of the alluvial sand and mud flats around the channel. The channel itself is normally so shallow that, once instrument probes are situated for surface measurements, they were also situated for bottom measurements. Thus, only one measurement was taken. Deeper waters (3-4 ft.) exist in the channel only during periods of heavy runoff or high tides. During either condition, strong and turbulent flow has always been observed at this station and it has been assumed that the water column is vertically mixed.

Station 12 is similar to station 13, but in a slightly wider and deeper channel at the mouth of Culver's Cut where it empties into Matagorda Bay. There is generally less turbulent flow at station 12 than at station 13. Some surface-bottom data do exist for station 12 which substantiate that the water column is vertically mixed (June, July, August, October) during periods of flow, whether runoff or tidal induced. Thus, during both low and high water conditions, the water column is vertically mixed, if flow exists. There are similar data (November and December) which indicate that during slack water conditions, the water column is not vertically mixed. Measurements made under these conditions at both surface and bottom show that exceptions exist when the water is too shallow to allow adjustment of probe position as at station 13.

Available surface-bottom field measurements of temperature, dissolved oxygen, salinity and conductivity for STP sampling station 12 are given below (Ref. 6.1-1).

	Temperature °C		Dissolved Oxygen		Salinity		Conductivity	
Month	S	B	S	B	S	B	S	B
June	28	28			14.4	14.4	25,000	25,000
July	32	31			7.8	7.9	15,000	15,000
Aug	31	32			8.0	7.8	15,220	14,700
Oct	25	24	9.0	7.6	0.05	0.8	976	1,520

	Temperature °C		Dissolved Oxygen		(Cont'd) Salinity		Conductivity	
Month	S	B	S	B	S	B	S	B
Nov	19 -	20			7.8 -	13.2	12,050 -	19,700
Dec	17 -	16	9.3 -	9.3	8.6 -	11.6	12,700 -	15,900

Contents of each carboy were mixed by agitation and transferred by means of a spigot to properly labeled sample bottles. Labels bore sufficient information to identify the sample as to location, replicate number, time and date of collection, and sample type. Perishable samples such as BOD and bacteria were immediately stored on ice and transported to a local analytical lab for processing. Other samples, containing appropriate stabilizing agents, were stored without refrigeration and shipped to an analytical laboratory. Preservatives, holding time, and analytical techniques for each parameter are as specified in the methods referenced in Table 6.1-3. Water samples were filtered (Millipore, 0.45 micron) in the field for chlorophyll a analysis.

6.1.1.1.3 Calculational Models Three major calculational models were used to assist in predicting the effect of plant operation upon the physical/chemical characteristics of the Colorado River.

The salinity distribution within the estuary portion of the river has been predicted for both ambient and plant operating conditions using an empirical model, designated "SALTY," which is based upon observed salinity distributions. The basis and complete description of the model are given in Appendix 6.1A entitled "An Empirical Model for Determining the Salinity Distribution in the Colorado River."

The excess temperature distribution in the Colorado River resulting from the discharge of the reservoir blowdown is predicted using a model, designated "MUDSUB," based on the work of Koh and Fan (Ref. 6.1-2). The model has been modified to adequately treat the water surface and river bottom boundary conditions which are present at the STP site. A detailed description of the model is given in Appendix 6.1B, entitled "Mathematical Dispersion Models for Heated Discharges."

A mathematical model was used to estimate the tidal flow and stage variations in the Colorado River near the proposed discharge point of the reservoir blowdown. Specifically, calculations have been carried out for one complete tidal cycle to determine the temporal variations of the longitudinal vertically integrated tidal/river flow at River Mile 12.5 (R.M. 12.5) for a range of gaged inflows up to 3,500 cubic feet per second (cfs).

To describe the hydrodynamic response along the length of the Colorado River under varying tidal inputs and river inflows, a numerical two-dimensional (area-wise) tidal hydrodynamic model (HYDTID) (Ref. 6.1-3) has been employed. This model solves explicitly the basic unsteady equations of motion in two orthogonal directions coupled with the unsteady flow continuity equation. A basic assumption of this model is that vertical velocity distributions are uniform and, hence, computed flows are integrated over the depth. Since application of HYDTID to the STP site involved flow in only one direction (longitudinal), the computer code was restructured to more efficiently solve

this one-dimensional problem. The only modification to the HYDTID model as applied to the Colorado River was to input values for lateral parameters which would result in uniform conditions across the width of the river.

The HYDTID model has been verified using prototype data from the San Antonio-Espiritu Santo Bays. A detailed description of the verification is given in Chapter V (pages 40-53) of the referenced report.

The HYDTID model uses a series of interconnected square elements to describe the physiography of a prototype system with the basic equation applied and solved over this grid arrangement. The model was adapted to handle rectangular elements to more effectively describe the river system. The length of these elements was specified as one-half mile (2,640 feet) and the width was varied between 150 and 185 feet as a function of river inflow. Average mean sea level bottom depths were assigned to each element based on profile data.

6.1.1.1.4 Continuous Measurement System. To measure the rate and extent of fluctuations, a continuous measurement system to monitor conductivity, temperature, and stream flow direction and velocity was installed in the Colorado River. Data from the continuous monitoring program will be used in confirming predictions made with mathematical models of the mixed quality of intake water from the lower Colorado River and the consequent blowdown composition. The monitoring system will also verify predictions of dispersive characteristics near the discharge point of the near field discharge plume region and the farfield estuary.

The monitoring system consisted of four stations, A, B, C, and D (see Figure 6.1-2). All stations were capable of continuously determining temperature and conductivity. Additionally, three of the four locations (stations A, C, and D) had the capability of recording river level, and one station (station C) river flow. Temperature and conductivity were monitored at three water depths at stations B, C, and D. At station A, they were monitored at only two depths because of the water shallowness.

The temperature sensors were the Thermistor-Sensitor, model RM-25, manufactured by the Schneider Instrument Company, Cincinnati, Ohio. These sensors measure over the range 0-50°C with an accuracy of ±0.5°C, full-scale.

Beckman direct reading electrodeless conductivity meters (Solu Meter), models SMS 905 and SMS 950, were used for conductivity measurements. Each element had automatic temperature compensation, a cell constant of 0.75/cm, and accuracy of ±3 percent, full-scale. Dual conductivity channels are used at each water depth for each station. The low-range channels (model SMS 905) had a range of 0-5,000 micromhos/cm and the high-range channels (model SMS 950) a range of 0-40,000 micromhos/cm.

For flow measurements, the Marsh-McBirney Electromagnetic Water Current Meter (model 711) was selected. This instrument propagates an electro-magnetic field which is sensed on dual flow-measuring axes and will measure water flow velocities up to 10 fps on each axis. The overall accuracy of the instrument is composed of four factors:

1. Long term zero drift — Less than ±0.07 fps

2. Linearity of response — ±2 percent of reading

3. Wideband electronic noise — $0.03/\sqrt{T}$ rms fps where T is the output time constant expressed in seconds (standard value is one second)

4. Absolute calibration — ±2 percent of reading.

The river level was monitored with a Water Level Parametric System, SIC model RM25, Schneider Instrument Company.

The subsurface sensors were cabled to wooden pilings in the river, and were hardwired to shore-based strip chart recorders by flexible shielded cabling. The cabling was enclosed in conduit which was anchored to the river bottom.

The chart recorders functioned as a back-up, with the primary data transfer system being a telemetry channel linked to a central data acquisition station in Pittsburgh. The shore-based chart recorders were housed in Cary-Way portable buildings equipped with air conditioning, heat, lighting and telephone.

The continuous monitor at station C became operational during the first week of January, 1974, and, at the remaining stations, during the first week of March. These monitors remained in operation until December 31, 1974. Station B was maintained through April 1976.

6.1.1.2 Ecological Parameters

A biological field study program was conducted in conjunction with the physical and chemical field program described in Section 6.1.1.1. This program was similarly divided into major and minor surveys. Major surveys (see Table 6.1-4) were conducted on a three-month basis and minor surveys (see Table 6.1-5) were made at monthly intervals between major surveys. All locations (see Figure 6.1-1) previously described in Section 2.7 were sampled.

The biological program was designed to assess the natural and seasonal variation in populations and interrelationships of fish, phytoplankton, zooplankton, ichthyoplankton and benthcs by repetitive monthly sampling in several localities. Taxonomic identification of organisms was made by qualified biologists with specialties in the respective areas above, using standard and accepted local and regional taxonomic keys and other scientific literature. Bacterial populations were also investigated using standard methods as referenced in Table 6.1-3. During each survey, visual observations were made for aquatic macrophytes. The contents of benthic and trawl samples were also observed for such plants. Since no aquatic macrophytes were observed, methodology for their study is omitted in the discussion below.

6.1.1.2.1 Plankton. Phytoplankton and zooplankton samples were obtained concurrently with the collection of water chemistry samples from two depths, surface and bottom, by use of a submersible pump. A 500-milliliter portion was refrigerated and shipped immediately to the laboratory for microscopic examination.

Three one-gallon replicate samples were fixed and preserved with acid Lugol's solution (approximately one percent final concentration). These samples were shipped to the laboratories for a detailed species composition analysis.

Additional zooplankton samples were collected using an Isaacs-Kidd high speed plankton sampler. This unit, equipped with a flowmeter, was towed for 10 minutes at each station, and the sample obtained was preserved in 10 percent formalin. To further implement the sampling of planktonic organisms, a 10-inch, No. 20 mesh Wisconsin plankton net was towed for one minute at the surface to collect highly buoyant forms. This sample also was preserved in 10 percent formalin.

Ichthyoplankton and larval shrimp, crabs, and larger members of the macrozooplankton were taken with a plankton sled equipped with a half-meter, No. 10 (0.5-millimeter) mesh, tapered net and an integral flowmeter which permitted volumetric determinations.

The sled was towed by boat at each station at or near the bottom for five minutes, and again near the surface for five minutes. Each sample was preserved with 10 percent buffered formalin. Approximately one gram per liter of Rose Bengal was added to facilitate the sorting and identification of larval fish and eggs.

Cooled plankton samples were concentrated by centrifugation and examined at 200x and 400x for motile algae. A qualitative species list was prepared to aid in the subsequent identification of preserved phytoplankton. A similar qualitative examination was made for live zooplankton.

For quantitative enumeration of phytoplankton, a 50-milliliter aliquot of the well-mixed preserved plankton sample was concentrated by centrifugation at 3,000 rpm for 10 minutes. The supernatant liquid was decanted and precipitated material was suspended in five milliliters of water. An aliquot of the concentrated sample was placed into the well of a Palmer counting chamber and all algal forms present were identified and enumerated. Hyrax mounts of cleaned diatoms were prepared to facilitate the identification to species level.

Samples collected with the Wisconsin plankton net were examined qualitatively to ascertain whether significant numbers of highly buoyant algal species were present at or near the surface.

Using a No. 20 mesh net, a 1.0-liter portion of the preserved plankton sample was filtered and allowed to settle. The zooplankters present were then identified and enumerated at 100x in a Sedgewick-Rafter cell. A 1.0-milliliter aliquot of the well-mixed sample obtained with the Isaacs-Kidd plankton sampler was examined at 100x in a Sedgewick-Rafter cell.

Samples collected with the plankton sled were hand stored in the laboratory. Both larval fish and eggs were identified (when possible) and counted using a stereomicroscope. Following removal of larval fish and eggs, the samples were retained for the later examination for larval shrimp and crabs, and other macrozooplankton. All specimens were stored in 10 percent formalin and deposited in a permanent collection of voucher specimens.

6.1.1.2.2 <u>Benthos.</u> Benthic macroinvertebrates were collected in June, 1973, with a Birge-Ekman dredge. All subsequent samples were taken with a Ponar dredge, which is better suited for use on substrates common to the Colorado River and Matagorda Bay estuaries. Nine samples, three near each bank and three from mid-channel, were taken at each station. Exceptions occurred at

stations 13, 15, and 16 which were sampled with three grabs, due to the open-water characteristics of these areas. After collection, benthic samples received an initial separation from sediments by washing in a 0.595-millimeter mesh sieve-bottom bucket. Samples were preserved in 10 percent formalin and returned to the laboratories for further processing.

Emergent adult insects were collected with an insect light trap, preserved in 70 percent ethyl alcohol, and returned to the laboratories. These samples provide necessary data for estimating seasonal life-cycle variations of important fish food species. Also, adult specimens are used to verify identifications of larval forms collected in benthic samples during previous field studies.

Benthic samples were washed in U.S. Standard Series sieves in the laboratory and hand sorted. Organisms not requiring special preparation prior to identification were classified and enumerated using appropriate optical aids. These specimens were then placed in 70 percent ethyl alcohol and deposited in a permanent collection. Chironomid larvae were cleared by digestion of muscle tissue in heated 5 percent potassium hydroxide solution. This process renders the taxonomic features more readily visible. Cleared specimens were then washed and mounted on glass slides for identification and enumeration. Oligochaete worms were mounted on glass slides in Ammans lactophenol solution and stored on trays for a period of 3 to 7 days. This procedure clears the specimen, rendering both internal and external characters visible under magnification, and facilitates identification and counting of individuals present. Both chironomid larvae and oligochaetes were placed in 70 percent ethyl alcohol after identification, and deposited in a permanent collection of voucher specimens.

6.1.1.2.3 Fish and Associated Organisms. Fish populations were sampled consistently with one or more types of collecting gear at each station (see Table 6.1-6). Experimental gill nets, consisting of five panels, each 25 feet wide and 6 feet deep, with an open mesh ranging from 1.5 to 3.5 inches, were set at selected stations for periods ranging from 12 to 24 hours. All fish and crabs collected by this method were identified, eighed, and measured.

An otter trawl, with an aperture of 20 feet (headrope length), upper bag mesh of 0.75 inch and cod end mesh of 0.25 inch, was towed for 5 minutes at those stations (see Table 6.1-6) where water and bottom conditions permitted its proper deployment and use. Upon retrieval of the catch, larger fish specimens were identified, weighed, measured and returned to the water; all smaller fish, shrimp, crabs, and other organisms were preserved in 10 percent formalin and returned to the laboratory. Additional estimates of the fish population were provided by the use of a two-man, 20-foot bag seine in shallow areas of Matagorda Bay and surrounding waters. Large specimens captured by this method were identified, weighed and measured in the field and released; smaller fish, crustaceans and other organisms were preserved as described above and returned to the laboratories.

Organisms collected by trawl or seine gear and returned to the laboratory were identified, enumerated and measurements of length and weight were obtained. These data were collected on a repetitive monthly basis, and provided valuable information on the following topics:

1. Seasonal variation in biomass

2. Growth rates of important estuarine-dependent species such as shrimp, crab, and many fish, and

3. Extent of utilization of the study areas by these organisms at various stages in their life-histories.

The type specimens for each species are preserved in 10 percent formalin and deposited in a permanent collection.

6.1.1.3 Special Studies

6.1.1.3.1 Little Robbins Slough Marsh Complex. Construction of the South Texas Project Reservoir may result in reduced freshwater flow and nutrient input into the Little Robbins Slough marsh complex. A possible result could include shifts in salinity gradients in the lower marsh.

To provide information regarding utilization of the Little Robbins Slough ecosystem as a nursery area by estuarine-dependent organisms, baseline studies were conducted to gather data on existing salinity regimes, temporal and spatial species distribution and species population sizes. The monitoring program included sampling at two Matagorda Bay control stations to provide information on organism migration into and utilization of the eastern portion of the Matagorda Bay estuary. Station 99, originally located in Matagorda Bay, was to have monitored the movement of estaurine organisms through an unnamed barge canal. However, it was learned that this canal has been plugged, precluding any movement through it. Therefore, it was decided that a station in Crab Lake would be more meaningful to the program. Hence, station 99 was relocated to the middle of Crab Lake. Such data can be used on a comparative basis with lower open-marsh data to establish the slough's relative role as a nursery.

Salinity monitoring of Little Robbins Slough environs was conducted concurrently with biological sampling to ensure detection of organism-salinity correlation.

Nutrient input studies were conducted monthly at selected stations to assess potential impact of reduced freshwater inflow and associated nutrients on the lower marsh's role in meeting developmental needs of young estuarine-dependent organisms.

Field studies began in April, 1975 and were continued until April, 1976 to document seasonal changes.

Thirteen stations were sampled including 11 stations in the Little Robbins Slough marsh complex and two stations in Matagorda Bay (Figure 6.1-1a). Stations 12, 13 and 16 were sampled during the June, 1973 - May, 1974 baseline environmental survey.

Salinity, specific conductance, water temperature, pH and dissolved oxygen were measured (in the field) concurrently with collection of biological samples at each station. Water level variation also was observed at each station.

Water samples for nutrient levels including nitrates, orthophosphate, inorganic carbon, total organic carbon and total carbon were taken monthly

during collection of biological samples at eight stations (stations 16, 91, 92, 93, 94, 95, 96 and 97 - see Figure 6.1-1a).

Fish, ichthyoplankton, crustaceans and macrozooplankton were sampled monthly at all stations, with frequency increasing to once every two weeks at the station in Crab Bayou (station 98) and stations 12, 13 and 99 during March through May and August through December. These periods of intensive sampling coincided with the expected highest influx of estuarine-dependent organisms. Benthos, phytoplankton, periphyton, macrophyton and microzooplankton were sampled quarterly at all stations in May, August, November and February. Macrophyton studies included quarterly sampling of all forms and relative abundance. Qualitative observations were made during other trips. Emergent hydrophytes were included in a terrestrial survey of the marsh ecosystem.

Duplicate water samples were taken monthly and duplicate sediment samples were taken quarterly during collection of biological samples at 12 stations. Water samples were analyzed for dissolved nutrients and when applicable (i.e., high turbidity), suspended matter was analyzed using procedures for analyses of sediment nutrients. Parameters included nitrates, orthophosphate, inorganic carbon, total organic carbon and total carbon.

6.1.1.3.2 Entrainment Monitoring Program. The location of the STP makeup pump station on the Colorado River is such that a potential exists for entrainment of eggs, larvae, and/or juveniles of commercially and recreationally valuable fish, shrimp and crabs. Low river flow allows some saltwater intrusion and associated migration of these organisms into the vicinity of and upstream from the intake. Under the proposed intermittent makeup water pumping scheme, the magnitude of any entrainment can be expected to vary with season and salinity regimes in the river. Although STP baseline data were gathered during an extremely wet year, density calculations for these organisms in the vicinity of the proposed intake were made in a conservative manner and are believed representative.

To confirm predicted entrainment under low flow conditions, an additional study was conducted to determine the densities of planktonic organisms adjacent to the makeup intake structure during low flow conditions.

The program was divided into two phases: the first phase was prior to actual pumping and the second phase will be during cooling lake filling operations. The first phase began during April, 1975 and continued until March 1976. The second phase has begun and will continue for one year, or until adequate data have been acquired to measure actual entrainment. 7

1. Phase One. During phase one, four stations in the Colorado River were sampled (stations 1, 2, 3, 5 - Figure 6.1-1) to enable characterization of population densities in the Colorado River under various flow conditions.

   Sampling was at least quarterly, and an intensive sampling schedule was initiated when salinity in the vicinity of the STP intake location (Station 2) reached 3 ppt at a depth of 8 to 10 ft, as determined by a continuous recording salinometer. The intensive sampling schedule was followed only for the duration of low river flow conditions (i.e., salinity ≥3 ppt at 8 to 10 ft at the intake location). When low flow conditions prevailed, intensive sampling was performed weekly March through May and

August through December and biweekly (i.e., every two weeks) during January, February, June and July.

Low river flow conditions did not occur during April, May, June, July or early August, 1975. Quarterly sampling trips were conducted on May 6 and August 5 when freshwater conditions existed at the intake location. Low river flow conditions first occurred on August 19, 1975. Except for most of September and a 16-day period in mid-October, low flow conditions required intensive sampling for the remainder of the study period.

Sampling dates were as follows:

1975	1976
May 5	January 6, 20
August 5, 19, 26	February 3, 17
September 24	March 2, 9, 17, 25
October 1, 3, 24, 30	April 2
November 6, 12, 20, 25	
December 2, 10, 16, 23	

Water quality parameters measured at each station concurrent with biological sampling included surface and bottom temperature, hydrogen ion concentration (pH), dissolved oxygen, specific conductance and salinity. Water transparency, as indicated by Secchi disc readings, was also determined. When a salt wedge was present, a vertical salinity profile was made at depth increments no greater than 5 feet. Additional salinity readings were made at locations between designated stations to determine the uppermost extent of saltwater intrusion. A continuous recording monitor system also measured specific conductance at the 8.5 ft depth at Station 2. A description of the continuous monitoring system is given in Section 6.1.1.1.4.

Tidal excursion was determined from analysis of field conductivity/salinity data recorded during biological sampling and from the continuous monitoring system at station 2. Water level instrumentation was added in September, 1975 to the continuous monitoring system at station 2 to provide additional information on tidal excursion. Freshwater flow data for the 24-hr period encompassing each field trip were obtained from the U.S. Geological Survey (USGS, unpublished records) records for the Bay City, Texas, gauge (#08162500).

A 3:1 conical plankton net (0.5 m dia; 505 μ mesh), equipped with a digital flowmeter to measure volume of water filtered, was used to collect ichtyoplankton, other members of the macrozooplankton and postlarval and juvenile crustacea. The net was fitted to a sled for use in mid-channel surface, bottom, and mid-depth (approximately 8 to 10 ft) collections. A graduated tow-line and wire-angle indicator were used to determine sampling depth to the nearest 1 ft. An identical net (without sled) was used for near-bank, oblique-tow collections taken parallel to the shoreline at each station.

Samples were preserved in 10 percent formalin by adding an equal volume of 20 percent formalin. A solution of Rose Bengal stain was added to the 20 percent 7
formalin to facilitate sorting and identification of larval fish and eggs.

In the laboratory, samples were hand-sorted in glass dishes over a light table. Larval fish and eggs were identified to the lowest practical taxon, using a dissecting microscope, and enumerated. Postlarval and juvenile 7

shrimp, crabs and other macrozooplankters were similarly identified and enumerated. All specimens were curated in 3 percent buffered formalin and deposited in a permanent voucher collection. Fish and associated macroinvertebrates were sampled at each station by seining and trawling. A 20 ft (headrope length) otter trawl with upper bag mesh of 0.75 in. and cod end mesh of 0.25 in. was towed on the bottom parallel to shore at mid-channel for 5 minutes. Larger fish and crabs were identified, weighed, measured in the field and returned to the water; smaller fish, shrimp, crabs and other organisms were preserved in 10 percent formalin for laboratory analysis.

Additional estimates of fish and invertebrate populations were obtained by use of a two-man bag seine (20 x 6 x 6 ft, 0.25 in. mesh) in shallow shoreline areas in the vicinity of each station. Specimens taken by seining were handled as described above for trawl samples.

Organisms collected by trawl or seine gear and returned to the laboratory were identified, counted and measured. Total weights were recorded by species. All specimens were stored in voucher collections.

2. <u>Phase Two</u>. During the second phase, emphasis will be on documentation of actual entrainment under various flow salinity conditions. Therefore, sampling is limited to station 2 and the siltation basin. Sampling is conducted at approximately two week intervals during periods of pumping. Additional samples are taken when salinities at station 2, at a depth of 8 to 10 ft, reach 3 parts per thousand. Salinity is checked daily by onsite personnel to determine the need for intensive sampling. Two permanently (for the duration of the study) positioned continuously recording salinometers are monitored. These recorders are positioned in the following locations: 7

   1) at the top of the weir approximately 2 feet below the water surface, and
   2) at a depth of 8 to 10 feet.

   Intensive sampling does not exceed weekly intervals during March through May and August through December, and will not exceed biweekly intervals during January, February, June and July. Intensive sampling is conducted only for the duration of low flows (as indicated by salinities ≥ 3 ppt at a depth of 8 to 10 feet). Samples are collected over a 24-hour period at 6-hour intervals. Exact sampling procedures in the siltation basin will be adjusted as necessary to meet physical sampling restrictions.

6.1.1.3.3 <u>Impingement Monitoring Program</u> Impingement monitoring is performed to determine species composition and to quantify the numbers of fishes and other organisms which become impinged on intake screens by diversion of water from the Colorado River to the cooling reservoir. The impingement monitoring program is on going and will continue for one year or until adequate data have been obtained to assess impingement. 7

Impinged organisms are sampled at the initiation of each pumping period and for one 24-hour period every seven days during extended periods of continuous pumping. Samples consist of 30-minute counts on each of two screens every eight hours during a 24-hour period. All fishes and other organisms are identified by species and the total weight of the 24-hour sample determined. All fish of a given species are used to compute modal length, maximum length, and modal weight. If greater than 100 fish of any one species are collected during a sample, a random subsample of at least 100 fish of that species are used for these measurements. Estimates of the total number of each species impinged per 24-hour sampling period are computed. The salinity, makeup volume and freshwater flowrate during sampling are recorded. 7

6.1.2 GROUND WATER

The STP site is located in Matagorda County, Texas. In the site area, shallow and deep aquifer zones are separated by an impervious confining zone of considerable thickness. The known major differences in the water quality data and the direction of ground-water flow confirm the substantial thickness of the impervious zone. The deep aquifer zone is recharged from infiltration of precipitation and stream percolation outside the site area. The shallow aquifer zone is also replenished from outside the site area (see Section 2.5.2).

6.1.2.1 Physical and Chemical Parameters

6.1.2.1.1 Physical Parameters. A weekly water level monitoring program was initiated for the STP in July 1973. Piezometers were installed at various depths in each aquifer zone. In addition to these onsite water level measurements, previous Texas Water Development Board measurements for wells in the offsite area have been utilized.

Piezometer locations are shown in Figure 6.1-3. Typical piezometer installation details are shown in Figure 6.1-5. Locations and depths of piezometers are shown in Figures 6.1-6 and 6.1-4.

The onsite water level measurements were obtained using piezometers consisting of slotted plastic (PVC) screens 2 inches in diameter and 3 feet long with 0.010-inch slots connected to plastic (PVC) rise pipes. The pipes are either 0.75 or 2.0 inches in diameter. The top of the riser generally projects about 2.5 feet above ground surface and is protected with metal covers. Installation of piezometers followed drilling, surging, and electric logging of the holes.

Clean uniform sand was placed in the borehole around the screen and riser to near the top of the particular sand unit in which the water level was to be monitored. Bentonite seals were placed in specified wells. The remainder of the hole was grouted with cement up to the ground surface, providing an effective seal. Holes for the piezometers were drilled using the hydraulic rotary method using only the natural muds while drilling. Several days after the cement grout had set, each of the piezometers was checked to ensure that it was functioning properly. Each riser was filled to the top with fresh water, and the rate of fall was then observed. When the response was sluggish, the piezometer was flushed by pumping.

Measurements of water level were taken using an electric fluid conductivity probe. When the probe at the end of the cable on the instrument touched the

top of the water in the piezometer, a red light flashed on. The depth to water was measured using an engineer's field scale with the probe which is accurate to ±.02 foot. The tops of the riser pipe and ground surface elevations were determined for all piezometers.

6.1.2.1.2 Chemical Parameters. The preoperational program of ground-water quality sampling is divided into two phases. Phase I consisted of a monitoring program in which the well samples were collected and analyzed at weekly intervals. Phase I was completed in December, 1973. The purpose of this program was to determine the short term variability of the ground-water quality. The Phase II sampling began February 1974. During Phase II the sampling program was conducted at monthly intervals for a 6-month period.

Samples for ground-water quality analysis were secured from three separate test wells located on the plant site (see Figure 6.1-3). These wells provide water from three distinct zones of the Gulf Coast Aquifer. The wells and the zones sampled are identified below:

1. Well No. 115-D 39.5 ft clay
2. Well No. 2 60-80 ft sand
3. Well No. 114-A 125 ft sand

Triplicate water samples from each well for bacteriological and chemical analysis of parameters indicated in Table 6.1-7 were acquired with an aspirator sampling device. This apparatus consisted of 0.5-inch I.D. polyvinyl chloride (PVC) pipe cut into 5-foot lengths for portability and handling ease and fitted with threaded couplings, a 5-gallon glass container for sample collection and connecting tubes of Tygon (flexible PVC). The required lifting force was supplied by a vacuum pump (Millipore Corporation) and power supply from a gasoline-powered generator.

Each well was pumped prior to sample collection to ensure a fresh inflow of water from the aquifer being sampled. Sample bottles were filled by reversing the connecting tubes, thus pressurizing the collection vessel and forcing the water into the sample bottles.

Water samples collected as described above were stored on ice and shipped to analytical labs for processing. Analytical techniques used for each parameter are referenced in Table 6.1-7.

The monitoring program was extended into Phase III to determine the effect of plant construction on the ground-water quality. Similarly, the effects of plant operation on the ground-water quality will be monitored by the continuation of the surveillance program into the operational phase.

6.1.2.2 Models

Models may be used to predict effects such as changes in ground-water level, dispersion of contaminants, and eventual transport through aquifers to surface water bodies. Descriptions of basic subsurface and ground-water parameters and comments relating to their reliability are presented in this section. The parameters to be discussed are those determined by one of the following methods: analysis of pump test data (Table 6.1-19), laboratory permeability testing procedure, or establishment of aquifer geometry. Q 330.6

6.1.2.2.1 <u>Analysis of Pump Test Data.</u> Theis (Ref. 6.1-4) developed the nonequilibrium well formula, which takes into account the effect of pumping time. Theis's formula is based on the following assumptions:

1. The aquifer is uniform in character and permeability in both vertical and horizontal directions.

2. The formation has uniform thickness and the well penetrates the formation fully.

3. The formation is of infinite areal extent and has no recharging source.

4. The water removed from storage is discharged instantaneously with lowering of head.

In its simplest form the Theis formula is

$$T = \frac{114.6QW(u)}{s}$$

where
s = drawdown in feet

Q = pumping rate in gpm

T = coefficient of transmissibility

$W(u)$ = well function of (u)

and

$$S = \frac{uTt}{1.87r^2}$$

where
S = coefficient of storage

t = time in days

r = distance in feet from pumped test well to observation well

The Theis curve-matching technique is used to get T and S. This technique is very well explained by Todd (Ref. 6.1-5).

Jacob (Ref. 6.1-6) modified the Theis formula for small values of u. If time is plotted on a log scale and drawdown on an arithmetical scale, then the curve becomes a straight line. The coefficient of transmissibility is

$$T = \frac{264Q}{\Delta s}$$

where
T = coefficient of transmissibility in gpd/ft

Q = pumping rate in gpm

Δs = slope of time-drawdown curve

$$S = \frac{0.3Tt_o}{r^2}$$

where t_o = intercept of straight line at zero drawdown in days

r = distance in feet from pumped well to obser vation well where drawdown measurements were made

Data from the test well sand piezometers were analyzed by this procedure. To provide a check of results the Theis method was also utilized and found to agree.

The Theis nonequilibrium equation is applicable for analysis of the recovery of a well pumped at a constant rate. If a well is pumped for a known period and then shut down, the drawdown thereafter will be the same as if the well were being pumped continuously and a recharging well of the same capacity were superimposed at the time the pumping was stopped.

Calculated recovery can be computed and plotted against logged time since pumping stopped. The values of T and S are then

$$T = \frac{264Q}{\Delta(s-s')}$$

$$S = \frac{0.3Tt_o}{r^2}$$

where $\Delta(s-s')$ = change in water level recovery per log cycle due to the recharging well

A second method of plotting the data permits direct use of residual drawdown without calculating the recovery from any extension of time-drawdown curves. It can be shown that in this case the coefficient of permeability is given by the following relation:

$$T = \frac{264Q}{\Delta s'}$$

where $\Delta s'$ = the change in residual drawdown per logarithmic cycle of t/t' where t is the time since pumping began and t' is the time since it stopped

6.1.2.2.2 Laboratory Permeability Testing. Permeabilities have been obtained on representative clayey samples from various borings using falling-head permeability tests and consolidation tests. Because of in situ soil fabric (root holes, silt seams, desiccation cracks and so forth) the in situ permeability may be considerably larger than (ten to one hundred or more times) the laboratory permeability.

Deviations from Darcy's law are most severe at low gradients, and gradients in the field seldom are much greater than unity. On the other hand, the gradi-

ents used in laboratory permeability tests and developed during consolidation tests are usually very large (one hundred or more). Therefore, the applicability of laboratory test results for analysis of field behavior is subject to scrutiny. Estimates of seepage rates and consolidation rates may be considerably greater than those actually developed in the field, if true non-Darcy flow exists.

6.1.2.2.3 Establishment of Aquifer Geometry. The subsurface explorations were reviewed and interpreted by ground-water hydrologists, who prepared generalized cross sections of the subsurface aquifer conditions. These evaluations are presented in Section 2.5 and shown in Figures 2.5-14 and 2.5-15.

The accuracy of these subsurface sections is known only at the actual locations of the subsurface borings. The interpolation between borings and the generalization of the figures represents the best professional interpretation.

The presence of an intervening confining clay layer, separating the shallow aquifer zone from the deep aquifer zone as evidenced by the following findings:

1. Drillers' logs from water wells in the site vicinity indicate a highly consolidated clay at depths of approximately 120 to 200 feet.

2. Site exploration borings and electric logs indicate a clay zone at depths of approximately 120 to 200 feet.

3. Different hydrostatic heads exist in the deep and shallow aquifer zones.

4. Ground-water gradients are oriented in almost opposite directions in the two primary aquifer zones.

5. Water quality in the two aquifers is noticeably different.

6. Onsite pump tests and previous offsite (water well) pump tests by others indicate confined conditions.

The shallow aquifer zone consists of interbedded sand, silt, and clay layers which extend under much of the site. The upper shallow aquifer is confined by a surface clay and separated from the lower shallow aquifer by a continuous 20-foot thick clay layer, which retards any vertical ground-water flow between the upper and lower portions of the aquifer. The lower shallow aquifer consists generally of two principal permeable layers separated by a rather continuous clay layer. However, some sand layers do occur locally within the clay, and the permeable strata are hydraulically interconnected. The hydraulic connection is shown by the fairly uniform piezometric response within the lower shallow aquifer stratification. The lower shallow aquifer is isolated by an 80-to 130-foot thick aquiclude consisting of a massive clay stratification, effectively precluding any hydraulic communication between the shallow and deep aquifer zones.

6.1.3 AIR

The preoperational meteorological program includes an onsite meteorological station designed to measure the parameters needed to evaluate the dispersive characteristics of the site, and a baseline study of the local meteorology to determine the potential environmental impact of STP.

6.1.3.1 Meteorology

Various meteorological parameters were used to determine the meteorological characteristics of the STP site region and as input to various models used to predict the environmental effects of plant operation.

6.1.3.1.1 Offsite Data. Low level meteorological data were used to obtain site regional characteristics and were used as input into fog prediction and diffusion models outlined in Section 6.1.3.2.

Data to determine STP region meteorological characteristics were obtained from Galveston, Victoria, and Corpus Christi, as well as from the onsite data program. Also, temperature and precipitation data were obtained from Matagorda, Palacios, and Bay City. Additional precipitation data were obtained from Woodsboro, Goliad, Pierce, and Sugar Land. Locations of and pertinent information regarding these stations are presented in Table 2.6-1 and Figure 2.6-1. Procedures for collecting data at these stations are available in Surface Observations (Ref. 6.1-7).

The natural occurrence of fog (see Section 2.6.2) in the vicinity of the STP site was investigated using hourly meteorological data collected at Victoria, Corpus Christi, and Galveston. The data used in the meteorological analysis consist of observations made during the period from October 1953 through September, 1958, for Galveston; from September, 1953, through August, 1958, for Victoria; and from March, 1955, through February, 1960, for Corpus Christi. These time periods were chosen because they are the most readily available data periods reported with hourly observations on magnetic tape (National Weather Service data after 1965 are reported as three-hourly observations).

6.1.3.1.2 Onsite Meteorological Measurement Program. The onsite meteorological measurements program at the STP has been upgraded to support emergency preparedness requirements and to replace existing equipment and sensors with state-of-the-art instrumentation to enhance maintainability and reliability of the system. The upgraded system became operational on July 30, 1984. This system will support the operation of STP Units 1 and 2.

The program includes a 60-meter guyed meteorological tower which serves as the primary data collection system and a 10-meter freestanding tower which serves 7
as a backup to the primary system. All functions of the backup tower are completely independent of the primary system. The locations of the Meteorological Towers with respect to the plant structures are shown on Figure 6.1-7. The primary system utilizes the existing meteorological tower from the preoperational monitoring program located approximately one mile east of the plant structures. The backup tower is located approximately 2500 feet south of the primary tower and 500 feet north of the Visitor's Center. Both locations are clear of any obstructions which could influence the collection of meteorological data on the towers. The equipment, instrumentation, and levels

of measurements, which meet the guidance of Regulatory Guide 1.23 (Ref. 6.1-71), are provided in Table 6.1-8 for both systems.

The upgraded system was designed to provide the maximum availability of the key wind and atmospheric stability measurements for use in the Units 1 and 2 emergency dose assessment system computer. This design includes backup meteorological measurements of the 10-meter wind speed and direction and atmospheric stability (delta T is the primary measurement, while wind direction standard deviation, sigma theta, from the primary and backup tower is the backup measurement), redundant power, redundant communications links, redundant data recording equipment, and reliable, state-of-the-art instrumentation. With this design, a high amount of data availability is assured.

Independent digital processors are used as the primary data collection system for both towers, with analog strip charts as backup. The microprocessors sample the meteorological processor modules once every two seconds for each parameter and then provide 1-, 15-, and 60-minute averages. Sigma theta is computed for each wind direction channel via the microprocessor. The calculated 15-minute average sigma theta is also output on the analog strip chart. Microprocessor output is provided for future links with the Units 1 and 2 dose assessment system computers in order to provide near-realtime meteorological data for use in atmospheric dispersion modeling. Fifteen and 60-minute averages of all parameters will be provided to the dose assessment system computers. Output will be displayed on printers located in the 7
meteorological shelters until the dose assessment computers are operational. The dose assessment computer will then provide appropriate displays of meteorological data in the control room, technical support center, and emergency operations facility. Both control rooms will also display instantaneous 10-meter wind speed and direction via analog meters. Additional microprocessor output is provided to an auto-answer telephone dial-up port for offsite access of current and past data. The past 72 hours of 15-minute averaged data can be accessed. One-, 15-, and 60-minute average data are also recorded on magnetic tape for system monitoring, data verification, and future processing (e.g., use in semiannual operating reports). Table 6.1-9 provides a description of the data collection and recording equipment.

The microprocessor also provides data validation checks on the 15-minute averaged data. These checks include electrical status (i.e., system within predefined calibration test limits) and meteorological validations. Meteorological validation includes checks such as minimum wind speed and wind direction variability, wind speed and direction comparison between levels, temperature ranges and hourly delta T limits. Output from the microprocessor is provided with system status flags based on the results of the meteorological and electrical validation checks. These validation checks help ensure that valid data are being provided for realtime data functions such as dispersion modeling.

Both the primary and backup systems have backup power provided by propane generators. The generators automatically switch on when a reduced power voltage level is sensed. The processing and recording equipment are housed in environmentally controlled instrument shelters. The backup power propane generators are also located in environmentally controlled shelters for protection to enhance reliability. The shelter sizes are 11 ft x 11 ft (primary system) and 8 ft x 10 ft (backup system) for the processing and recording equipment, and 8 ft x 8 ft (both systems) for the generators. The shelters

are located downwind of the prevailing southeasterly wind directions from the towers to minimize wind turbulence and/or thermal effects on the meteorological measurements. Tower booms (8 ft long) are orientated into the prevailing winds to reduce tower effects on the measurements. The ground surface at the base of the towers has been kept natural (i.e., grasses).

System calibrations are performed quarterly in order to achieve maximum data recovery. All calibrations and maintenance activities are performed in accordance with the specifications of Regulatory Guide 1.23. Maintenance and calibration activities on the primary tower are greatly facilitated by the addition of an instrument elevator. Malfunctions can be readily determined via the system dial-up capability and monitoring of system status indicators provided by the microprocessor.

The onsite system will be used to provide representative meteorological data for use in realtime atmospheric dispersion modeling for dose assessments during and following any accidental atmospheric dispersion modeling for dose assessments during and following any accidental atmospheric radiological releases. The data will be used to represent meteorological conditions within the approximate 10-mile Emergency Planning Zone (EPZ) radius.

6.1.3.2.1 Short-Term (Accident) Diffusion Estimates

6.1.3.2.1.1 Objective. Conservative and realistic estimates of relative concentration (X/Q) values resulting from atmospheric diffusion have been calculated for the exclusion area boundary (EAB) and for the outer boundary of the low population zone (LPZ) for various time periods up to 30 days after an accident. 7

Onsite meteorological data have been used to evaluate Design Basis Accidents (DBA's) for the STP site. DBA's are postulated to characterize highly unlikely physical events and upper limit radioactivity concentrations and doses at onsite and offsite locations. Among the basic inputs to the accident analysis are the meteorological conditions and associated parameters which define the dilution capacity of the atmosphere.

6.1.3.2.1.2 Calculations. Cumulative frequency distributions of X/Q values have been calculated using the procedures described in Section 1.3.1 of Regulatory Guide 1.145 (Rev 1) dated November 1982 (Ref 6.1-72) for the following interval lengths: 1 hour (used to represent 2 hours), 8 hours, 16 hours, 3 days (72 hours), and 26 days (624 hours).

The STP meteorological data upon which the derived cumulative frequency distributions are based were collected during the period July 21, 1973, through September 30, 1977. Data from July 21, 1976, through September 30, 1976 were excluded from these calculations due to equipment problems which occurred during that period. Wind data were obtained from measurements at a height of 33 feet above ground. Atmospheric stability was determined from vertical temperature lapse rates that were obtained from temperature difference measurements between 33 and 195 ft. Atmospheric stability classes were assigned to each hour of data on the basis of these temperature difference measurements. Observations with calm winds were assigned a wind speed of 0.75 mph (which is the starting threshold of the wind sensor) and distributed in proportion to noncalm wind speeds less than 3 mph. Adjustments to the X/Q values for building wake effects were calculated using a factor of 2640 m^2 as

the minimum cross-sectional area of the containment building based on a 60-meter height, a diameter of 48 meters with a hemispheric top.

For the first two hours following an accident X/Q values were calculated at the effluent plume centerline assuming a ground level release, no plume rise and complete ground reflection. Hourly X/Q values were calculated at 16 wind direction sectors for the EAB and LPZ distances. (These distances are described in Section 1.2 of Reg. Guide 1.145.) The sector X/Q values were ranked from highest to lowest and the value that would be exceeded 0.5 percent of the time was selected for each sector. The highest of these 16 values is defined as the Maximum Sector X/Q value. Conservatively, the one-hour values were assumed to apply for the two hour period. In addition, the worst case X/Q values were determined for the EAB and LPZ. Both values occurred in the ENE affected sector.

For the LPZ, Sector X/Q values were also determined for various time periods using logarithmic interpolation between the 2-hour Sector X/Q and the annual average X/Q in the same sector. For each time period, the highest of the 16 Sector X/Q values is the Maximum Sector X/Q for that time period.

The hourly X/Q values that are exceeded 5 of the time are defined in RG 1.145 as the 5% Overall Site X/Q values. These Overall Site X/Q values were determined from the distribution of hourly X/Q values for all sectors combined. Overall Site X/Q values were calculated at both the EAB and the LPZ. In addition, for the LPZ, 5% Overall Site X/Q values were determined for 8-, 16-, 72-, and 624-hour time periods using logarithmic interpolation between the 5% Overall Site X/Q value (assumed to apply for a 2-hour period) at the LPZ and the maximum of the 16 annual average X/Q values calculated at the LPZ. 7

50% X/Q values were also calculated using the same procedures as for the 5% Overall Site X/Q calculations. Sector X/Q values are presented for the EAB (2-hour) and LPZ (2-,8-,16-,72-, and 624 hour) in Table 6.1-20. Worse Case, Maximum Sector, Overall Site, and 50% X/Q values are summarized in Table 6.1-21 for the various averaging periods.

6.1.3.2.2 Long-Term (Routine) Diffusion Estimates

6.1.3.2.2.1 Objective. Realistic estimates of annual average atmospheric transport and diffusion characteristics have been provided out to a distance of 45 miles (72.4 km) from the STP site. Annal average X/Q values were determined for the STP site using onsite meteorological data for the July 21, 1973 through September 30, 1977 period (July 21, 1976 to September 30, 1976 was excluded) based on 33-ft wind data and temperature differences between 33 and 195 feet.

6.1.3.2.2.2 Calculations. Annual average atmospheric relative concentration (X/Q) values were determined for the STP site on a directional basis. The X/Q values were determined for each hour of data by use of the Constant Mean Wind Direction Model for a ground level release as described in RG 1.111 (Ref. 6.1-73).

$$(X/Q)_j = \frac{2.032}{S_{z_j} ux} \quad \text{(Equation 1)}$$

where:

$(X/Q)_j$ = Relative concentration (X/Q) which is the concentration (X) normalized to source strength (Q) for sector j at distance x, sec/m³

S_{z_i} = Effective vertical dispersion parameter, for stability class i, (defined in Equation 1), m

$\bar{u}$ = Mean wind speed for hour of calculation, m/sec

x = Downwind distance, m

An effective vertical dispersion parameter, S_{z_i}, was used to account for building wake effects as shown in Equation 2 (Ref. 6.1-71):

$$S_{z_i} = \left[\sigma_{z_i}^2 + \frac{0.5D^2}{\pi}\right]^{1/2} \qquad \text{(Equation 2)}$$

with the constraint that

$$S_{z_i} \leq \sqrt{3}.\bar{V}_{z_i}$$

where: 7

$\bar{V}z_i$ = Vertical plume spread parameter for stability class "i", m

D = Height of the highest adjacent building (Containment building (60 m)

Observations with calm winds were assigned a speed of 0.375 mph (which is one-half the starting threshold of the wind sensor) and distributed in proportion to the directional frequencies of wind speeds less than 3.36 mph within each stability class.

For each hour of meteorological data, hourly X/Q values were calculated at each of the 16 wind sectors for the following distances: Site boundary (as defined in Table 6.1-23), LPZ, 0.5 miles, 1.5 miles, 2.5 miles, 3.5 miles, 4.5 miles, 7.5 miles, 15 miles, 25 miles, 35 miles and 45 miles. The annual average X/Q values at each distance and sector were then determined by summing the hourly X/Q values for each distance and each wind direction sector and dividing by the total number of observations in the data record.

The annual average X/Q values at the site boundary are presented in Table 6.1-22. Annual Average X/Q values, Depleted X/Q values, Relative Deposition Rates, Decayed X/Q values (half-life of 2.26 days), Decayed X/Q values (half-life of 8 days), Decayed and Depleted X/Q values (half-life of 2.26 days) and Decayed and Depleted X/Q values (half-life of 8 days) are presented in Table 6.1-23.

6.1.3.2.3 Cooling Reservoir Fog Predictor (CRFP) Model. The Cooling Reservoir Fog Predictor (CRFP) model described herein was developed to provide a consistent and reliable prediction of the thermal performance and fog potential of a thermally loaded body of water. The CRFP model considers the sources of heat transfer to and from the cooling reservoir, and, in particular, the air-side temperature and humidity distribution above and downwind of the cooling reservoir. Based on this model, it is possible to calculate the occurrences of fog due to the operation of the cooling reservoir as a function of the ambient meteorological conditions. In addition, the ability to determine the humidity distribution within the cooling reservoir plume provides a means of quantifying the severity of the fog when combined with a suitable model for visibility.

Thermal inputs to a cooling reservoir consist of the power plant condenser discharge, feed streams, precipitation and natural thermal loads from solar and atmospheric radiation. The losses of thermal energy consist of the plant intake, lake effluent streams (including blowdown), see page, back-radiation, and convective and evaporative heat transfer. The net rates of energy transfer and mass flow establish the thermal performance, water quality and consumptive water use for a cooling reservoir. However, the prediction of the fogging potential of a thermally loaded cooling reservoir requires a description of the convective and evaporative heat exchange components, not merely as

an integral effect, but in the detailed air-side distributions of the temperature and humidity. Fog will form in the cooling reservoir plume when the air becomes saturated with water vapor at the local temperature.

The CRFP model permits a detailed thermal and mass balance on the cooling reservoir based on a specification of the thermal inputs, meteorological conditions and the influent and effluent mass flows. Models are included to account for solar and atmospheric radiant energy based on the location of the reservoir and cloud cover. A model for thermal and mass diffusion through an inhomogeneous, atmospheric boundary layer was developed and calibrated for prediction of the convective and evaporative heat exchange. This latter model considers the wind, humidity and temperature structure of the air in order to determine the contribution of the convective and evaporative components to the energy balance. The humidity and temperature distributions in the air above and downwind of the reservoir are established from the reservoir convective and evaporative losses and the dispersion characteristics of the atmosphere. The calculations of the local air-side temperature and humidity are then used to determine whether or not there is a potential for fog formation within the cooling reservoir plume.

The CRFP model permits meteorological data to be read in either from National Weather Service tapes or data tapes from site meteorological towers. An iterative algorithm is then used to calculate the cooling reservoir temperature based on specified thermal inputs (power plant streams, influent and effluent streams, seepage and precipitation) as well as the relative distribution of the thermal energy losses between the radiative, convective, and evaporative components. The results from these calculations are then used to establish the local temperature and humidity distributions in the air, which, in turn, provide a direct measure of the fog potential by comparison with the local saturation humidity. The density of the fog, expressed in terms of visibility, is quantified by means of a suitable relation between local excess water content and visibility (Ref. 6.1-17).

6.1.3.2.3.1 Verification of CRFP Model. The CRFP model was validated by comparing its predictions to field observations for the following parameters:

1. the thermal energy losses from a cooling reservoir;

2. the frequency of fog formation over thermally loaded reservoirs; and

3. the height and density of the visible plumes.

Verification of the CRFP model has led to the conclusion that the model can provide fog prediction with confidence. The results of these verification studies are summarized below.

6.1.3.2.3.2 Verification of Thermal Performance Predictions. The basic requirement of the thermal performance prediction, at least with respect to the fog prediction capability of the model, is that the convective and evaporative components of energy exchange be correctly calculated. The convective and evaporative energy fluxes are required to establish the distribution of temperature and humidity above and downwind of the cooling reservoir. To establish the confidence of these predictions, reservoir temperature and ambient air conditions for the Four Corners cooling reservoir were used to give representative sets of data. These data were then used with the Johns Hopkins (Ref. 6.1-18), MIT (Ref. 6.1-19), and CRFP models to determine the combined convective and evaporative heat exchange. While the initial comparison between the CRFP and Johns Hopkins model was good over a wide range of the variables, there was a significant departure at the high wind speeds. This was associated with the form of the velocity function used in the Johns Hopkins model as compared to the theoretical prediction in the CRFP model.

The same discrepancy has been noted by Ryan and Stolzenbach (Ref. 6.1-19) even when the prediction was compared against the original data used in the n alization of the Johns Hopkins model.

A more consistent comparison is provided between the MIT model and the CRFP model. The MIT model was normalized against some of the same data used for the Johns Hopkins model as well as some wind tunnel data. When the MIT and CRFP models are compared on the same basis a good correlation is found. As shown in Figure 6.1-19 the ratio of the CRFP-to-MIT model predictions was found to be essentially the same over the range of wind speeds, with 98 percent of the calculations agreeing to within ±10 percent and 92 percent of the calculations agreeing to within ±5 percent. Figure 6.1-20 shows the frequency distribution of these calculations as a departure from exact correlation between these models. It should be remembered that the above predictions are based on actual lake temperature measurements and meteorological conditions associated with these lake temperatures. As a consequence, they provide a meaningful and representative combination of the air-side variables such as temperature, humidity, and wind speed. The distribution of predictions, therefore, represents some differences in the manner with which these variables are treated by the respective models. In particular, the use of the Bowen ratio in the MIT model to correlate convective and evaporative heat exchange is considered the primary cause of the discrepancy between the CRFP and MIT models. This was tested by artificially destroying the driving force for convective heat exchange (allowing the lake temperature to approach the ambient air temperature) and recalculating the convective and evaporative

components. In this case, the MIT model predicted a limiting ratio of the convective to evaporative component (equal to the Bowen ratio), while the CRFP model correctly predicted the loss of the convective component. The conclusions from this portion of the verification study may be summarized as follows:

(1) Good agreement is achieved between the theoretical CRFP model and the empirical MIT model over a wide range of conditions.

(2) The use of a constant Bowen ratio for predicting the relative distribution of evaporative and convective heat exchange appears to apply as an average condition, but it can cause serious errors under certain combinations of meteorological conditions.

(3) The deviations observed between the CRFP and MIT model predictions are probably due to the use of a constant Bowen ratio in the MIT model, which, on the average, correctly predicts the combined evaporative and convective heat exchange. The CRFP model has been demonstrated to have the correct behavior for the combination of variables under limiting conditions.

6.1.3.2.3.3 Verification of Frequency of Fog Occurrences. The Dresden cooling lake performance has been monitored for a considerable period of time, providing a unique combination of water temperature, meteorological tower data, and observations of fog occurrence.

The cooling reservoir temperature and the meteorological conditions (ambient temperature, thermal lapse rate, wind speed, and humidity) were inputted to the CRFP model, and the convective and evaporative heat transfer rates were predicted therefrom. These predictions were, in turn, used to establish the theoretical air-side temperature and humidity distribution over an individual pool of the lake. The Dresden cooling lake consists of five such pools of varying size. The results obtained from the calculations were then compared with the local saturation humidity to establish the occurrence of fog. The criterion used to establish the occurrence of a visible fog was based on the relation between moisture content and visibility developed by Radford as reported by Petterssen (Ref. 6.1-17). The theoretical model was found to show a strong correlation between observation and prediction, with the observation of fog or no fog being correctly predicted for 90 percent of the data. In this, a comparison between observation and the CRFP model prediction of source fog occurrence provides further verification of the model. The Dresden cooling lake and meteorological data span a very wide range of operating and climatological data. The strong correlation between the observational data and the predictions provides indirect verification of the thermal performance calculations and confidence in the ability to predict the occurrence of the source fog.

6.1.3.2.3.4 Verification of the Source Region Fog Characteristics. In addition to the frequency of occurrence of fog over the source region, it is also possible to use the CRFP model to predict the height of the visible vapor plume. This provides a description of the source region vapor plume, and, hence, confidence in the prediction of its downwind behavior. The Dresden data also included visual estimates of the vapor plume heights, although the

reliability of these estimates is uncertain. In general, the predictions were observed to yield larger visible plume heights than were recorded by field observers. This is thought to arise from two sources:

1. The definition of the top of the visible plume is based on visibility limits of 1,000 meters or less.

2. The ability to accurately represent the vertical distributions of the ambient temperature and humidity.

In the latter case, the representation of the ambient temperature distribution in the air mass was based on the use of a constant thermal lapse rate (measured between 35 and 125 feet) and a uniform humidity (based on the dew point temperature at 35 feet). While these representations of the ambient conditions have an influence on the prediction of the upward extent of the visible plume, they are not expected to affect the prediction of the horizontal extent of ground-level fog. Comparison between observed and predicted data revealed that the CRFP model predictions of visible plume height were generally conservative.

6.1.3.2.4 Noise Models. Sound is created when a pressure disturbance is propagated through the air in the form of compression waves. Noise may be defined as undesirable sound. The pressure fluctuation at a point in space due to sound waves is measured in terms of the sound pressure level which is defined as:

$$L_p = 20 \log_{10} \frac{P}{P_o} \qquad (1)$$

where:

L_p = sound pressure level, decibels referenced to P_o (dB re P_o)

P = sound pressure, N/m^2

P_o = reference sound pressure, N/m^2

The reference sound pressure is taken as 2×10^{-5} N/m^2 which approximates the minimum audible sound at 1000 Hertz (Hz).

While sounds are composed of many frequencies with a sound pressure level associated with each frequency, normally only those in the frequency range of 20 to 20,000 Hz are perceived by people. To provide a more detailed description of noise, this wide frequency range is usually divided into octave bands whose upper frequencies are twice the lower frequencies. Since the response of people to sound is frequency-dependent, a sound is often measured in terms of the A-weighted sound pressure level (dBA re 2×10^{-5} N/m^2), which is a single number representation scheme of weighting the contribution of each frequency according to the frequency response curve which approximates that of the human ear. The sound pressure levels (dBA) for several common situations are presented in Table 6.1-18.

The effect of plant operation upon the present environmental sound levels has been calculated based upon the methods presented below, and the results are

presented in Section 5.7. The results of the noise predictions for the alternative cooling systems are presented in Section 10.1. The principal noise sources of the facility include the cooling system, transformers, turbines, pumps and motors. The contribution of each source to the ambient sound levels has been estimated based upon its sound power level. The sound power level of a noise source, which is a measure of the total sound energy radiated by the source per unit time, is defined by:

$$L_w = 10 \log_{10} \frac{W}{W_o} \qquad (2)$$

where:

L_w = sound power level, dB re W_o

W = sound power of the source, watts

W_o = reference sound power taken as 10^{-12} watts.

The sound pressure level defined by Equation (1) is related to the sound power level of a point source with hemispherical sound wave radiation at a distance r from the source by (Ref. 6.1-20 and 6.1-21):

$$L_p = L_w - 20 \log_{10} r + 2.5 - A \qquad (3)$$

Where:

L_p = sound pressure level, dB re 2×10^{-5} N/m²

r = distance from source, feet

A = attenuation effects, dB re 2×10^{-5} N/m²

Atmospheric attenuation of sound waves is accounted for by A, which under normal atmospheric conditions is:

$$A = 1.7 \times 10^{-6} rf, \qquad (4)$$

where:

f = centerband frequency, Hz.

Equation (4) accounts for the much larger attenuation of high frequencies such that far from a source only the lower frequencies are audible.

Using Equations (3) and (4), the expected sound pressure level in each octaveband at a distance r from a noise source may be determined from the manufacturer's information on the sound power level of the source or from other estimates of the sound power level. At any specified distance from the site the noise contribution of each noise source to the background level was determined by first calculating the resultant sound pressure level in each octave band and then calculating the A-weighted sound pressure level. This calculational procedure is performed by a computer model which uses as input data the coordinates and sound power levels of each noise source and outputs the resultant

A-weighted sound pressure levels at an array of points around the site. The resultant values are then used to construct A-weighted sound pressure contours on a site map. When compared to the background environmental sound levels, the noise impact of the facility can be assessed.

In evaluating the noise impact of the facility on areas beyond the site boundary, consideration was given to the HUD Noise Criteria (Ref. 6.1-22), which state that levels below 45 dBA are "acceptable" for continuous 24-hour exposure, and levels up to 65 dBA are "normally acceptable" in a residential area.

6.1.4 LAND

6.1.4.1 Geology and Soils

Extensive geologic data collection and investigations were conducted to assess the environmental impact of construction and operation of the STP.

An extensive literature search was conducted for both regional and local information. Representatives of federal, state, and local government agencies, personnel of local consulting firms and oil companies, and faculty members of several universities were contacted to obtain information not available in the published literature.

State-of-the-art remote sensing studies were conducted as an aid in evaluating geologic conditions of the site vicinity. The remote sensing studies utilized high-altitude National Aeronautics and Space Administration (NASA) photographs, Earth Resources Technology Satellite (ERTS) imagery, Side-Looking Airborne Radar (SLAR) imagery, thermal and color infrared imagery, and conventional color and black and white aerial photographs.

The Site Exploration Plan (SEP), Figure 6.1-8, shows the locations of field investigations that included drilling exploratory borings, ground-water investigations, geophysical explorations, and geologic mapping. The methods used included standard 2-inch diameter split-spoon sampling; 3-inch and 6-inch diameter thin-wall tube sampling; 3-inch diameter thin-wall fixed piston sampling; static Dutch cone penetration testing; installation and reading of piezometers and pore pressure sensors; water well drawdown and recovery tests; seismic reflection and refraction surveys; geophysical borehole logging; and shallow exploratory trench and outcrop mapping.

Boreholes were drilled at selected locations to determine subsurface conditions at the site. Most of the boreholes shown on Figure 6.1-8 were drilled along the designated alignments of both external and internal cooling reservoir dikes. In addition to the borings shown, numerous other borings (see Figures 6.1-9, 6.1-10, and 6.1-11) were drilled and sampled at selected locations in the plant site area. The boreholes were supplemented by information available from holes previously drilled for water wells, oil and gas exploration. These holes are also shown in Figure 6.1-8. Most borings in the plant site area were drilled to a depth of 300 ft. The maximum drilled depth was 2619.5 ft. Most borings in the Essential Cooling Pond (ECP) area were drilled to a depth of 90 ft or less.

The holes were drilled with 4.75-in diameter drag bits and direct circulating drilling mud. All aspects of the drilling and sampling procedure were compiled on a field log of each boring. Standard Penetration Test (SPT) samples and 3-in thin-wall-tube samples generally were obtained alternately at 5-ft intervals or less to a depth of 100 ft, at 10-ft intervals to a depth of 200 ft, and at 20-ft intervals at greater depths.

Four aquifer pump tests were performed to determine the characteristics of the shallow aquifer at the site.

Geophysical logs were run in each completed borehole. These logs consist of electrical resistance, self-potential, and natural gamma radiation measurements.

Seismic reflection surveys of the site consisted of 24 miles of proprietary data purchased from commercial sources. Field investigations for deep seismic reflection data consisted of six traverse lines totaling 31 miles in length and shallow seismic reflection data totaling 20 miles. Four seismic refraction survey lines were run in the plant site area. These four surveys totaled approximately 5,600 ft in length. Cross-hole shearwave velocity measurements were obtained at each of the two plant unit locations.

Approximately 7,500 ft of exploratory trenches were excavated and mapped at a scale of 1 in = 2 ft. The trenches were located across imagery-observed tonal anomalies, mapped at the site to assist in determining the nature of these anomalies. Five 20-ft-long trenches were excavated through pimple mounds located in the southeastern part of the site. About 50 soil samples were obtained at selected locations from the walls of the various trenches. Gilgai microrelief structure was sampled in detail. In addition, 4,000 ft of exposed river bank in the Colorado River channel east of the site was geologically mapped at a scale of 1 inch = 50 ft.

Selected soil samples from boreholes and trenches were tested in the laboratory. All laboratory tests were conducted in accordance with applicable American Society for Testing and Materials (ASTM) standards. Classification tests included mineralogical analyses by X-ray and petrographic methods, and determinations of moisture content, particle size, dry unit weight, and specific gravity.

6.1.4.2 Land Use and Demographic Surveys

6.1.4.2.1 Demography. Specific methodologies used for demographic discussions in Section 2.2 are presented in this section.

Estimates of the 1970 resident population within 5 miles of the plant were determined from house counts and 1970 census data. The house count data were obtained from an automobile survey of the area taken in July, 1973. House counts were converted to population by applying the ratio of persons per housing unit obtained from 1970 census data for Matagorda County. In order to be conservative, the ratio for the Tidehaven division of Matagorda County, the highest ratio for the county and the district in which the site is located, was used. The ratio was 3.58 persons per housing unit (Ref. 6.1-23).

Beyond the 5-mile radius, population estimates were based on 1970 census data (Ref. 6.1-24) and the corresponding state census map. From this map, census units within each segment of the population wheel were identified and the fraction of their area within each segment was determined. The population wheel and the continued segments are described by concentric circles, centered on the reactor building, of 1, 2, 3, 4, 5, 10, 20, 30, 40, and 50 miles radii and 22.5° radial lines forming sectors centered on the 16 cardinal compass points. Use was made of population data for the smallest applicable census unit (e.g., division, city, town). It was assumed that the population within each such census unit was uniformly distributed. To reflect a more accurate population concentration within the 5-10 mile annular ring, population figures for the towns of Matagorda, Wadsworth, Buckeye, Collegeport, and El Maton were taken from the Texas Almanac And State Industrial Guide, published by A. H. Belo Corporation, 1972-73. These figures were then added to the segments in which they are geographically located.

The Texas Almanac population figures for these five towns was then subtracted from the U.S. Census subdivision figures for each town and the balances uniformly distributed, as previously described.

The populations for segments within 10 miles for the years 1980, 1990, 2000, 2010, and 2020 were based on corresponding projections for Matagorda County, the only county within 10 miles of the plant. It was assumed that each component (or fraction) of the county had the same decennial rate of the growth as that for the county as a whole.

Projections for the population of Matagorda County were obtained from the Houston-Galveston Area Council (HGAC). Projections from HGAC were available for the county for 1980, 1990, 2000, 2010, and 2020 (Ref. 6.1-25).

6.1.4.2.1.1 Population Between 10 and 50 Miles. The 1970 population and projections through 2020 between 10 and 50 miles from the STP site were determined in accordance with the method used for the area between 5 and 10 miles from the plant. The HGAC counties include Colorado, Fort Bend, Brazoria, Matagorda and Wharton, which are within 50 miles of the plant.

Projected populations were obtained from projections computed by the Houston-Galveston Area Council for the years 1980, 1990, 2000, 2010, and 2020 (Ref. 6.1-25).

Other Texas counties within 50 miles of the plant include Calhoun, Jackson, Lavaca, and Victoria. The projected populations for each of these counties were derived by using population projections calculated by the University of Texas, Austin, for the years 1980 to 1990. By assuming the decennial rate of growth for the decades between 1990 and 2020 to be constant and equal to the rate of growth from 1980 to 1990, the 1980 to 1990 growth rate was used to project populations to 2020 (Ref. 6.1-26).

Decennial projections for the counties in the study area are shown below:

	1970	1980	1990	2000	2010	2020
Brazoria	108,312	201,500	400,000	558,000	669,000	750,000
Calhoun	17,831	21,500	25,000	29,070	33,802	39,305
Colorado	17,638	25,000	39,000	45,000	51,000	57,000
Fort Bend	52,314	100,000	250,000	300,000	345,000	400,000
Jackson	12,975	12,400	11,600	10,852	10,152	9,497
Matagorda	27,913	32,000	38,000	43,500	49,000	54,000
Victoria	53,766	62,400	69,500	77,408	85,215	96,025
Wharton	36,729	45,500	57,600	82,200	110,000	125,000

6.1.4.2.2 Land Use. Land use patterns in the study area were studied by field reconnaissance, contact with appropriate local and state officials, and aerial photographic interpretation. Field checks of vegetation were conducted to ensure that the aerial photographic interpretations were correct. The Section 2.2 bibliography lists all references and contacts used to support compilation of the section.

6.1.4.2.3 Water Use. Data on ground-water use on and in the environs of the STP site consist primarily of an updated well survey and contact with some local users. The Texas Water Development Board was consulted for water well depth and use data.

The Texas Water Development Board and the Lower Colorado River Authority were contacted for data concerning the surface water use downstream from the plant.

A Matagorda County Agricultural Agent and local industrial users were contacted with respect to the present and future agricultural and industrial users of the ground and surface water in the study area.

6.1.4.3 Ecological Parameters - Terrestrial

6.1.4.3.1 Selection of Sampling Sites. The terrestrial ecology sampling program for STP was initiated in June, 1973, with a preliminary visit to the site. The major objective of this program was to characterize the terrestrial ecology of the plant site and surrounding area. The major emphasis was on distribution and abundance of important flora and fauna prior to and following construction and operation of the power plant facility.

The main thrust of Section 6.1.4.3 on preoperational monitoring is directed at outlining methodologies for obtaining baseline information on the terrestrial biota. Methodologies for monitoring specific impacts during construction are discussed in Section 6.1.4.3.8.

The preliminary information gathered from an onsite inspection of topography, soils, existing vegetation and land use, coupled with inspection of low level aerial photographs (500 feet to the inch, in color), a review of the literature, and interviews with landowners and local biologists, were used to map the study site with respect to existing and potential vegetation. This initial input divided the large heterogeneous site (12,352 acres) into a number of smaller, more homogeneous units on the basis of similarities in soils, potential vegetation, successional (seral) stage of existing vegetation, and

history of land use. This general knowledge of soils, vegetation, and land use subsequently served as the basis for gathering more detailed information on vegetation, mammals, herptiles (reptiles and amphibians) and birds. Since characterization and delineation of soil types on the STP site did not exist when the study was initiated, the Soil Conservation Service developed, on request, a map of soil types for the entire site.

A 100m x 100m grid was superimposed on a base map of the study site to facilitate selection of sample areas and to serve as a reference for establishing sampling points on the ground and subsequent presentation of data (Figure 6.1-12). Using the 100m x 100m map grid and standard surveying techniques, a reference point was selected near the center of the site in the southeast corner of the junction of two roads (Figure 6.1-12), and several columns and rows were located on the ground to serve as baselines. Each baseline was marked at 100-meter intervals with a wooden stake bearing the column and row number. The columns and rows were located on the following degrees of azimuth (magnetic) from the reference point: 82°, 172°, 262°, and 352°. These particular azimuths were selected to parallel the main east-west road at Row 45 (Figure 6.1-12). A sufficient number of columns and rows were surveyed to allow sampling of all major types available for investigation in each survey period.

Figure 6.1-13 depicts in a general way the location of sample areas for various disciplines of terrestrial ecology. A more detailed consideration of each appears below. Figure 6.1-14 shows the location of these same sample areas in relation to the site and facility layout design.

Since construction of the 7,000-acre cooling reservoir is predicted to have the greatest impact of any site preparation and construction activity on the existing terrestrial biota and land use, a major effort was directed at characterizing the extent and quality of agricultural productivity and wildlife habitat within its boundaries. A second area of major concentration, as indicated in Figure 6.1-14, is the river bottomland and adjacent upland to the east of the reservoir. This area contains important vegetation types and habitats for wildlife which are of limited extent in the southern portion of the Colorado River drainage (see Section 2.7.1).

An indirect effect of creating the cooling reservoir may be to reduce the extent and quality of some habitats including coastal marshlands in the drainage area of Little Robbins Slough to the south of the site (see Section 4.1). Thus the monitoring program included inspection of these areas as a third point of study.

Finally, studies conducted outside the STP site will serve as a control in verifying impacts attributed to preemption of land, site preparation, construction of the physical plant, and land management practices associated with the STP project.

When the terrestrial sampling program was initiated, access to all of the site property had not been acquired (Figure 6.1-15). At the time the ER-CP was written (November 1973), 15 percent of the site remained inaccessible (Figure 6.1-16). One of the later acquired areas in the west-central portion of the site contained a tract of land characterized by vegetation of an important intermediate stage of succession: the sea myrtle-bushy bluestem savanna type

(Figure 6.1-16, C20-R35). Although limited time during the fall survey prevented quantitative analysis of this area, a qualitative characterization with respect to the dominant species was made. The area was incorporated into the quantitative sampling program during the winter survey.

Sample plots were not established in the southwest and south-central sections of the site because field inspection indicated that vegetation and land use were comparable to other areas being sampled; for example, V1, V6, V7, and V8 (Figure 6.1-13).

6.1.4.3.2 Baseline Sampling Schedule. The one-year baseline sampling schedule for various aspects of the terrestrial program is summarized in Table 6.1-11. The rationale for this sampling schedule is discussed below in conjunction with descriptions of the individual baseline sampling programs.

6.1.4.3.3 Baseline Sampling Program - Vegetation. Following initial stratification and delineation, eight vegetation types were selected for a more detailed quantitative sampling. These were annual irrigated cropland, perennial non-irrigated cropland, unimproved pasture, improved pasture, fallow field, deciduous forest, mixed evergreen broadleaf-deciduous forest, and evergreen broadleaf scrubland. Three additional types - annual non-irrigated cropland, deciduous scrubland savanna, and tallgrass prairie - were incorporated into the quantitative sampling program during the spring and early summer surveys (Table 6.1-11). A qualitative study was conducted of aquatic macrophytes and plants bordering sloughs, channels and swampy or marshy areas. Sampling was sufficient to allow mapping of major vegetation and land use types for the entire site (Figure 2.7-4).

Qualitative information on species composition in sample areas dominated by tall grasses was obtained during the summer months. These areas were quantitatively sampled in the fall period at the time of maximum biomass accumulation and when flowering and fruiting was at its peak. Disturbed or early successional plant communities (e.g., fallow fields, pastures) and woodlands were sampled in the summer and fall. Sampling of spring-flowering herbaceous species was conducted in April, 1974, when the spring flora was at its peak (Ref. 6.1-30).

Where feasible, a minimum of 25 points was sampled within representative areas of vegetation and land use. Except at sample areas V1 and V8 where a modified random sampling scheme was used, points were located at 165-ft intervals along two or more baselines 165 ft apart. All plots were designated according to grid coordinates (Table 6.1-12) with the exact patterning of plots dependent upon the general configuration of the stand. All points were a minimum of 330 ft from the edge of the stand, except where the objective was to measure the transition between two vegetation types.

Vegetation was analyzed by establishing a series of nested plots (Ref. 6.1-28) at each sampling point (Figure 6.1-17) for the various strata as follows:

1. Tree stratum (stems $\geq$ 2.5 cm in diameter at breast height (dbh) or 4.5 ft above the ground) - 10m x 10m plot generally positioned to the east and south of the grid sampling point;

2. Shrub stratum (stems $\angle$ 2.5 cm dbh and $\geq$ 1 m in height) - two 4m x 4m plots generally located in the northwest and northeast corners of the tree stratum plot;

3. Herb stratum (stems $\angle$ 1 m in height) - two 25cm x 4m plots positioned along the original baseline with the long axis coincident with shrub stratum plots. Tall grasses, regardless of height, were treated in the herb stratum.

Basic vegetation measures for each stand in which plots were established included:

1. Vascular plant species composition and number;

2. Frequency - the percentage of plots in which each species occurs;

3. Density - the number of individuals of each species per unit area, omitted for herbaceous species in the herb stratum (Ref. 6.1-28); and

4. Dominance - the mean "coverage" of each species in a specified area (Ref. 6.1-28). Determination of the last measure varied with different strata. Tree stratum dominance was based on measurements of stem basal area (from dbh measurements) and is presented as (mean) basal area per square meter.

Where an individual was multiple-stemmed at the base, its basal area represented the sum of several stems. For the shrub and herb strata, dominance was derived from visual estimates of percent crown or canopy coverage (of the ground) and is given as (mean) percent coverage of each species in the stand. Estimates of basal area for the tree stratum were supplemented with estimates of canopy coverage from aerial photography to provide a more extensive sample estimate of dominance. The canopy coverage information was particularly helpful in areas where stems were distributed in a very irregular fashion because of land use practices and where an inordinate number of sample plots would have been required to derive reliable estimates of the population basal area.

In addition to the basic measures outlined above, records were kept of flowering and fruiting activity. Also, any additional species located outside sample plots were noted. Such information was necessary, especially for species that are rare on the site and, by chance, were missed by the quantitative sampling scheme.

Additional vegetation studies were conducted in the "pimple mound" or "hogwallow" areas of the site (areas V2, V3, V15 in Figure 6.1-13). These upland areas are characterized by a mosaic of raised mounds superimposed on an otherwise rather flat terrain. Inspection of aerial photographs indicates this type of microrelief was much more extensive in the uplands prior to the introduction of crop farming and had a substantial effect on the patterning of vegetation in the original landscape. Furthermore, initial field observations indicated the vegetation on the mounds is substantially different from that between mounds. Therefore, three mounds to the south and west of C63-R60 in area V3 were studied in some detail. In addition to a qualitative description of species composition, two 0.25m x 4m herb plots were established at distances of one meter to the east and west of the mound apices along the grid axis and the same quantitative data gathered as for standard plots elsewhere.

Finally, for mound number 1, linear transects were run from the apex out beyond the edge of the mound. A measuring tape was placed along the north and west axes of the grid leading from the mound apex. All plants touching the tape were recorded, along with distances of each from the center of the mound.

Voucher specimens were collected for most species and, where possible, duplicates were obtained. All specimens were given a collection number, recorded along with date and location of collection, and curated according to standard techniques. Taxonomic questions were resolved by NUS plant taxonomists in consultation with personnel and facilities of the Tracy Herbarium, Texas A&M University. Where available, duplicates of all plant collections were deposited in the Tracy Herbarium, with the original specimens retained in the NUS Herbarium in Pittsburg, Pennsylvania and Clear Lake, Texas. Plant nomenclature was based on Correll and Johnston (Ref. 6.1-31) with supplemental information on colloquial names from Gould (Ref. 6.1-32).

The qualitative and quantitative information gathered over a six-month period was used to refine the preliminary map of vegetation and land use types. At the end of this period a particular type, for example, deciduous forest, was subcategorized on the basis of its dominant species. (Generally, a species was considered domninant if it made up 10 percent or more of the basal area or canopy coverage in the upper stratum of the stand.) Thus, for example, the deciduous forest was segregated into a general bottomland type with red ash dominant and a riparian type with sycamore, pecan and sugarberry dominant. Spring and early summer surveys included sampling of important vegetation types and in direct impact areas which had not previously been sampled quantitatively (Figures 6.1-13 and 6.1-14). This sampling was used to confirm the qualitative observations in these areas.

Subsequent to preparation of the ER-CP, a qualitative inspection of vegetation was conducted along Little Robbins Slough between the southern boundary of the site and Matagorda Bay, for reasons outlined in Section 6.1.4.3.1 Methodologies are presented in the following paragraphs.

Low level (1:12,000 or 1 inch = 1000 ft) color infrared aerial photography, using Kodak type 2443 film, of the watershed was taken on September 22 and 23, 1975 between 10:15 AM and 11:15 AM. Water levels were approaching low tide, which occurred at 1:30 PM and 2:00 PM on September 22 and 23, respectively.

After preliminary inspection of the aerial photography, a field reconnaissance of the Little Robbins Slough wetlands was conducted (October 9-17). A portable light table provided for onsite inspection of the color infrared photography. In addition, black and white prints of the infrared photography were used for direct reference of field observations. Field observations were recorded at 110 points distributed throughout the wetlands system (Ref. 6.1-33). At several observation points, sampling subpoints were established along transects.

In the vicinity of each observation point, the relative abundance of each plant species was recorded as follows: 1, very rare; 2, rare; 3, infrequent to common; 4, abundant; and 5, very abundant (Ref. 6.1-28). Abundance values were designed to reflect both frequency of occurrence and percent cover (foliar and stem) of each species relative to total ground or water surface area. Dominance (D) and presence (P) were recorded at some additional observation

points, when detailed data were available from adjacent areas of similar vegetation.

Vegetation structure was determined from dominant individuals at each observation point and classified as: trees, woody plants $\geq$ 20 ft in height; shrubs, wood plants $<$ 20 ft in height; emergents, rooted herbaceous or semi-woody plants with most of the vegetation portion above the surface of the water or wet soil surface; floaters, herbaceous plants with vegetation parts principally on the water surface; and submergents, herbaceous plants with vegetation parts principally below the water surface (Ref. 6.1-34 and 6.1-35). Emergents, the most extensive vegetation type in the wetlands, were subdivided into three height classes: short, $<$ 1.5 ft tall; mid, 1.5-5 ft tall; tall, $>$5 ft tall. Areas with less than 5 percent cover were classified as open water or bare land.

Vascular plant nomenclature was based on Correll and Johnston (Ref. 6.1-31), Correll and Correll (Ref. 6.1-36) and Gould (Ref. 6.1-37). Algal determinations were based on Prescott (Ref. 6.1-38). Unidentified specimens were collected for positive identification, curated according to standard techniques, and deposited in the NUS Herbarium in Clear Lake, Texas, for permanent reference.

An index of water depth at each vegetation observation point was recorded in accordance with conventional wetland classes: wet, no standing water at surface face; shallow, water depth 0-0.5 ft above the ground surface; deep, water depth 0.5-3 ft; and excessively deep, water depth greater than 3 ft (Ref. 6.1-34).

At several of the vegetation observation points, the salinity of standing water was recorded with a Beckman Model RS5-3 Salinometer. Also, soil samples were collected from the upper 0.5 ft of the soil and analyzed for total soluble salt concentration using an Industrial Instruments RD-B15-Solu-Bridge. Determinations were based on air-dried soil samples mixed with two parts water by volume (Ref. 6.1-39). Conductivity readings (mmhos/cm) of soils were converted to salinity (ppt) using a multiplier of 0.64, and soil salinity was equivalent to 25°C.

Various salinity classification schemes have been used. The schemes differ in the salinity levels selected as the boundaries between classes (Ref. 6.1-40). This variation has led to considerable confusion concerning the description of wetlands vegetation, because information on species tolerance is often presented according to salinity classes. The Ekman system of describing salinity classes closely approximates techniques used by wetland plant ecologists and was adopted for the STP study. The Ekman salinity classes are: fresh, 0-0.5 ppt; slightly brackish, 0.5-3 ppt; moderately brackish, 3-10 ppt; highly brackish, 10-17 ppt, saline, 17 ppt. Ecologists debate the break between fresh and brackish more often than the break between brackish and saline classes. Discrepancies at the fresh-brackish interface probably occur because wetland vegetation studies have demonstrated "natural" discontinuities in plant communities that occur near this portion of the salinity regime. On the other hand, these discrepancies may, in part, represent an artificiality due to varying methods of measuring salinity.

Information obtained from field observations and aerial photography was used to prepare a vegetation map of the study area. A Bausch and Lomb Model ZT4 Zoom Transfer Scope was used to superimpose photographic details onto a topographic base map at a scale of 1:6000 (i.e., 1 inch = 500 ft). A key for determining dominant species mixtures from the infrared aerial photographs was made. The infrared color tones and textures for dominant species at field observation points were described using Munsell-Foss color charts (Ref. 6.1-41 and 6.1-42). Where species occurred in a variety of substrate conditions (e.g., from exposed soil to deep water), several color tones and textures were assigned to the same species. Designation of vegetative cover types was based on the structure of individuals in the uppermost stratum; vegetation subtypes were based on dominant species in all state. Dominant species had relative abundance of 4 or greater except, where plant cover was sparse, species having abundance estimates of 3 were considered dominant. The minimum area of individual vegetation subtypes included on the map was 0.25 acre.

6.1.4.3.4 Baseline Sampling Program - Mammals. The mammal sampling program consisted of two phases:

1. A qualitative phase designed to verify the presence of all species likely to occur on the STP site, and to identify important species (species defined by the AEC guidelines, March 1973, and the Texas Parks and Wildlife Department as rare, endangered, commercially or recreationally valuable, or critical to the structure and function of the ecosystem); and

2. A quantitative phase designed to characterize the seasonal plant-mammal associations by obtaining seasonal indices of the relative abundance of small mammals in areas sampled for vegetation.

Selection of sampling sites was based on both dominant vegetation and degree of disturbance (e.g., grazing, application of 2,4-D). Sampling locations are indicated in Figure 6.1-13. The associated vegetation types and the map coordinates of mammal sampling sites are shown in Table 6.1-13. Areas M21 through M26 were first sampled for mammals during the November sampling trip.

The qualitative phase, which was expanded to include newly accessible areas, involved surveys of 26 areas. The presence of larger mammals was verified by means of day and night time observation, photography of tracks, interviews with local residents and personnel from the Texas Parks and Wildlife Department, road kills, and the identification of scat. Smaller mammals were captured with live traps, kill traps, and pit traps. Species difficult to identify in the field were collected and curated as voucher specimens. All specimens collected were subsequently identified. General and regional references on identification include Hall and Kelson (Ref. 6.1-43), Burt and Grossenheider (Ref. 6.1-44) and Davis (Ref. 6.1-45).

Specific plant communities were sampled seasonally for small mammals to provide indices of relative abundance. Live traps or snap traps were placed in two 450-ft lines with paced 50-ft intervals between traps and between lines. Kill traps and pit traps were places in areas most likely to be frequented by the species being sought. Captured animals were identified as to species, sex, age (adult or juvenile) and breeding conditions where obvious (e.g., lactating or pregnant females). All animals captured alive were toe clipped and released. Estimates of relative abundance were based on Davis (Ref. 6.145) and Overton (Ref. 6.146).

6.1.4.3.5 Baseline Sampling Program - Birds. The bird sampling program was generally designed to:

1. Assess characteristics of bird populations on the STP site;

2. Describe relationships between bird communities, and major plant communities; and

3. Determine use of the site by endangered and other declining species, and recreationally or economically important species.

Seven sampling trips and a preliminary survey trip were made over a 12-month period from June, 1973, to April, 1974, i.e., June 27-30 (preliminary survey); July 30-August 4 and October 8-12 (fall migration sampling); November 12-17 and December 31-January 4 (waterfowl census); February 4-9 (winter birds and waterfowl census); April 22-26 (spring migration sampling); and June (breeding bird census) (Table 6.1-11).

Twenty avifauna study areas were located in twenty major habitats in order to assess bird population characteristics of each (Table 6.1-14, Figures 6.1-13 and 6.1-18). Study areas B1-B7 were located in the bottomland area adjacent to the Colorado River on the eastern portion of the site; study areas B8-B17 were situated in the upland areas west of the bottomlands; and study areas B18-B20 were located in an area of extensive marshes and tidal ponds southwest of the site, near Matagorda Bay. Although not shown on the site map, additional areas adjacent to the site were investigated. Study areas B21-B24, located in the uplands of the STP site, were included in the bird sampling program during the winter and spring 1974 surveys (Table 6.1-14, Figure 6.1-18).

The following measures were used to describe the avifauna on the STP site and surrounding region:

1. Species composition - the species recorded in each habitat;

2. Population level - number of individuals per species;

3. Relative abundance - number of individuals per species divided by the number of individuals of all species;

4. Frequency - the percent of sample plots in which a species occurred; and

5. Relative density - the mean number of birds recorded per sample plot.

Data on population density per species were not obtained because of the highly variable and fluctuating nature of populations during migration periods. Estimates of density were made during the winter (wintering birds) and were also conducted in early summer (breeding birds) when populations are more stable.

The use of specific measures for various groups of birds and habitats is discussed below in conjunction with the application of census techniques.

Five census techniques were employed during fall migration (Table 6.1-15); i.e., direct observation and count; aerial census; night census route; circular sample plots (300 ft in diameter); and belt transects (300 ft wide).

The direct observation and count technique was used to census large and relatively common species that are difficult to census by other techniques. This method was also used to census specific circumscribed areas that could be covered from a series of strategic locations, for example, bottomland pond and marsh; Colorado River; bottomland sloughs; Kelly Lake; Little Robbins Slough; upland fence hedgerow; rice field; rice field and mudflats; upland canals, ditches and sloughs; and the salt marshes and tidal ponds located southwest of the site.

Estimates of species composition and population levels of waterfowl present on the site and in adjacent areas were obtained in November, 1973, from a fixed-wing aircraft. Five north-south transects were flown at about 500-ft altitude over the site and adjacent areas.

A night census route was established to estimate species composition and population levels of nocturnal species. Stops on the route were arranged at half-mile intervals. Five minutes were spent at each stop imitating calls and listening for birds.

Permanent circular sample plots referenced to the standard grid were used in all wooded or semiwooded habitats. Accordingly, the observer stood at a point and recorded all birds detected in a 150-ft radius. From these observations, estimates were made of species composition, relative abundance, relative density, and frequency.

Permanent belt transects were employed to provide data on species composition and relative abundance in upland pasture, upland fallow field, and hayfield-prairie habitats. In these open habitats continuous walking was important in flushing hidden birds. Using this technique, the observer walked a marked line and recorded all birds detected out to a lateral distance of 150 ft (Ref. 6.1-47). The techniques using the circular sample plot and the belt transect were particularly applicable to making a census of small passerines and similar species not easily observed over large areas.

Table 6.1-15 presents the census techniques used during winter sampling (winter birds), spring sampling (spring migration), and early summer sampling (breeding birds).

6.1.4.3.6 Baseline Sampling Program - Herptiles. The objectives of the herptile sampling program were to verify the presence of species likely to occur on the STP site, to identify important species, and to obtain indices of the relative abundance of important and common species.

Reptiles and amphibians were sampled qualitatively along sloughs, levees and in other wet areas on the STP site. Major samplings were conducted during mammal sampling periods. Additional sampling was done incidental to surveys of plants, mammals, and birds.

Field methods included road surveys, seining, the use of pit traps, search under logs, day and night time observation, and tape recordings of frog and

toad calls. Species difficult to identify were photographed or collected for later identification.

Rough indices of the relative abundance of the more common species were obtained by examining transects along levees and in other likely habitats.

Sampling methods, species lists and field identifications were based on Wright and Wright (Ref. 6.1-48 and 6.1-49), Conant (Ref. 6.1-50), Blair et al (Ref. 6.1-51), Raun and Gehlbach (Ref. 6.1-52) and Brown (Ref. 6.1-53).

6.1.4.3.7 Baseline Sampling Program - Soils. The baseline soil sampling program had two objectives:

1. To characterize the soils on the STP site and to allow for internal soils comparisons; and

2. To quantify a number of soil factors known to be of ecological significance in determining the distribution of plant species and habitat types.

The first objective was completed in December, 1973, for incorporation into the Construction Phase Environmental Report. The second objective was completed in June, 1974.

The procedures and methods used to describe and map the soils of the STP site can be found in publications of the U.S.D.A. Soil Survey Staff (Ref. 6.1-54, 6.1-55, 6.1-56, and 6.1-57).

Following delineation of major soil series, soil sampling points were selected using a stratified random sampling scheme so as to obtain information on the major soil series in each vegetation type. Undisturbed samples, collected with a Hoffer tube, provided the information necessary to develop a soil survey of the site area. A bucket auger was used to obtain soil samples from the A horizon of the profile for chemical and physical determinations (see Section 2.7.1).

Published data available from the National Cooperative Soil Survey were used to characterize such measures as bulk density, particle size distribution, and water retention characteristics for each horizon. Bulk density is expressed as grams per cubic centimeter of water per centimeter of soil depth and available values are expressed as centimeters of water per centimeter of soil depth. Textural classes were assigned to each soil horizon based on the percentage of sand, silt and clay separates.

Cation exchange capacity (CEC), pH, organic matter content, conductivity, and ionic concentrations were determined using the methods described in Black (Ref. 6.1-58). The following nutrients were selected for quantification: nitrogen, phosphorous, potassium, calcium, magnesium, iron, manganese, copper, chlorine, sodium and sulfur.

6.1.4.3.8 Monitoring Program During Site Preparation and Construction. The major objective of a monitoring program during site preparation and construction is to verify the positive and negative impacts on the terrestrial biota and land use. This includes inspection of treatments designed to mitigate the effects of site preparation and construction. Monitoring of the site and

surrounding area may also provide identification of impacts not previously anticipated.

6.1.4.3.8.1 Environmental Protection Control Program (EPCP). An environmental protection program was initiated for the South Texas Project to establish construction practices and monitoring to minimize the negative impacts associated with construction activities along the transmission corridors and on the site proper.

Specifically, the on-site environmental protection program stresses adherence to the construction activities and mitigative measures presented in the ER-OL Section 4.1.1.1, to the environmental protection commitments set forth in the Final Environmental Statement (Section 4.5.1), and applicable federal, state and local environmental laws. Standard construction practices covered under the on-site program include:

a. run-off and erosion control;
b. excavation;
c. waste disposition;
d. dust control;
e. noise control;
f. fuel and oil storage; and
g. landscape restoration.

The transmission corridor environmental protection program derives its basis from the commitments in the Final Environmental Statement (Section 4.5.1) and the construction permit.

Responsibility for on-site monitoring, documenting and reporting to ensure compliance to the program; evaluating noncompliance and corrective action; and maintaining a daily log of activities from which weekly and monthly reports are filed, is assigned to the Site Environmental Coordinator (SEC). The SEC is further responsible for providing management with evaluations related to environmental impacts due to ongoing construction activities and scheduled activities in order that they and the governing authorities may be kept abreast of environmentally significant activities. To keep pace with the demands of an active construction project, the following items have been added to the SEC's responsibilities:

a. coordination of sampling and reporting activities when required by federal and/or state permits or guidelines;
b. consultation with the primary contractor when resolution or interpretation of the control program is needed;
c. interface with state and/or federal agencies for project compliance to applicable standards;
d. monitoring compliance to the site SPCC Plan and supervision of spill control, clean-up and reporting;
e. overseeing herbicide and pesticide requisition and product application; and
f. relocation of site wildlife when necessary.

Audits by HL&P are periodically conducted to determine the adequacy of the control program and the effectiveness of the Site Environmental Coordinator.

Responsibility for implementation, inspection and documentation of the transmission corridor environmental protection program has been delegated to each of the STP Participants. Reports of the environmental requirements are submitted to the HL&P Environmental Protection Department.

6.1.4.3.8.2 Special Ecological Monitoring Programs. In addition to daily surveillance by the owner, "important species" as defined by RG 4.2 are monitored during the construction period. For the STP site and surrounding area, these species include the American alligator (Alligator mississippiensis), bald eagle (Haliaeetus leucocephalus), white-tailed deer (Odocoileus virginianus) and several species of ducks and geese. The following special monitoring programs have been conducted annually since 1978 (Refs. 6.1-75 through 6.1-83).

Alligator Study - American alligators are counted along six transect lines on the STP site (Fig. 6.1-23) on three consecutive nights in the month of May. The date on which the moon is in the dark phase is at the mid-point of the survey. Counting starts no earlier than one hour after sunset and ends no later than 30 min before sunrise. A 300,000 candlepower, hand-held 12-volt spotlight is used to illuminate the observation area. Alligators' eyes reflect the light and emit a characteristic amber glow, making them easily distinguishable from other marsh inhabitants such as raccoons, skunks, opposums and nutria, all of which reflect light from their eyes as a greenish glow. When an alligator is spotted, its presence is recorded and, if it can be approached closely enough to get an accurate estimate, its snout length is estimated (snout to eye). This is later transformed to total length in feet 7
by using the following equation developed by Chabreck (Ref. 6.1-74):

$$y = -0.5113 + 1.1456x.$$

In this equation, y is total length (in feet) and x is snout length (in inches).

Transect 1 (Kelly Lake) and transect 3 (south drainage canal) are surveyed by canoe, whereas transects 4, 5, 7 and 8 are surveyed from a slow-moving vehicle. Transects 2 and 6, which were located on the Colorado River and the west drainage canal, have been discontinued because they are not good alligator habitat and few alligators were counted along them. Counts are not made during heavy rainfall or fog which limit visibility and cause an underestimate of the size of the alligator population.

Bald Eagle Study - No specific observation points have been designated for the bald eagle study on the STP site. During the field counts for deer and waterfowl, any bald eagles observed on or near the STP site are noted. Information recorded on each sighting includes the exact location, date, time of day and the developmental stage (immature or adult). Similar data are gathered from on-site personnel such as the Site Environmental Coordinator and the State trapper as well as residents of the area surrounding the site.

Each year the National Wildlife Federation sponsors a mid-winter survey of bald eagles. In Texas, the Texas Center for the Advancement of Science and Technology (TCAST) is the agency which conducts the survey, primarily by low

altitude aerial surveys along the shorelines of lakes and rivers. Data from these surveys are used to determine trends in the population levels of bald eagles. Further information on bald eagles is available in the form of nesting activity observed by Texas Parks and Wildlife Department (TPWD) personnel during annual surveys. During these surveys, the number of active nests in each county is recorded and the fledging success for each nest is tabulated. Data from both of the aforementioned surveys will be used to evaluate population trends of bald eagles in the area surrounding the STP site.

<u>White-tailed Deer Census</u> - White-tailed deer are counted from two fixed observation points and one transect line located on the top of the cooling reservoir dike (Fig. 6.1-24). Two of the observation points are located on the 7 east side of the reservoir, one at the makeup pipeline entrance to the reservoir (point A) and the other at the blowdown structure (point B). In both cases, deer are counted in the corridors which were cleared during construction of the facilities, from the base of the reservoir dike to the Colorado River. In addition to the fixed-point counts on the east side of the reservoir, a transect line (AB) approximately 3.0 km long is surveyed. This line covers the area between points A and B, from the base of the dike to the edge of the wooded area east of the reservoir.

Deer counts are conducted for 30-min time periods, starting at sunrise for the morning counts and 30 mins before sunset for the evening counts. Point A (makeup pipeline corridor) and point B (blowdown canal) are surveyed one time per day. When point A is surveyed in the morning, point B is surveyed in the evening. The following day, the morning count is taken at point B and the evening count at point A. This alternation in the times the surveys are made continues for five consecutive days each month the study is conducted (October, November and December). After both the morning and evening counts at points A and B, transect line AB is driven and all deer observed between the reservoir dike and the wooded area east of the reservoir are recorded.

During the field counts of white-tailed deer, both binoculars and a spotting scope are used to count the deer and determine their sex and development stage (fawn, yearling or adult). Binoculars are used to scan the area under observation. Once a herd of deer or an individual has been observed, the time of observation is recorded as is the number of each sex and development stage. The spotting scope is used to ensure the accuracy of sex determinations when the deer are located a great distance from the observation points. From the field data, the total number of deer observed is calculated as are the ratios of fawns to does and does to bucks. These values are compared to those from previous years to evaluate changes which may occur in the white-tailed deer population on the site.

<u>Waterfowl Census</u> - As a part of Coastal Waterfowl Project W-29-R, conducted by the Texas Parks and Wildlife Department, aerial inventories of waterfowl populations have been flown during the fall and winter in Texas since 1947. These annual census data will be reviewed and compared to estimate the effect of Cooling Reservoir construction on local populations of wintering waterfowl.

The total number of each species of waterfowl (ducks and geese) present in the cooling reservoir at STP during the months of October, November and December 7 is calculated by making daily counts for five consecutive days during these

months. The highest number counted for a given species during each 5-day period is the number reported for that species for the month.

The waterfowl counts are conducted by slowly driving around the dike system of the reservoir (both external and internal). At short intervals, the vehicle is stopped and all the birds visible from that location (and not previously counted) are identified and tabulated. Both binoculars and a 22x Bushnell spotting scope attached to a window mount are used to make species identifications and counts. 7

6.1.5 RADIOLOGICAL SURVEYS

United States Nuclear Regulatory Commission (USNRC) regulations require that nuclear power plants be designed, constructed, and operated to keep levels of radioactive material in effluents to unrestricted areas as low as reasonably achievable (10CFR50.34a). To assure that such releases are kept as low as practicable, each license authorizing reactor operation includes technical specifications (10CFR50.36a) governing the release of radioactive effluents. In-plant monitoring is utilized to assure that these pre-determined release limits are not exceeded (see Section 6.2.1.1).

The regulations governing the quantities of radioactivity in reactor effluents allow nuclear power plants to contribute, at most, only a few percent increase above normal background radioactivity. Background levels at any one location are not constant but vary with time, as they are influenced by external events such as cosmic ray bombardment, weapons test fallout, and atmospheric variations. These levels also can vary spatially within relatively short distances reflecting variation in the geological composition. Because of these spatial and temporal variations, the radiological surveys of the plant environs are divided into preoperational and operational phases. The preoperational phase of the program of sampling and measuring radioactivity in various media permits a general characterization of the radiation levels and concentrations prevailing prior to plant operation along with an indication of the degree of natural variation to be expected. The operational phase of the program obtains data which, when considered along with the data obtained in the preoperational phase, assist in the evaluation of the radiological impact of plant operation.

Implementation of the preoperational monitoring program fulfills the following objectives:

1. personnel training;

2. evaluation of procedures, equipment and techniques;

3. identification of probable critical pathways to be monitored after the plant is in operation; and

4. measurement of background levels and their variations along anticipated critical pathways in the area surrounding the plant.

The preoperational phase of the radiological survey program is not scheduled to be completely implemented until approximately two years prior to anticipated issuance of an operating license.

The criteria for selecting sample types are based on the sources of radioactivity expected to be released to the environment and the exposure pathways for these radionuclides to man and important biota. Sampling locations have been selected on the basis of local ecology, meteorology, physical characteristics of the terrain, and demographic and cultural features of the region. The frequency of sampling and the duration of the sampling period are dependent on the radionuclide of interest and the biological behavior of the environmental media and radionuclide. Sufficient samples are included in the program to define the spatial and temporal variation in radioactivity levels where necessary.

The following paragraphs describe the general program to be instituted including the expected types of samples, the collection frequency, and the analysis to be accomplished on each sample type.

Several nationally organized radiological monitoring networks maintain stations in Texas. In addition, the Texas State Department of Health conducts extensive monitoring activities throughout the state. Data collected from these sources have been presented in Section 2.8. The USNRC recommends measurements of background radiological characteristics of proposed nuclear sites, including natural background radiation levels occurring in soils and rocks. During August 20, 1973, an aerial gamma ray spectrometric survey of the STP site and surrounding area was conducted to obtain this information. Based upon the collected data, 20 Thermo-luminescent Dosimeter (TLD) stations were selected. The first set of TLDs was placed in the site vicinity during October, 1973. These TLDs are collected and read quarterly. An environmental radiological survey including the sampling of biota, vegetation, soils and water was also conducted on and around the STP site during the month of November, 1973. The analytical results of these surveys are presented in Section 2.8. These environmental surveys are not intended to be preoperational monitoring programs. However, the survey data gathered were considered in determining the sampling locations for the preoperational monitoring programs. Based on the aerial gamma ray spectrometric survey there appear to be no obvious anomalies in the site region. However, the whole region may be an anomaly with respect to the State of Texas.

6.1.5.1 Airborne Iodine and Particulates

Airborne iodine and particulates will be sampled by continuous low volume air samplers (approximately 2.5 cfm) fitted with charcoal canisters. The air sampling network will consist of 8 stations. One station will be located at 7 each of three locations at the exclusion zone boundary (in the N, NNW and NW sectors). Since all releases will be at ground level or from roof vents, the highest calculated offsite ground level concentration of airborne releases occur at the site boundary regardless of direction. Air sampling systems will be placed at or near the population centers of Bay City, Celanese Plant Matagorda, and El Maton. 7 A control station will be located at least 20 miles from the site in a minimal wind direction, W of the site. The filters will be 7 changed weekly and analyzed for gross beta activity. Quarterly composited filters will be subjected to gamma isotopic analyses. Charcoal canisters will be collected and analyzed weekly, starting six months prior to issuance of the Operating License.

6.1.5.2 Soil Sampling

Soil samples will be collected from the same locations as airborne particulates as well as 2 farms within 5 miles of the site for a total of 10 locations. Soil will be obtained annually during the preoperational radiological 7
monitoring program. A gamma isotopic analysis will be performed on the collected soils.

6.1.5.3 Ambient Radiation Measurements

Background ionizing radiation levels will be measured during the preoperational monitoring program by a TLD network of 40 stations. A few of these 7
stations were monitored as part of a 20-station preconstruction monitoring network. The preconstruction network is described in detail in Section 2.8.2.

Two dosimeters will be placed at each preoperational TLD station. The dosimeters will be collected and analyzed quarterly. The TLD stations are located adjacent to air monitoring stations. They are also generally situated in two concentric rings about the plant at the 0-2 mile range and 4-6 mile range in 7
16 sectors. The balance of the stations are placed in special interest areas (example: population centers) and control locations 10-15 miles from the site in minimal wind directions.

During plant startup and operation, TLDs will be very closely examined for any additional exposure level due to plant operation.

6.1.5.4 Water Sampling

The plant will discharge its circulating water system to the Cooling Reservoir. The radionuclide concentration of the reservoir water will quickly become homogeneous due to mixing. Water from the reservoir will enter the upper shallow aquifer beneath the reservoir through seepage. Discharges to the environment from the upper shallow aquifer will be composed of surface water and ground water flow as described below. In addition, direct discharge of reservoir water to the Colorado River will occur through blowdown. Surface and ground water flows will both be sampled in the radiological survey.

6.1.5.4.1 Surface Water Sampling. First, the surface water monitoring program will be discussed. Because the reservoir blowdown is discharged directly to the Colorado River, the reservoir water will be sampled. A sampling station within the reservoir will be located at the point of the reservoir blowdown. Composite monthly samples will be collected. Gamma isotopic analyses will be performed monthly. (Quarterly composite samples 7
will be analyzed for gross B and tritium on reservoir samples only).

The Colorado River water will also be sampled. A control station will be located up river from the site beyond plant discharge influence. A second station will be located more than 1 mile downstream from the location of reservoir blowdown to monitor the effect of mixing of the effluent with the Colo- 7
rado River. A monthly composite sample will be collected from these locations. The sample will undergo gamma isotopic analysis monthly, and tritium analysis on quarterly composites per location.

As described in Section 2.5, water from the Cooling Reservoir will diffuse downward to the upper shallow aquifer, which flows southeast. Approximately 70 percent of the seepage from the lake (or about 3840 AF/yr) is expected to be discharged via the relief well system. Radionuclides in the Cooling Reservoir will follow the seepage path and appear in collector ditches at lower concentrations. To monitor the radionuclide concentration in these releases during plant operation, a monitoring program has been established. A baseline sampling program will commence after reservoir filling and flow is observed from the relief well system. Sampling will then be conducted quarterly (grab sample) at the three locations at the site boundary where these surface flows would enter offsite surface water bodies. 7

Particularly during filling of the reservoir, and perhaps thereafter, flow from relief wells could be intermittent or minimal at some locations. This is a function of variable seepage and hydraulic conditions. It may not, therefore, be possible to obtain quarterly samples at each of the three offsite discharge points on a regular basis. However, the program will be established with regular quarterly sampling as an objective. The water obtained will be analyzed for gross activity. 7

6.1.5.4.2 Ground Water Sampling. As described in Section 2.5, two basic aquifer units underlie the site: the shallow aquifer, composed of the upper and lower units; and a deep aquifer from which most potable water is obtained.

The majority of the wells in this region are 300 to 400 ft deep. This deep aquifer flows to the west from the site. Due to the depth of this aquifer and the presence of the shallower one, it is virtually impossible that any ground water contamination of the deep aquifer will result from the operation of this plant. Therefore, no samples in the deep aquifer will be obtained for this program. Potential contamination will be monitored by an extensive sampling program in the shallow aquifer, which would receive radionuclides initially in any case. The requirement to monitor potential sources of drinking water will be satisfied by the sampling program in the lower shallow aquifer.

Water entering the shallow aquifer from the reservoir would first flow in the upper portion of that aquifer, perhaps not even penetrating the lower portion. Both portions of the shallow aquifer will be monitored, however, by sampling (grab sampling) in control and downgradient wells constructed to monitor piezometric levels onsite (Figures 6.1-5 and 6.1-6). Upgradient control wells 603 and 602 will be used to monitor the upper and lower shallow aquifers, respectively. Corresponding downgradient wells 446 and 446A will also be sampled. 7 Q330.7

Gamma isotopic and tritium will be analyzed in water samples obtained quarterly from wells 603 and 446 in the upper shallow aquifer. Tritium and gamma isotopic analyses will be performed on water samples obtained from wells 602 and 446A in the lower shallow aquifer. 7

6.1.5.5 Rooted Aquatic Plants

Because rooted aquatic plants are almost non-existent in the lower Colorado River, as indicated in Section 2.7, they will not be collected. 7

6.1.5.6 Fish

Radioactivity in the liquid effluent from the plant will be available to the
fish in the Cooling Reservoir, the Colorado River, and to a lesser extent the 7
West Branch of the Colorado River and Little Robbins Slough through the water
and their food chain. Because of area accessability, sampling reliability,
limited sample volume and minimal fishing use, only the cooling reservoir and 7
the Colorado River will be sampled. Although off limits to fishermen the
cooling reservoir will be sampled because of its prime location. Since some
of the Colorado River fish may be eaten by man, this food chain will be moni-
tored. In this region of the Colorado River, there is some local sport
fishing and minimal commercial fishing. Fish will be collected semi-annually
or in season from the Cooling Reservoir, about 2 miles downstream from the
reservoir blowdown structure, and up river from the site beyond plant dis- 7
charge influence.

A minimum of two species will be taken that are representative of the fish
types used for human consumption and will include fishes with different
feeding habits. The flesh of the fish samples will be subjected to a gamma 7
isotopic analysis.

6.1.5.7 Agricultural Products

The lower Colorado River Authority (LCRA), which regulates the majority of
irrigation water in the vicinity of the site, indicates that these waters
originate above the Bay City Dam which is not influenced by plant discharge. 7
No routine sampling program will be required. In the event these conditions
change, the following will be performed.

In the area surrounding the plant site, there are diversified agricultural activities. Since the primary interest is the potential dose to the public, the samples will be limited to those crops directly consumed by man or that reach man indirectly through the food chain. Samples will consist of pasture grass, rice, grain sorghum and broad leaf vegetation. They will be collected, when available, at local farms in the area which are irrigated by water that may contain diluted plant effluent. These samples will be subjected to a gamma isotopic analysis. Radioiodine will be analyzed in broad leaf vegetation during the operational phase only. Figure 6.1-21 shows the location of irrigated crops in the site area.

Milk samples are likely to be unobtainable due to the lack of dairy animals in 7
the vicinity of STP. If available, one sample will be taken from milking
animals in each of 3 areas where doses are calculated to greater than 1
mrem/yr. Sampling frequency will be semi-monthly when animals are on pasture
and monthly at other times. Analyses will be gamma isotopic and iodine-131.
Samples of broad leaf vegetation grown in locations of highest calculated
annual average ground-level /Q, if milk sampling is not performed, will be 7
collected monthly when available and analyzed gamma isotopically.

6.1.5.8 Domestic Meat

At least one sample of meat will be obtained semi-annually from farms located 7
within 10 miles of the plant. The flesh will be subjected to gamma isotopic
analysis.

6.1.5.9 Game 7

Game will be obtained on site or within 10 miles of the site, when available. The edible tissue will be analyzed for gamma-emitting radionuclides.

6.1.5.10 Program Summary

Table 6.1-16 summarizes the environmental monitoring program. The table describes sample media, sampling locations, type of sampling, collection 7
frequency, methods of analysis and analysis frequency.

The design and implementation of all radiological environmental surveillance activities shall be performed by Houston Lighting and Power Company. Radiological environmental surveillance shall be performed in such a manner as to meet the intent of USNRC Regulatory Guide 4.15 "Quality Assurance for Radio- 7
logical Monitoring Programs" (Rev. 1, February 1979). In addition, the analysis laboratory will be required to participate in an NRC approved Inter-Laboratory Comparison Program to provide assurance of the accuracy of analysis.

Detection capabilities for environmental sample analysis are provided in Table 6.1-17.

This preoperational environmental monitoring program will be instituted approximately 2 years prior to issuance of the Operating License except radioiodine monitoring which will begin no less than six months prior to this issuance.

REFERENCES

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TABLE 6.1-8

METEOROLOGICAL INSTRUMENTATION
STP ONSITE METEOROLOGICAL MONITORING PROGRAM (OPERATION)

Primary System

Measurement	Levels (Meters)	Manufacturer	Model Number	Sensor Specifications*
Wind Speed	10, 60	Teledyne Geotech	Cups 170-41 Sensor 1564B Processor 21.11	Threshold - 0.60 mph Accuracy - ± 0.30 mph for speeds less than 5.0 mph; ± 1.12% for speeds from 5.0 mph to 100 mph
Wind Direction	10, 60	Teledyne Geotech	Vane 53.2 Sensor 156B Processor 21.22-1	Threshold - 0.70 mph Damping ratio - 0.4 @ 10° deflection Distance Constant - 3.7 ft Accuracy - ± 3°
Temperature System Sensors & Processor	Ambient - 10 Delta T 6010	Teledyne Geotech	RTD T-200 Processor 21.35 327C Aspirated Shield	Accuracy - ± 0.11°F
Dewpoint	10	General Eastern	1200 DPS	Accuracy - ± 0.7°F
Precipitation	Surface	Teledyne Geotech	PG-200A-H Gauge	Accuracy - ± 1%
Solar Radiation	Surface	Eppley	Sensor 8-48 Processor 40.33	Accuracy - better than ± 3%

* Accuracies noted are instantaneous accuracies through the digital recording system.

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TABLE 6.1-8 (Cont'd.)

METEOROLOGICAL INSTRUMENTATION
STP ONSITE METEOROLOGICAL MONITORING PROGRAM (OPERATION)

Backup System

Measurement	Levels (Meters)	Manufacturer	Model Number	Sensor Specifications*
Wind Speed	10	Teledyne Geotech	Cups 170-41 Sensor 1564B Processor 21.11	Threshold - 0.60 mph Accuracy - ± 0.30 mph for speeds less than 5.0 mph; ± 1.12% for speeds from 5.0 mph to 100 mph
Wind Direction	10	Teledyne Geotech	Vane 53.2 Sensor 156B	Threshold - 0.7 mph Damping ratio - 0.4 @ 10° deflection Distance Constant - 3.7 ft Accuracy - ± 3°
Ambient Temperature	10	Teledyne Geotech	RTD T-200 Processor 21.32 327C Aspirated Shield	Accuracy - ± 0.11°F

* Accuracies noted are instantaneous accuracies through the digital recording system.

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TABLE 6.1-9

DATA COLLECTION AND RECORDING EQUIPMENT
STP ONSITE METEOROLOGICAL MONITORING PROGRAM (OPERATION) 7

Equipment	System	Manufacturer	Model Number	Accuracy
Microprocessor	Primary & Backup	Teledyne Geotech	Auto Met V	Better than ± 0.10% of full scale
Multipoint Recorder Temperature Delta T Dewpoint Solar Radiation Precipitation Sigma Theta*	Primary & Backup	Esterline Angus	L1108S	± 0.25% of full scale
Continuous Trace Recorders** Wind Speed Wind Direction	Primary & Backup	Esterline Angus	L1152S	± 0.25% of full scale
Magnetic Tape Recorder	Primary & Backup	Digi-Data	1140	N/A

* Standard deviation of wind direction fluctuations
** Two records for the primary system and one recorder for the backup system.

TABLE 6.1-10

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TABLE 6.1-16

PREOPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE MEDIA	COLLECTION			ANALYSIS	
	NOMINAL NUMBER OF SAMPLE LOCATIONS	ROUTINE SAMPLING MODE	NOMINAL COLLECTION FREQUENCY	ANALYSIS TYPE	MINIMUM ANALYSIS FREQUENCY
1. Direct Radiation TLD's	Total Stations: 40 16 stations located in sixteens sectors approximately 1 mile or less from containment. 16 stations located in sixteen sectors 4-6 miles from containment. 6 stations located in special interest areas (e.g. school, population center) within a 14 mile radius of containment. 2 control stations located in areas of minimal wind direction (W,ENE) 10-15 miles from containment.	Continuous	Quarterly	Gamma	Quarterly
2. Airborne a. Radioiodine Particulates	Total Station: 18 (8) 3 stations located at the exclusion zone, approximately 1 mile from containment, in the N,NNW,NW sectors. 4 stations located in special interest areas, 4-14 miles from containment. 1 control station located in a minimal wind direction (W) 11 miles from containment.	Continuous	Weekly	Radiodine Canister: 1-131 Particulate Sample: Gross Beta Gamma-Isotopic	 Weekly Weekly Quarterly composite (by location)

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TABLE 6.1-16 (Continued)

PREOPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE MEDIA	COLLECTION			ANALYSIS	
	NOMINAL NUMBER OF SAMPLE LOCATIONS	ROUTINE SAMPLING MODE	NOMINAL COLLECTION FREQUENCY	ANALYSIS TYPE	MINIMUM ANALYSIS FREQUENCY
b. Soils	(10) 8 same as air stations. 2 stations located on or adjacent to farms within 5 miles of containment.	Grab	Semiannually	Gamma-Isotopic	According to collection frequency
3. Waterborne a. Surface	Total Stations: 17 (6) 1 station located in reservoir at point of reservoir blowdown to Colorado River. 1 control station located above the Site on the Colorado River not influenced by plant discharge. 1 station approximately 2 miles downstream from blowdown entrance into the Colorado River (marker).	Composite	Monthly	Gamma-Isotopic Tritium	Monthly Quarterly composite
	Relief Well discharge exit monitoring 1 station located near Site boundary in the Little Robbins Slough. 1 station located near Site boundary in the East Fork of Little Robbins Slough. 1 station located near Site boundary in the West Branch of the Colorado River.	Grab	Quarterly (if available)	Gross Beta, Tritium	Quarterly or according to collection frequency

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TABLE 6.1-16 (Continued)

PREOPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE MEDIA	COLLECTION			ANALYSIS	
	NOMINAL NUMBER OF SAMPLE LOCATIONS	ROUTINE SAMPLING MODE	NOMINAL COLLECTION FREQUENCY	ANALYSIS TYPE	MINIMUM ANALYSIS FREQUENCY
b. Ground	(4) 1 station located at well #603B upgradient from the reservoir in the upper shallow aquifer. 1 station located at well #446A down gradient in the upper shallow aquifer. 1 station located at well #603A upgradient from the reservoir in the lower shallow aquifer. 1 station located at well #446 down gradient in the lower aquifer.	Grab	Quarterly (if available)	Gamma-Isotopic, Tritium	Quarterly or according to collection frequency
c. Drinking	(1) 1 station located on Site.	Grab	Monthly	Gamma-Isotopic Tritium	Monthly
d. Sediment	(6) 1 station located near Site boundary in the Little Robbins Slough. 1 station located near Site boundary in the West Branch of the Colorado River. 1 control station located above the Site on the Colorado River not influenced by plant discharge.	Grab	Semiannually (if available)	Gamma-Isotopic	According to the collection frequency

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TABLE 6.1-16 (Continued)

PREOPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE MEDIA	COLLECTION: NOMINAL NUMBER OF SAMPLE LOCATIONS	COLLECTION: ROUTINE SAMPLING MODE	COLLECTION: NOMINAL COLLECTION FREQUENCY	ANALYSIS: ANALYSIS TYPE	ANALYSIS: MINIMUM ANALYSIS FREQUENCY
d. Sediment (Cont'd)	1 station located approximately 2 miles downstream from blowdown entrance into the Colorado River. 1 station located in reservoir at point of reservoir blowdown to Colorado River. 1 station located in reservoir near coolant discharge.				
4. Ingestion	Total Stations: 10				
a. Milk	--------------------------	Limited source of sample in vicinity at STPEGS--------------------------------- (Attempts will be made to collect samples when available)			
		Grab	Semimonthly when on pasture, monthly at other times when available.	Gamma-Isotopic & Low Level 1-131	According to collection frequency
b. Broadleaf (Standardized plant types)	(4) 3 stations located at the exclusion zone, approximately 1 mile from containment, in the N,NW,NNW sectors. 1 control station located in a minimal wind direction (W), 11 miles from containment.	Grab	Monthly during growing season (when available)	Gamma-Isotopic	Monthly

TABLE 6.1-16 (Continued)

PREOPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE MEDIA	COLLECTION			ANALYSIS		7
	NOMINAL NUMBER OF SAMPLE LOCATIONS	ROUTINE SAMPLING MODE	NOMINAL COLLECTION FREQUENCY	ANALYSIS TYPE	MINIMUM ANALYSIS FREQUENCY	
c. Agricultural Projects	----------------------------	No sample stations have been identified in the vicinity---------------------------- of the Site. Presently no agricultural land is irrigated by water into which liquid plant wastes will be discharged. Agricultural products will be considered if these conditions change.				
d. Terrestrial & Aquatic Animals	(3) 1 sample representing commercially and/or recreationally important species in vicinity of STPEGS that may be influenced by plant operation. (e.g. fish, game birds). *1 sample of same or analogous species in area not influenced by STPEGS. 1 sample of same or analagous species in the reservoir (if available).	Grab	Sample in seasons or semiannually if they are not seasonal.	Gamma-Isotopic (Edible portion)	According to collection frequency	
e. Pasture Grass	(2) 1 station location at the exclusion zone, NW. 1 control station 11 miles W.	Grab	Quarterly (when cattle are on pasture)	Gamma-Isotopic	According to collection frequency	

*Applies to aquatic samples only.

TABLE 6.1-16 (Continued)

PREOPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE MEDIA	COLLECTION			ANALYSIS	
	NOMINAL NUMBER OF SAMPLE LOCATIONS	ROUTINE SAMPLING MODE	NOMINAL COLLECTION FREQUENCY	ANALYSIS TYPE	MINIMUM ANALYSIS FREQUENCY
f. Domestic Meat (Edible portion)	(1) 1 sample representing domestic stock fed on crops exclusively grown within 10 miles of containment.		Semiannually	Gamma-Isotopic	According to collection frequency

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TABLE 6.1-17

Detection Capabilities for Environmental Sample Analysis[a]

Lower Limit of Detection (LLD)[b]

Analysis	Water (pCi/Kg)	Airborne Particulate or Gas (pCi/m^3)	Fish (pCi/kg,wet)	Milk (pCi/kg)	Food Products (pCi/kg, wet)	Sediment (pCi/kg, dry)
gross beta	4	1×10^{-2}				
^{3}H	2000*					
^{54}Mn	15		130			
^{59}Fe	30		260			
$^{58,60}Co$	15		130			
^{65}Zn	30		260			
^{95}Zr	30					
^{95}Nb	15					
^{131}I	1[c]	7×10^{-2}		1	60[d]	
^{134}Cs	15	5×10^{-2}	130	15	60	150
^{137}Cs	18	6×10^{-2}	150	18	80	180
^{140}Ba	60			60		
^{140}La	15			15		

Note: This list does not mear that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported.

* If no drinking water pathways exist, a value of 3000 pCi/Kg may be used for ^{3}H.

TABLE 6.1-17 NOTES

[a]Acceptable detection capabilities for thermoluminescent dosimeters used for environmental measurements are given in Regulatory Guide 4.13 (July 1977). 7

[b]Table 6.1-17 indicates acceptable detection capabilities for radioactive materials in environmental samples. These detection capabilities are tabulated in terms of the lower limits of detection (LLDs). The LLD is defined as the smallest concentration of radioactive material in a sample that will yield a net count (above system background) that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66 S_b}{E \cdot V \cdot 2.22 \cdot Y \cdot \exp(-\lambda \Delta t)}$$

Where:

LLD is the lower limit of detection as defined above (as pCi per unit mass or volume)

S_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute)

E is the counting efficiency (as counts per disintegration)

V is the sample size (in units of mass or volume)

2.22 is the number of disintegrations per minute per picocurie

Y is the fractional radiochemical yield (when applicable)

λ is the radioactive decay constant for the particular radionuclide

Δt is the elapsed time between sample collection and counting

The value of S_b used in the calculation of the LLD for a particular measurement system should be based on the actual observed variance of the background counting rate or of the counting rate of the blank samples (as appropriate) rather than on an unverified theoretically predicated variance. In calculating the LLD for a radionuclide determined by gamma-ray spectrometry, the background should include the typical contributions of other radionuclides normally present in the samples (e.g., potassium-40 in milk samples). Typical values of E, V, Y, and t should be used in the calculation.

TABLE 6.1-17 NOTES
(Continued)

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capabilitv of a measurement system and not as a posteriori (after the fact) limit for a particular measurements.

[c]LLD for drinking water.

[d]LLD for board leaf vegetation. 7

TABLE 6.1-20

SECTOR X/Q VALUES (sec/m^3) at STP
BASED ON 10-60 m DELTA-T and
10 METER WINDS
JULY 21, 1973 - SEPTEMBER 30, 1977[a]
VALUES FOR EVALUATION

Affected Sector	EAB (2-hr)[b]	LPZ (2-hr)[b]	LPZ (8-hr)	LPZ (16-hr)	LPZ (72-hr)	LPZ (624-hr)
N	1.1E-04	3.4E-05	1.5E-05	9.7E-06	3.8E-06	1.0E-06
NNE	6.4E-05	1.8E-05	7.4E-06	4.7E-06	1.8E-06	4.5E-07
NE	6.5E-05	1.8E-05	7.2E-06	4.5E-06	1.7E-06	4.0E-07
ENE	3.0E-05	6.2E-06	2.8E-06	1.8E-06	7.5E-07	2.1E-07
E	6.4E-05	1.5E-05	6.0E-06	3.8E-06	1.4E-06	3.3E-07
ESE	3.4E-05	8.1E-06	3.4E-06	2.2E-06	8.7E-07	2.3E-07
SE	6.4E-05	1.8E-05	7.0E-06	4.4E-06	1.6E-06	3.8E-07
SSE	1.0E-04	3.0E-05	1.2E-05	7.5E-06	2.8E-06	6.5E-07
S	1.1E-04	3.2E-05	1.3E-05	8.4E-06	3.2E-06	7.8E-07
SSW	1.2E-04	3.7E-05	1.5E-05	9.8E-06	3.7E-06	9.5E-07
SW	1.3E-04[c]	3.8E-05[c]	1.6E-05[c]	1.1E-05[c]	4.2E-06	1.1E-06
WSW	1.3E-04[c]	3.7E-05	1.5E-05	9.8E-06	3.7E-06	9.5E-07
W	1.3E-04[c]	3.8E-05[c]	1.5E-05	1.0E-05	3.9E-06	1.0E-06
WNW	1.2E-04	3.6E-05	1.5E-05	9.6E-06	3.7E-06	9.5E-07
NW	1.2E-04	3.6E-05	1.6E-05[c]	1.1E-05[c]	4.3E-06[c]	1.2E-06[c]
NNW	1.1E-04	3.3E-05	1.5E-05	1.0E-05	4.1E-06	1.1E-06

[a] Period from 07/21/76 - 09/30/76 is unavailable.

[b] The 1-hour value is calculated and assumed to apply to the 2-hour period.

[c] Maximum sector X/Q value.

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TABLE 6.1-21

STP X/Q VALUES (SEC/M^3) BASED ON T(60m - 10m)
STABILITY DATA AND 10-METER WINDS

July 21, 1973 - September 30, 1977[a]

Averaging Time[b]	Distance	Maximum Sector[c]	5 Percent Overall	50 Percent Overall	Worst Case[d]
1-hour 2-hour	Minimum exclusion area boundary (EAB) - 1430 meters	1.3×10^{-4} (SW, WSW, W)	1.3×10^{-4}	1.7×10^{-5}	6.3×10^{-4} (ENE)
1-hour 2-hour	Low population zone - 4800 meters	3.8×10^{-5} (SW, W)	3.8×10^{-5}	3.1×10^{-6}	2.1×10^{-4} (ENE)
8-hour	Low population zone - 4800 meters	1.6×10^{-5} (SW, NW)	1.6×10^{-5}	2.0×10^{-6}	-
16-hour	Low population zone - 4800 meters	1.1×10^{-5} (SW, NW)	1.1×10^{-5}	1.6×10^{-6}	-
72-hour	Low population zone - 4800 meters	4.3×10^{-6} (NW)	4.3×10^{-6}	1.1×10^{-6}	-
624-hour	Low population zone - 4800 meters	1.2×10^{-6} (NW)	-1.2×10^{-6}	5.5×10^{-7}	-

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[a] Data period from July 21, 1976 through September 30, 1976 is unavailable.

[b] The 1-hour value was calculated; the 2-hour value is assumed equal to the 1-hour value.

[c] Maximum sector values are the highest of the 0.5 percent Sector X/Q values.

[d] Worst-case values are the highest of the calculated 1-hour values, all sectors considered.

The directions for the sectors given above are the directions of the "Affected Sectors" (i.e., a wind from the east will affect a west sector).

TABLE 6.1-22

ANNUAL AVERAGE GROUND LEVEL X/Q VALUES AT THE SITE BOUNDARY[a]
GROUND LEVEL RELEASE

Based on Meteorological Data[b] for July 21, 1973 to September 30, 1977[c]

Wind Direction	Exposure Direction	Distance (meters)	X/Q (sec/m^3)
S	N	1,521	1.0×10^{-6}
SSW	NNE	1,555	4.1×10^{-7}
SW	NE	1,586	3.4×10^{-7}
WSW	ENE	1,600	2.1×10^{-7}
W	E	1,567	2.7×10^{-7}
WNW	ESE	2,971	8.5×10^{-7}
NW	SE	6,889	4.0×10^{-8}
NNW	SSE	6,428	7.2×10^{-8}
N	S	5,936	1.0×10^{-7}
NNE	SSW	6,560	1.2×10^{-7}
NE	SW	4,426	2.4×10^{-7}
ENE	WSW	3,419	2.9×10^{-7}
E	W	2,160	6.0×10^{-7}
ESE	WNW	1,889	6.6×10^{-7}
SE	NW	1,792	1.0×10^{-6}
SSE	NNW	1,631	1.6×10^{-6}

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[a] The site boundary is the STP property limits except in those cases where FM 521 is closer, in which case the boundary is taken as the inside boundary to the FM 521 right-of-way.

[b] Winds at 10 meters and T(60m-10m).

[c] Data period of July 21, 1976 through Septemgher 30, 1976 is unavailable.

TABLE 6.1-23(a)

AVERAGE METEOROLOGICAL RELATIVE CONCENTRATION ANALYSIS

DATA PERIOD : 7/21/73 TO 9/30/77

PROGRAM ANDIFF3 ANNUAL X/Q FAC — HOUSTON LIGHTING & POWER
NO TERRAIN CORRECTION FACTORS — SOUTH TEXAS PROJECT
DEPOSITION/DEPLETION INCLUDED — 4490-115-12
DATE 20-MAR-84 TIME 17:10:53 — LONG-TERM X/Q (ROUTINE RELEASE) ANALYSIS

AFFECTED SECTORS

NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N
SITE BOUNDARY DISTANCES															
4.1E-07	3.4E-07	2.1E-07	2.7E-07	8.5E-08	4.0E-08	7.2E-08	1.0E-07	1.2E-07	2.4E-07	2.9E-07	6.0E-07	6.6E-07	1.0E-06	1.1E-06	1.0E-06
3.6E-07	2.9E-07	1.9E-07	2.4E-07	7.0E-08	3.0E-08	5.5E-08	7.8E-08	8.3E-08	1.9E-07	2.3E-07	5.1E-07	5.7E-07	8.7E-07	9.8E-07	8.8E-07
2.8E-09	1.3E-09	6.4E-10	7.9E-10	2.7E-10	1.1E-10	3.1E-10	4.8E-10	3.7E-10	7.6E-10	8.7E-10	2.0E-09	2.8E-09	6.3E-09	8.4E-09	7.7E-09
4.1E-07	3.3E-07	2.1E-07	2.7E-07	8.4E-08	3.9E-08	7.1E-08	9.9E-08	1.1E-07	2.4E-07	2.8E-07	5.9E-07	6.6E-07	1.0E-06	1.1E-06	1.9E-06
4.1E-07	3.3E-07	2.1E-07	2.7E-07	8.4E-08	4.0E-08	7.2E-08	1.0E-07	1.1E-07	2.4E-07	2.8E-07	5.9E-07	6.6E-07	1.0E-06	1.1E-06	1.0E-06
3.6E-07	2.9E-07	1.8E-07	2.4E-07	6.9E-08	2.9E-08	5.4E-08	7.6E-08	8.6E-08	1.9E-07	2.3E-07	5.0E-07	5.7E-07	8.6E-07	9.8E-07	8.7E-07
3.6E-07	2.9E-07	1.9E-07	2.4E-07	7.0E-08	3.0E-08	5.5E-08	7.7E-08	8.7E-08	1.9E-07	2.3E-07	5.1E-07	5.7E-07	8.7E-07	9.8E-07	8.8E-07
1555.	1586.	1600.	1567.	2971.	6889.	6428.	5936.	6560.	4426.	3419.	2166.	1889.	1792.	1631.	1521.
LOW POPULATION ZONE DISTANCE (4800 METERS)															
8.4E-08	7.0E-08	4.5E-08	5.6E-08	4.4E-08	6.5E-08	1.1E-07	1.4E-07	1.8E-07	2.2E-07	1.8E-07	2.0E-07	1.8E-07	2.5E-07	2.4E-07	2.0E-07
6.6E-08	5.5E-08	3.5E-08	4.4E-08	3.5E-08	5.1E-08	8.5E-08	1.1E-07	1.4E-07	1.7E-07	1.4E-07	1.6E-07	1.4E-07	2.0E-07	1.9E-07	1.5E-07
4.3E-10	2.1E-10	1.0E-10	1.2E-10	1.2E-10	2.1E-10	5.1E-10	6.9E-10	6.3E-10	6.6E-10	4.9E-10	5.2E-10	5.8E-10	1.2E-09	1.4E-09	1.1E-09
8.2E-08	6.9E-08	4.3E-08	5.4E-08	4.3E-08	6.4E-08	1.1E-07	1.3E-07	1.7E-07	2.2E-07	1.8E-07	1.9E-07	1.8E-07	2.4E-07	2.4E-07	1.9E-07
8.3E-08	7.0E-08	4.4E-08	5.5E-08	4.4E-08	6.5E-08	1.1E-07	1.4E-07	1.8E-07	2.2E-07	1.8E-07	2.0E-07	1.8E-07	2.5E-07	2.4E-07	2.0E-07
6.5E-08	5.4E-08	3.4E-08	4.3E-08	3.4E-08	5.0E-08	8.4E-08	1.1E-07	1.4E-07	1.7E-07	1.4E-07	1.5E-07	1.4E-07	1.9E-07	1.9E-07	1.5E-07
6.6E-08	5.5E-08	3.5E-08	4.4E-08	3.5E-08	5.1E-08	8.4E-08	1.1E-07	1.4E-07	1.7E-07	1.4E-07	1.5E-07	1.4E-07	2.0E-07	1.9E-07	1.5E-07
4800.	4800.	4800.	4800.	4800.	4800.	4800.	4800.	4800.	4800.	4800.	4800.	4800.	4800.	4800.	4800.
0.5 MILES (805 METERS)															
1.1E-06	9.8E-07	6.3E-07	7.7E-07	6.1E-07	9.2E-07	1.5E-06	1.9E-06	2.4E-06	3.1E-06	2.5E-06	2.7E-06	2.4E-06	3.4E-06	3.2E-06	2.7E-06
1.1E-06	9.0E-07	5.8E-07	7.1E-07	5.6E-07	8.4E-07	1.4E-06	1.8E-06	2.2E-06	2.8E-06	2.3E-06	2.5E-06	2.2E-06	3.1E-06	3.0E-06	2.4E-06
8.2E-09	4.0E-09	1.9E-09	2.3E-09	2.3E-09	4.0E-09	9.7E-09	1.3E-08	1.2E-08	1.3E-08	9.3E-09	9.9E-09	1.1E-08	2.3E-08	2.6E-08	2.2E-08
1.1E-06	9.8E-07	6.3E-07	7.7E-07	6.1E-07	9.2E-07	1.5E-06	1.9E-06	2.4E-06	3.1E-06	2.5E-06	2.7E-06	2.4E-06	3.3E-06	3.2E-06	2.7E-06
1.1E-06	9.8E-07	6.3E-07	7.7E-07	6.1E-07	9.2E-07	1.5E-06	1.9E-06	2.4E-06	3.1E-06	2.5E-06	2.7E-06	2.4E-06	3.3E-06	3.2E-06	2.7E-06
1.0E-06	8.9E-07	5.7E-07	7.0E-07	5.6E-07	8.4E-07	1.4E-06	1.7E-06	2.2E-06	2.8E-06	2.3E-06	2.5E-06	2.2E-06	3.1E-06	3.0E-06	2.4E-06
1.1E-06	9.0E-07	5.8E-07	7.1E-07	5.6E-07	8.4E-07	1.4E-06	1.8E-06	2.2E-06	2.8E-06	2.3E-06	2.5E-06	2.2E-06	3.1E-06	3.0E-06	2.4E-06
805.	805.	805.	805.	805.	805.	805.	805.	805.	805.	805.	805.	805.	805.	805.	805.
1.5 MILES (2415 METERS)															
2.2E-07	1.8E-07	1.2E-07	1.4E-07	1.1E-07	1.7E-07	2.8E-07	3.6E-07	4.6E-07	5.7E-07	4.7E-07	5.1E-07	4.7E-07	6.5E-07	6.4E-07	5.1E-07
1.8E-07	1.5E-07	9.8E-08	1.2E-07	9.7E-08	1.4E-07	2.4E-07	3.0E-07	3.9E-07	4.8E-07	4.0E-07	4.3E-07	3.9E-07	5.5E-07	5.4E-07	4.4E-07
1.4E-09	6.6E-10	3.2E-10	3.9E-10	3.8E-10	6.6E-10	1.6E-09	2.2E-09	2.0E-09	2.1E-09	1.6E-09	1.6E-09	1.9E-09	3.9E-09	4.4E-09	3.6E-09
2.2E-07	1.8E-07	1.1E-07	1.4E-07	1.1E-07	1.7E-07	2.8E-07	3.6E-07	4.6E-07	5.6E-07	4.7E-07	5.0E-07	4.6E-07	6.5E-07	6.4E-07	5.1E-07
2.2E-07	1.8E-07	1.2E-07	1.4E-07	1.1E-07	1.7E-07	2.8E-07	3.6E-07	4.6E-07	5.7E-07	4.7E-07	5.1E-07	4.7E-07	6.5E-07	6.4E-07	5.1E-07
1.8E-07	1.5E-07	9.6E-08	1.2E-07	9.6E-08	1.4E-07	2.4E-07	3.0E-07	3.8E-07	4.8E-07	3.9E-07	4.2E-07	3.9E-07	5.5E-07	5.4E-07	4.3E-07
1.8E-07	1.5E-07	9.7E-08	1.2E-07	9.7E-08	1.4E-07	2.4E-07	3.0E-07	3.9E-07	4.8E-07	4.0E-07	4.3E-07	3.9E-07	5.5E-07	5.4E-07	4.3E-07
2415.	2415.	2415.	2415.	2415.	2415.	2415.	2415.	2415.	2415.	2415.	2415.	2415.	2415.	2415.	2415.

TOTAL OBS -35014 TOTAL INV OBS - 262 CALMS UPPER LEVEL - 0.00 CALMS LOWER LEV -112.00

KEY ENTRY 1 RELATIVE CONCENTRATION - XOQ (S/M**3)
ENTRY 2 DEPLETED RELATIVE CONCENTRATION (S/M**3)
ENTRY 3 RELATIVE DEPOSITION RATE (1/M**2)
ENTRY 4 DECAYED XOQ (S/M**3) - HALF LIFE 2.26 DAYS
ENTRY 5 DECAYED XOQ (S/M**3) - HALF LIFE 8.00 DAYS
ENTRY 6 DEC+DPL XOQ (S/M**3) - HALF LIFE 2.26 DAYS
ENTRY 7 DEC+DPL XOQ (S/M**3) - HALF LIFE 8.00 DAYS
ENTRY 8 - DISTANCE IN METERS

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TABLE 6.1-23(b)

AVERAGE METEOROLOGICAL RELATIVE CONCENTRATION ANALYSIS
DATA PERIOD : 7/21/73 TO 9/30/77

PROGRAM ANDIFF3 ANNUAL X/Q FAC — HOUSTON LIGHTING & POWER
NO TERRAIN CORRECTION FACTORS — SOUTH TEXAS PROJECT
DEPOSITION/DEPLETION INCLUDED — 4490-115-12
DATE 20-MAR-84 TIME 17:10:53 — LONG-TERM X/Q (ROUTINE RELEASE) ANALYSIS

AFFECTED SECTORS

NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N
2.5 MILES		(4024 METERS)													
1.1E-07	8.8E-08	5.6E-08	7.0E-08	5.6E-08	8.2E-08	1.4E-07	1.7E-07	2.2E-07	2.8E-07	2.3E-07	2.5E-07	2.3E-07	3.2E-07	3.1E-07	2.5E-07
8.5E-08	7.1E-08	4.5E-08	5.7E-08	4.5E-08	6.6E-08	1.1E-07	1.4E-07	1.8E-07	2.2E-07	1.9E-07	2.0E-07	1.8E-07	2.6E-07	2.5E-07	2.0E-07
5.8E-10	2.8E-10	1.4E-10	1.6E-10	1.6E-10	2.8E-10	6.8E-10	9.4E-10	8.5E-10	8.9E-10	6.6E-10	7.0E-10	7.8E-10	1.6E-09	1.9E-09	1.5E-09
1.0E-07	8.7E-08	5.5E-08	6.9E-08	5.5E-08	8.1E-08	1.4E-07	1.7E-07	2.2E-07	2.7E-07	2.3E-07	2.5E-07	2.3E-07	3.1E-07	3.1E-07	2.5E-07
1.1E-07	8.8E-08	5.6E-08	7.0E-08	5.6E-08	8.2E-08	1.4E-07	1.7E-07	2.2E-07	2.8E-07	2.3E-07	2.5E-07	2.3E-07	3.2E-07	3.1E-07	2.5E-07
8.4E-08	7.0E-08	4.4E-08	5.5E-08	4.4E-08	6.5E-08	1.1E-07	1.4E-07	1.8E-07	2.2E-07	1.8E-07	2.0E-07	1.8E-07	2.5E-07	2.5E-07	2.0E-07
8.5E-08	7.1E-08	4.5E-08	5.6E-08	4.5E-08	6.6E-08	1.1E-07	1.4E-07	1.8E-07	2.2E-07	1.8E-07	2.0E-07	1.8E-07	2.5E-07	2.5E-07	2.0E-07
4024.	4024.	4024.	4024.	4024.	4024.	4024.	4024.	4024.	4024.	4024.	4024.	4024.	4024.	4024.	4024.
3.5 MILES		(5634 METERS)													
6.7E-08	5.7E-08	3.6E-08	4.5E-08	3.6E-08	5.3E-08	8.6E-08	1.1E-07	1.4E-07	1.8E-07	1.5E-07	1.6E-07	1.5E-07	2.0E-07	1.9E-07	1.6E-07
5.2E-08	4.4E-08	2.8E-08	3.5E-08	2.8E-08	4.1E-08	6.7E-08	8.4E-08	1.1E-07	1.4E-07	1.1E-07	1.2E-07	1.1E-07	1.5E-07	1.5E-07	1.2E-07
3.2E-10	1.6E-10	7.7E-11	9.2E-11	9.1E-11	1.6E-10	3.8E-10	5.3E-10	4.8E-10	5.0E-10	3.7E-10	3.9E-10	4.4E-10	9.2E-10	1.0E-09	8.6E-10
6.6E-08	5.5E-08	3.5E-08	4.4E-08	3.5E-08	5.1E-08	8.5E-08	1.1E-07	1.4E-07	1.7E-07	1.5E-07	1.6E-07	1.4E-07	2.0E-07	1.9E-07	1.5E-07
6.7E-08	5.6E-08	3.6E-08	4.5E-08	3.5E-08	5.2E-08	8.6E-08	1.1E-07	1.4E-07	1.8E-07	1.5E-07	1.6E-07	1.4E-07	2.0E-07	1.9E-07	1.6E-07
5.1E-08	4.3E-08	2.7E-08	3.4E-08	2.7E-08	4.0E-08	6.6E-08	8.3E-08	1.1E-07	1.4E-07	1.1E-07	1.2E-07	1.1E-07	1.5E-07	1.5E-07	1.2E-07
5.2E-08	4.4E-08	2.8E-08	3.4E-08	2.7E-08	4.0E-08	6.6E-08	8.4E-08	1.1E-07	1.4E-07	1.1E-07	1.2E-07	1.1E-07	1.5E-07	1.5E-07	1.2E-07
5634.	5634	5634.	5634	5634.	5634.	5634.	5634.	5634.	5634.	5634.	5634.	5634.	5634.	5634.	5634.
4.5 MILES		(7244 METERS)													
4.8E-08	4.1E-08	2.6E-08	3.2E-08	2.5E-08	3.7E-08	6.1E-08	7.7E-08	1.0E-07	1.3E-07	1.1E-07	1.1E-07	1.0E-07	1.4E-07	1.4E-07	1.1E-07
3.6E-08	3.1E-08	1.9E-08	2.4E-08	1.9E-08	2.8E-08	4.6E-08	5.8E-08	7.6E-08	9.5E-08	8.0E-08	8.6E-08	7.7E-08	1.1E-07	1.0E-07	8.4E-08
2.1E-10	1.0E-10	5.0E-11	5.9E-11	5.9E-11	1.0E-10	2.5E-10	3.4E-10	3.1E-10	3.2E-10	2.4E-10	2.5E-10	2.9E-10	6.0E-10	6.7E-10	5.5E-10
4.7E-08	3.9E-08	2.5E-08	3.1E-08	2.5E-08	3.6E-08	6.0E-08	7.5E-08	9.9E-08	1.2E-07	1.0E-07	1.1E-07	1.0E-07	1.4E-07	1.3E-07	1.1E-07
4.8E-08	4.0E-08	2.6E-08	3.2E-08	2.5E-08	3.7E-08	6.1E-08	7.6E-08	1.0E-07	1.3E-07	1.1E-07	1.1E-07	1.0E-07	1.4E-07	1.4E-07	1.1E-07
3.5E-08	2.9E-08	1.9E-08	2.3E-08	1.8E-08	2.7E-08	4.5E-08	5.6E-08	7.4E-08	9.4E-08	7.8E-08	8.3E-08	7.5E-08	1.0E-07	1.0E-07	8.2E-08
3.6E-08	3.0E-08	1.9E-08	2.4E-08	1.9E-08	2.8E-08	4.6E-08	5.7E-08	7.5E-08	9.5E-08	7.9E-08	8.5E-08	7.7E-08	1.0E-07	1.0E-07	8.3E-08
7244.	7244.	7244.	7244.	7244.	7244.	7244.	7244.	7244.	7244.	7244.	7244.	7244.	7244.	7244.	7244.
7.5 MILES		(12073 METERS)													
2.4E-08	2.1E-08	1.3E-08	1.6E-08	1.3E-08	1.9E-08	3.1E-08	3.8E-08	5.1E-08	6.5E-08	5.4E-08	5.8E-08	5.2E-08	7.0E-08	6.8E-08	5.6E-08
1.7E-08	1.4E-08	9.2E-09	1.1E-08	9.0E-09	1.3E-08	2.1E-08	2.7E-08	3.6E-08	4.5E-08	3.8E-08	4.1E-08	3.6E-08	4.9E-08	4.7E-08	3.9E-08
8.6E-11	4.2E-11	2.0E-11	2.4E-11	2.4E-11	4.2E-11	1.0E-10	1.4E-10	1.3E-10	1.3E-10	9.8E-11	1.0E-10	1.2E-10	2.4E-10	2.7E-10	2.3E-10
2.3E-08	2.0E-08	1.2E-08	1.5E-08	1.2E-08	1.8E-08	3.0E-08	3.7E-08	4.9E-08	6.3E-08	5.2E-08	5.6E-08	5.0E-08	6.7E-08	6.6E-08	5.4E-08
2.4E-08	2.0E-08	1.3E-08	1.6E-08	1.3E-08	1.9E-08	3.0E-08	3.8E-08	5.1E-08	6.4E-08	5.4E-08	5.8E-08	5.1E-08	6.9E-08	6.7E-08	5.5E-08
1.6E-08	1.4E-08	8.6E-09	1.1E-08	8.5E-09	1.3E-08	2.1E-08	2.6E-08	3.4E-08	4.4E-08	3.6E-08	3.9E-08	3.5E-08	4.7E-08	4.6E-08	3.7E-08
1.7E-08	1.4E-08	9.0E-09	1.1E-08	8.8E-09	1.3E-08	2.1E-08	2.6E-08	3.5E-08	4.5E-08	3.7E-08	4.0E-08	3.6E-08	4.8E-08	4.7E-08	3.8E-08
12073.	12073.	12073.	12073.	12073.	12073.	12073.	12073.	12073.	12073.	12073.	12073.	12073.	12073.	12073.	12073.

TOTAL OBS -35014 TOTAL INV OBS - 262 CALMS UPPER LEVEL - 0.00 CALMS LOWER LEV -112.00

KEY ENTRY 1 RELATIVE CONCENTRATION - XOQ (S/M**3)
ENTRY 2 DEPLETED RELATIVE CONCENTRATION (S/M**3)
ENTRY 3 RELATIVE DEPOSITION RATE (1/M**2)
ENTRY 4 DECAYED XOQ (S/M**3) - HALF LIFE 2.26 DAYS
ENTRY 5 DECAYED XOQ (S/M**3) - HALF LIFE 8.00 DAYS
ENTRY 6 DEC+DPL XOQ (S/M**3) - HALF LIFE 2.26 DAYS
ENTRY 7 DEC+DPL XOQ (S/M**3) - HALF LIFE 8.00 DAYS
ENTRY 8 - DISTANCE IN METERS

7

TABLE 6.1-23(c)

AVERAGE METEOROLOGICAL RELATIVE CONCENTRATION ANALYSIS
DATA PERIOD : 7/21/73 TO 9/30/77

PROGRAM ANDIFF3 ANNUAL X/Q FAC	HOUSTON LIGHTING & POWER
NO TERRAIN CORRECTION FACTORS	SOUTH TEXAS PROJECT
DEPOSITION/DEPLETION INCLUDED	4490-115-12
DATE 20-MAR-84 TIME 17:10:53	LONG-TERM X/Q (ROUTINE RELEASE) ANALYSIS

AFFECTED SECTORS

NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N
15.0 MILES	(24146 METERS)														
9.8E-09	8.5E-09	5.4E-09	6.7E-09	5.2E-09	7.7E-09	1.2E-08	1.5E-08	2.1E-08	2.7E-08	2.2E-08	2.4E-08	2.1E-08	2.8E-08	2.7E-08	2.2E-08
6.0E-09	5.3E-09	3.3E-09	4.1E-09	3.2E-09	4.7E-09	7.6E-09	9.4E-09	1.3E-08	1.6E-08	1.4E-08	1.5E-08	1.3E-08	1.7E-08	1.7E-08	1.4E-08
2.5E-11	1.2E-11	5.8E-12	7.0E-12	6.9E-12	1.2E-11	2.9E-11	4.0E-11	3.6E-11	3.8E-11	2.8E-11	3.0E-11	3.4E-11	7.0E-11	7.9E-11	6.5E-11
9.0E-09	7.7E-09	4.7E-09	5.9E-09	4.7E-09	7.0E-09	1.1E-08	1.4E-08	1.9E-08	2.5E-08	2.1E-08	2.2E-08	1.9E-08	2.6E-08	2.5E-08	2.1E-08
9.5E-09	8.3E-09	5.2E-09	6.4E-09	5.1E-09	7.5E-09	1.2E-08	..5E-08	2.0E-08	2.6E-08	2.2E-08	2.3E-08	2.1E-08	2.7E-08	2.6E-08	2.2E-08
5.5E-09	4.7E-09	2.9E-09	3.6E-09	2.9E-09	4.3E-09	7.0E-09	8.7E-09	1.2E-08	1.5E-08	1.3E-08	1.3E-08	1.2E-08	1.6E-08	1.6E-08	1.3E-08
5.9E-09	5.1E-09	3.2E-09	3.9E-09	3.1E-09	4.6E-09	7.4E-09	9.2E-09	1.2E-08	1.6E-08	1.3E-08	1.4E-08	1.3E-08	1.7E-08	1.6E-08	1.3E-08
24146.	24146.	24146.	24146.	24146.	24146.	24146.	24146.	24146.	24146.	24146.	24146.	24146.	24146.	24146.	24146.
25.0 MILES	(40244 METERS)														
5.1E-09	4.5E-09	2.9E-09	3.5E-09	2.8E-09	4.1E-09	6.4E-09	7.9E-09	1.1E-08	1.4E-08	1.2E-08	1.3E-08	1.1E-08	1.5E-08	1.4E-08	1.2E-08
2.8E-09	2.5E-09	1.6E-09	1.9E-09	1.5E-09	2.2E-09	3.5E-09	4.4E-09	6.0E-09	7.7E-09	6.5E-09	6.9E-09	6.1E-09	8.0E-09	7.7E-09	6.4E-09
9.7E-12	4.7E-12	2.3E-12	2.7E-12	2.7E-12	4.7E-12	1.1E-11	1.6E-11	1.4E-11	1.5E-11	1.1E-11	..2E-11	1.3E-11	2.7E-11	3.1E-11	2.5E-11
4.5E-09	3.8E-09	2.3E-09	2.9E-09	2.3E-09	3.5E-09	5.7E-09	7.0E-09	9.6E-09	1.3E-08	1.0E-08	1.1E-08	9.6E-09	1.3E-08	1.3E-08	1.0E-08
4.9E-09	4.3E-09	2.7E-09	3.3E-09	2.6E-09	3.9E-09	6.2E-09	7.6E-09	1.0E-08	1.4E-08	1.1E-08	1.2E-08	1.1E-08	1.4E-08	1.4E-08	1.1E-08
2.5E-09	2.1E-09	1.3E-09	1.6E-09	1.3E-09	1.9E-09	3.1E-09	3.8E-09	5.3E-09	7.0E-09	5.7E-09	6.0E-09	5.3E-09	7.1E-09	7.0E-09	5.7E-09
2.7E-09	2.4E-09	1.5E-09	1.8E-09	1.4E-09	2.1E-09	3.4E-09	4.2E-09	5.7E-09	7.5E-09	6.2E-09	6.6E-09	5.8E-09	7.7E-09	7.5E-09	6.2E-09
40244.	40244.	40244.	40244.	40244.	40244.	40244.	40244.	40244.	40244.	40244.	40244.	40244.	40244.	40244.	40244.
35.0 MILES	(56341 METERS)														
3.4E-09	3.0E-09	1.9E-09	2.3E-09	1.8E-09	2.7E-09	4.2E-09	5.2E-09	7.2E-09	9.4E-09	7.9E-09	8.4E-09	7.3E-09	9.6E-09	9.2E-09	7.8E-09
1.7E-09	1.5E-09	9.6E-10	1.2E-09	9.2E-10	1.4E-09	2.1E-09	2.6E-09	3.6E-09	4.7E-09	3.9E-09	4.2E-09	3.7E-09	4.8E-09	4.6E-09	3.9E-09
5.2E-12	2.5E-12	1.2E-12	1.5E-12	1.4E-12	2.5E-12	6.1E-12	8.4E-12	7.6E-12	8.0E-12	5.9E-12	6.2E-12	7.0E-12	1.5E-11	1.7E-11	1.4E-11
2.9E-09	2.4E-09	1.4E-09	1.8E-09	1.5E-09	2.2E-09	3.6E-09	4.4E-09	6.1E-09	8.1E-09	6.7E-09	7.0E-09	6.1E-09	8.2E-09	8.1E-09	6.6E-09
3.2E-09	2.8E-09	1.7E-09	2.1E-09	1.7E-09	2.5E-09	4.0E-09	5.0E-09	6.8E-09	9.0E-09	7.5E-09	7.9E-09	6.9E-09	9.1E-09	8.8E-09	7.4E-09
1.4E-09	1.2E-09	7.2E-10	9.1E-10	7.3E-10	1.1E-09	1.8E-09	2.2E-09	3.1E-09	4.1E-09	3.3E-09	3.5E-09	3.1E-09	4.1E-09	4.1E-09	3.3E-09
1.6E-09	1.4E-09	8.7E-10	1.1E-09	8.5E-10	1.3E-09	2.0E-09	2.5E-09	3.4E-09	4.5E-09	3.7E-09	4.0E-09	3.5E-09	4.6E-09	4.4E-09	3.7E-09
56341.	56341.	56341.	56341.	56341.	56341.	56341.	56341.	56341.	56341.	56341.	56341.	56341.	56341.	56341.	56341.
45.0 MILES	(72439 METERS)														
2.5E-09	2.2E-09	1.4E-09	1.7E-09	1.4E-09	2.0E-09	3.1E-09	3.9E-09	5.3E-09	7.0E-09	5.8E-09	6.2E-09	5.4E-09	7.1E-09	6.8E-09	5.7E-09
1.2E-09	1.0E-09	6.6E-10	8.1E-10	6.3E-10	9.3E-10	1.5E-09	1.8E-09	2.5E-09	3.2E-09	2.7E-09	2.9E-09	2.5E-09	3.3E-09	3.2E-09	2.7E-09
3.2E-12	1.6E-12	7.6E-13	9.1E-13	9.0E-13	1.6E-12	3.8E-12	5.2E-12	4.8E-12	5.9E-12	3.7E-12	3.9E-12	4.4E-12	9.1E-12	1.0E-11	8.5E-12
2.1E-09	1.7E-09	9.9E-10	1.3E-09	1.0E-09	1.6E-09	2.6E-09	3.1E-09	4.4E-09	5.8E-09	4.8E-09	4.9E-09	4.3E-09	5.8E-09	5.8E-09	4.7E-09
2.4E-09	2.0E-09	1.3E-09	1.6E-09	1.2E-09	1.8E-09	2.9E-09	3.6E-09	5.0E-09	6.6E-09	5.5E-09	5.8E-09	5.0E-09	6.6E-09	6.5E-09	5.4E-09
9.6E-10	7.9E-10	4.6E-10	5.9E-10	4.8E-10	7.3E-10	1.2E-09	1.5E-09	2.0E-09	2.7E-09	2.2E-09	2.3E-09	2.0E-09	2.7E-09	2.7E-09	2.2E-09
1.1E-09	9.5E-10	5.8E-10	7.2E-10	5.8E-10	8.6E-10	1.4E-09	1.7E-09	2.3E-09	3.1E-09	2.5E-09	2.7E-09	2.3E-09	3.1E-09	3.0E-09	2.5E-0[illegible]
72439.	72439.	72439.	72439.	72439.	72439.	72439.	72439.	72439.	72439.	72439.	72439.	72439.	72439.	72439.	72439.

TOTAL OBS -35014 TOTAL INV OBS - 262 CALMS UPPER LEVEL - 0.00 CALMS LOWER LEV -112.00

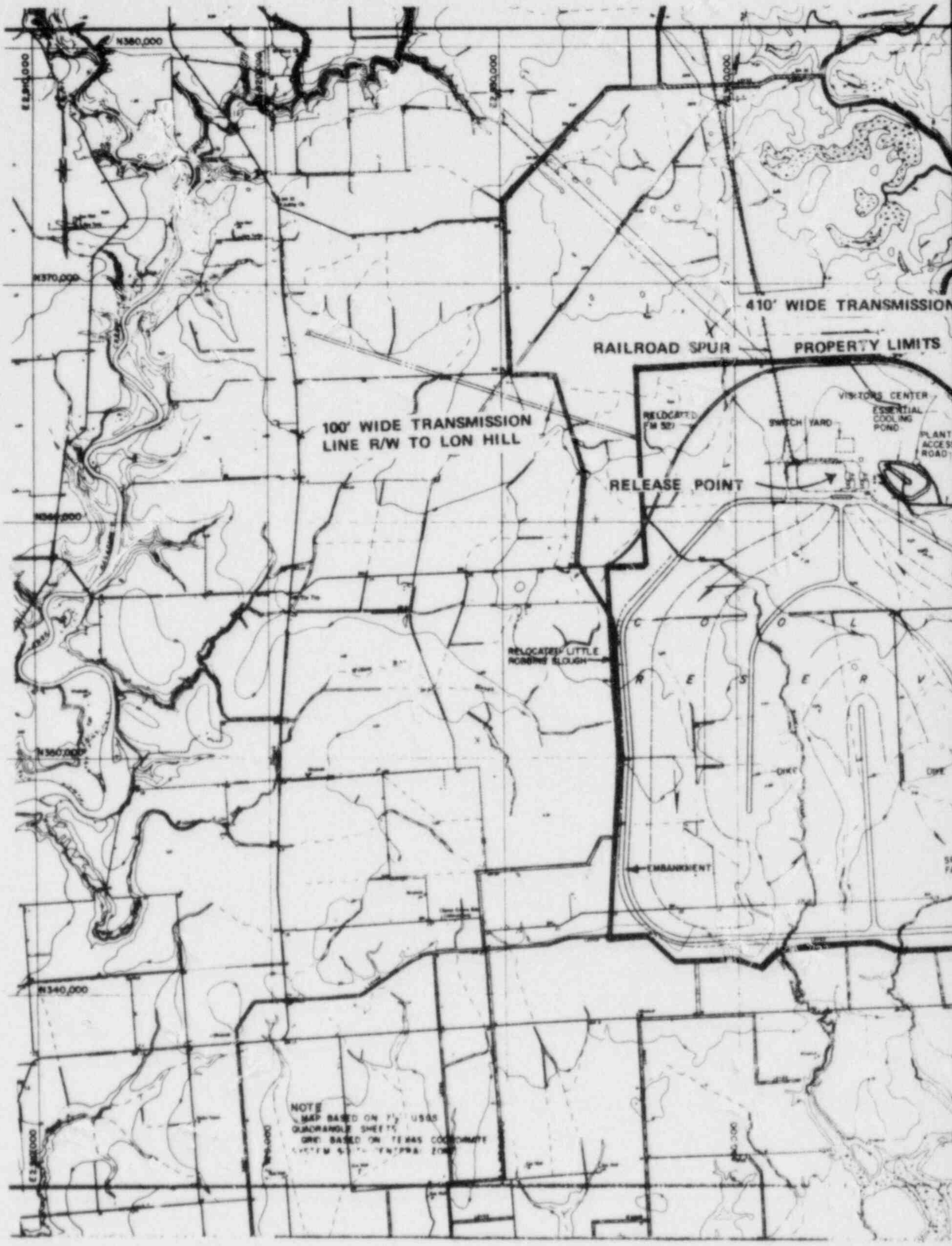
KEY ENTRY 1 RELATIVE CONCENTRATION - XOQ (S/M**3)
ENTRY 2 DEPLETED RELATIVE CONCENTRATION (S/M**3)
ENTRY 3 RELATIVE DEPOSITION RATE (1/M**2)
ENTRY 4 DECAYED XOQ (S/M**3) - HALF LIFE 2.26 DAYS
ENTRY 5 DECAYED XOQ (S/M**3) - HALF LIFE 8.00 DAYS
ENTRY 6 DEC+DPL XOQ (S/M**3) - HALF LIFE 2.26 DAYS
ENTRY 7 DEC+DPL XOQ (S/M**3) - HALF LIFE 8.00 DAYS
ENTRY 8 - DISTANCE IN METERS

7

APPENDIX 6.1A

AN EMPIRICAL MODEL FOR DETERMINING THE SALINITY DISTRIBUTION IN THE COLORADO RIVER

In accordance with the discussion in the Introduction to Regulatory Guide 4.2, Revision 2, pertaining to the "Applicant's Environmental Report - Operating License Stage," this section is not addressed since no updating of the corresponding material presented in the Environmental Report - Construction Permit Stage was necessary.


N380,000
N370,000
N360,000
N350,000
N340,000
410' WIDE TRANSMISSION
RAILROAD SPUR
PROPERTY LIMITS
100' WIDE TRANSMISSION
LINE R/W TO LON HILL
VISITORS CENTER
SWITCH YARD
ESSENTIAL COOLING POND
PLANT ACCESS ROAD
RELEASE POINT
RELOCATED LITTLE ROBBINS SLOUGH
EMBANKMENT
NOTE

4490-079-12

TI APERTURE CARD

Also Available On Aperture Card

SOUTH TEXAS PROJECT
UNITS 1 & 2

LOCATION OF METEOROLOGICAL TOWERS

FIGURE 6.1-7 Amendment 7

8412280081-/D

6.2 APPLICANT'S PROPOSED OPERATIONAL MONITORING PROGRAMS

This section provides a general description of the proposed operational monitoring programs. These programs have been developed largely on the basis of the preoperational monitoring results. However, not all phases of the pre-operational program are complete at this time. Therefore, the proposed monitoring programs must be considered flexible in that results of the remaining pre-operational studies and advances in state-of-the-art may suggest changes in instrumentation, incorporation of modifications such as the addition or deletion of certain parameters, adjustment in number and location of sampling stations, and alterations of frequency of observations and number of replications. Any changes made to the program(s) will be designed to provide an adequate monitoring plan.

A more detailed discussion of the proposed operational monitoring program is presented in Appendix A.

6.2.1 RADIOLOGICAL MONITORING

Plant releases will be measured by the collection and analysis of effluent samples to determine isotopic composition and concentration as required by RG 1.21 Rev. 1. The impact of the expected releases on the environment and the dose-to-man level have been calculated using models discussed in Sections 5.2 and 5.3. The environmental radiological monitoring program developed per guidance of USNRC, November 1979 Branch Technical Position will provide limited confirmatory surveillance in selected pathways to man. 7

6.2.1.1 Plant Effluent Monitoring

6.2.1.1.1 Introduction. The Radiation Monitoring System furnishes information to operations personnel regarding radioactivity levels in the plant effluent streams. This system will help to maintain radiation levels as low as reasonably achievable and to verify compliance with applicable governmental regulations.

The monitors within the Radiation Monitoring System (RMS) which are responsible for monitoring any liquid or gaseous effluents are:

1. Reactor Containment Building (RCB) Stack Monitor

2. Mechanical-Electrical Auxiliaries Building (MEAB) Stack Monitor

3. Fuel Handling Building (FHB) Stack Monitor

4. Condenser Vacuum Pump Monitor

5. Liquid Waste Processing System (LWPS) Monitor

6. Turbine Generator Building (TGB) Drain Monitor

7. Condensate Polishing System Monitor

The portions of the Radiation Monitoring System described in the following sections serve in conjunction with a comprehensive sampling program.

The sampling program is the primary method for quantitatively and qualitatively evaluating system and effluent activity levels to comply with RG 1.21 Rev 1.

6.2.1.1.2 Design Objectives. The Radiation Monitoring System is designed to measure and record radioactivity levels, to alarm abnormal radioactivity levels, and control, as required, the release of radioactive liquids, gases, and particulates produced in the operation of the plant. The RMS is also designed to facilitate compliance with the requirements of 10CFR50, 10CFR20, RG 1.21 Rev. 1, and General Design Criteria 60, 63, and 64. The system aids in the protection of the general public and plant personnel from exposure to radiation or radioactive materials in excess of those allowed by the applicable regulations of governmental agencies by controlling or terminating releases exceeding discharge limits and warns plant personnel so they can take appropriate measures to maintain the exposure to themselves and the general public as low as reasonably achievable.

The design objectives of the effluent monitors, for normal operation, are as follows:

1. Provide continuous surveillance of radioactivity levels in effluent streams from minimum detectable levels to levels commensurate with Technical Specification limits by indicating any recording these levels in the Control Room and by alarming any abnormal activity levels.

2. Provide data useful in estimating total released activity to comply with RG 1.21 Rev. 1.

3. Give early warning of increasing radioactivity levels indicative of equipment failure, malfunction or deteriorating system performance by using a "warning" setpoint alarm.

4. Initiate prompt corrective action, either automatically or through operator response, on high radioactivity level by using a second "high" alarm setpoint.

For some anticipated operational occurrences resulting from accidents or malfunctions, the Radiation Monitoring System activities necessary isolation or diversion valves thereby terminating releases if radioactivity levels exceed "high" alarm setpoints.

6.2.1.1.3 Expected Radiation Levels. T... expected radioactivity concentrations in the effluent streams will be such that radiation levels at the site boundary are a small fraction of 10CFR20 limits. See Section 3.5 for expected release rates.

6.2.1.1.4 General Description. The effluent monitors within the RMS are off-line monitors with provisions for continuous sampling. Each monitor is capable of independent operation with all required indication and alarm being generated by the individual monitors. Monitor data such as real-time ...ivity level, time average activity level, and monitor setpoints for a partic...r effluent stream are transmitted to the plant main control room. This information is displayed on a CRT mounted in the main control board. A RMS typer and audible alarm is also provided in the main control room.

In addition to the control room indication and alarms, each monitor has a local readout with locally mounted alarm lights to indicate monitor status. Selected monitors also provide remote displays in the radwaste control room to facilitate operation of various waste systems.

The effluent stream flow is measured by the process instrumentation and is recorded by the plant main computer for use in preparing the RG 121 Rev. 1 reports.

6.2.1.1.5 Specific Monitor Details

6.2.1.1.5.1 Reactor Containment Building Stack Monitor. Containment air is continuously monitored for particulate, iodine and noble gas activities. A continuous air sample drawn from the containment dome are passes through a moving filter paper to collect particulates, which are viewed by a shielded beta sensitive scintillation detector, through an impregnated charcoal filter to collect iodine, which is viewed by a shielded gamma sensitive scintillation detector, and finally through a chamber, where the radioactive gases are detected by a shielded beta sensitive detector.

The sample stream is then returned to the containment, and thus is a closed system. The sample probe is located near the containment dome above the HVAC risers.

This system is also used to sample the containment ventilation discharge duct during containment purging. A sample and sample return line are provided for a sample probe located in the main plant exhaust stack. Valves used to select either the containment or duct sample are controlled from the Main Control Room.

The charcoal cartridge is replaced at weekly intervals and the used cartridge is counted in the counting room for more accurate determination of I-131 activity. Determination of I-133 and I-135 activity is performed on one of these weekly samples at least once per quarter.

Indication and annunciation is provided in the Main Control Room. If the radioactivity level reaches the "high" setpoint on any of the channels, closure of the containment purge supply and exhaust valves is automatically initiated.

6.2.1.1.5.2 Mechanical-Electrical Auxiliaries Building Stack Monitor. This monitor measures the radioactivity of the Mechanical and Electrical Auxiliaries Building ventilation exhaust at the plant main exhaust stack prior to its discharge to the environment. This monitor will detect particulates, iodine and radioactive gases. The monitor subsystem is identical to the RCB monitor subsystem in construction and operation, except that it can sample from only one location and therefore does not have remotely operated sample isolation valves.

6.2.1.1.5.3 Fuel Handling Building Stack Monitor. This monitor samples the Fuel Handling Building ventilation duct at the plant main exhaust stack prior to its discharge to the environment. This monitor detects particulate, iodine and gaseous activity. The monitor subsystem is identical to the RCB monitor in construction and operation, except that it can sample from only one location, and therefore does not have remotely operated isolation valves.

6.2.1.1.5.4 Condenser Vacuum Pump Monitor. This monitor samples the common discharge of the condenser vacuum pumps prior to its discharge to the environment. This monitor detects only gases. The gases which can be detected are activation or fission product gases which will result if steam generator tube leaks occur. The sample is passed through an internally polished chamber with a stainless steel well in which a beta sensitive scintillation detector is located. The detector and chamber is shielded to minimize the effect of background radiation. The sample is returned downstream of the sample probe.

6.2.1.1.5.5 Liquid Waste Processing System Monitor. This monitor detects high activity present in the liquid waste effluent being discharged from the monitor tanks to the environment. A sample is taken from the discharge line after the monitor tank pumps, passed through the monitor and returned to the pump suction. The monitor consists of a sample chamber with a stainless steel well in which a beta scintillation detector is located. The chamber and detector are shielded with lead to minimize the effect of background radiation.

Prior to discharge, the liquid in the monitor tank is sampled and analyzed in the laboratory for radioactivity to comply with Regulatory Guide 1.21. Based upon this analysis, a discharge permit will be issued specifying the release rate and the dilution rate, if any. The release rate and dilution rate are used to determine the alarm setpoints from a computer calculation, chart or graph. Prior to the release, the alarm setpoints will be set to the values determined by the analyses to comply with Technical Specification limits.

Indication and annunciation is provided on the liquid waste processing panel as well as in the Main Control Room. In the event of a "high" alarm the liquid waste discharge valve closes automatically.

6.2.1.1.5.6 Turbine-Generator Building Drain Monitor. This monitor is a liquid monitor on the discharge of the TGB drain sump. The monitor is identical to the LWPS monitor in construction and operation.

Upon detection of a "high" alarm, the drain sump pumps are stopped automatically.

6.2.1.1.5.7 Condensate Polishing System Monitor. This monitor is a liquid monitor on the discharge of the condensate polishing system holdup tank. The monitor is identical to the LWPS monitor in construction and operation.

6.2.1.2 Environmental Radiological Monitoring

The emphasis of the operational program is to verify source control at the plant and to provide verification of the estimates of individual and population radiation exposure. If the new data are found to be statistically different from the data base, a critical evaluation will follow to identify the cause and correct it if this is deemed necessary to protect man in the restricted and unrestricted environment. 7

In meeting these objectives, certain findings reported in Sections 2.2.2, 2.6 and 2.7 have been considered in formulating the Operational Radiological Monitoring Program. Among these the most important in relation to critical exposure paths and population groups are the following:

1. There are no commercial dairies within ten (10) miles of the plant nor any individual cows or goats within five (5) miles whose milk is consumed by humans; however, there are six ranches with about 3600 head of beef cattle within 10-mile radius.

2. There are extensive commercial crops grown, mainly rice, soybeans, grain sorghum, and cotton in the region immediately surrounding the plant. The major portion of irrigation in this region is from the canal and levee systems with water controlled by the LCRA in Bay City. Alternate irrigation comes from deep water wells 30 ft or greater. 7

3. Local town derive their drinking water from groundwater wells; there is no population consumption of water from the Colorado River below the plant, though some of its water is permitted for irrigation, although not currently used.

4. There is substantial commercial harvesting of shellfish in Matagorda Bay, with the potential of harvesting fin fish as well depending on State controls. The Colorado estuary is limited to sports fishing, as a rule. 7

5. Mean background radiation levels due to terrestrial radiation sources are of the order of 8.5 microrem per hour with another 4 microrem/hour due to cosmic rays and fallout.

6. Prevailing winds are South to East Southeast. 7

6.2.1.2.1 <u>The Operation Radiological Monitoring Program</u>. The sampling media, collection location, and type of analysis are essentially the same in both pre-operational and operational radiological monitoring programs, as generally described in Section 6.1.5.

The operational program will be a slightly modified extension of the pre-operational program which will be continued for the first 36 months of commercial operation (or other period corresponding to a maximum burnup in the initial core cycle), after which time the program will be reviewed and modified, as required by data collected to date. 7

Table 6.2-1 summarizes the proposed radiological environmental program for the Operational Phase. This program was developed per guidance of USNRC November 1979 Branch Technical Position. 7

Requirements for the operational program include the following:

1. The design and implementation of the Radiological Environmental Monitoring Program, related surveillance activities, sample analysis and required reports shall be performed by the Applicant.

2. The Radiological Environmental Monitoring Program shall be designed and implemented per guidance of the NRC Branch Technical Position, November 1979. 7

3. The proposed minimum Radiological Environmental Monitoring Program shall be conducted as specified in Table 6.2-1.

4. If the Radiological Environmental Monitoring Program is not conducted as specified in Table 6.2-1, a statement will be prepared and submitted to the NRC in the Annual Radiological Environmental Operating Report. The NRC Branch Technical Position, November 1979, Sections A and B will be used for guidance.

5. Determination of a "Reportable Value" for a non-routine Radiological Environmental Monitoring Operating Report shall be in accordance with NRC Branch Technical Position, November 1979, Section B.

6. The Applicant will perform land use census(s) per guidance of the NRC 7
Branch Technical Position, November 1979. In the event that nc reliable milk sample is available for collection and analysis, broad leaf samples will be collected and analyzed in accordance with Table 6.2-1.

7. The Applicant shall submit an Annual Radiological Environmental Operating Report according to guidance provided by the NRC Branch Technical Position, November 1979, Section A.

8. Analysis shall be performed as part of an NRC approved Interlaboratory Comparison Program. A summary of the results data shall be included in the Annual Radiological Environmental Operating Report.

9. The Radiological Environmental Monitoring Program and surveillance activities shall be performed in such a manner to meet the intent of USNRC Regulatory Guide 4.15 "Quality Assurance for Radiological Monitoring Programs" where applicable.

6.2.1.2.2 Basis for the Choice of Sampling Frequency. The sampling frequencies given in Table 6.2-1 were selected so that the results of the radiological environmental monitoring supplements the results of the radiological effluent monitoring by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and modeling of the environmental exposure pathways. In some cases the sampling frequency is determined by inherent characteristics of the medium, e.g., air filters can be run only for a week before excessive pressure-drop arises; agricultural crops are best sampled at the time of harvest.

At present no milk animals (cows or goats) are known to exist within 5 miles of STP. An annual census for milk animals will be conducted during plant operation. If it is determined that human consumption of local milk is occurring, one milk sample will be taken in each of as many as 3 areas where doses are calculated to be greater than 1 mrem per year. Sampling frequency will be semi-monthly when animals are on pasture and monthly at other times. Analysis will be gamma isotopic and iodine-131.

6.2.1.2.3 Station Locations. Unless otherwise indicated, station locations will be the same as shown in Table 6.2-1. 7

6.2.1.2.4 Quality Control. Control checks and tests will be applied to the analytical operations by means of blind duplicate analyses of selected samples, and by the introduction of calibrated environmental samples, such as 7
provided through the USEPA Environmental Radioactivity Laboratory Intercomparison Studies Program. Analytical procedures will be similar to those reported in HASL-300 or equivalent commercial practice.

6.2.1.2.5 Analytical Sensitivity. The detection sensitivities of the various program elements are listed in Tables 6.1-17. Samples will be analyzed as described in the program summary (Table 6.2-1). 7

6.2.1.2.6 Data Presentation. Reporting units will be the same as in Table 6.1-17. The standard deviation of the net counting rate will be computed using the gross counting rate and the background counting rate. Suitable statistical methods will be used to determine whether a count is significant.

6.2.1.2.7 Routine Data Reporting Requirements. Reports on environmental radiological monitoring sample analyses will be submitted in accordance with the requirements of the Environmental Technical Specifications. These reports will be summaries of the results of the environmental activities and assessments of the observed impacts of the plant operation on the environment.

6.2.2 CHEMICAL EFFLUENT MONITORING

The South Texas Project chemical effluent monitoring program has been designed to meet all the chemical effluent control requirements stipulated by Texas State and Federal regulatory agencies. The anticipated environmental effects on the lower Colorado River are estimated to be insignificant. The analysis of these effects is presented in Sections 5.1, 5.4, 10.2 and 10.3. Nevertheless, all effluent streams likely to contain chemical contaminants will be monitored to ensure compliance with the requirements. The effluent monitoring program will be coordinated with the ecological monitoring program reported in Section 6.2.5.

The plant effluent flows entering the lower Colorado River will range from 80 to 308 cfs. In addition, there will be other waste streams which will discharge into the cooling reservoir. These streams will arise from the Sanitary Sewage Plant wastes, demineralizer neutralization tanks, and treatment of auxiliary boilers.

6.2.2.1 Cooling Reservoir Blowdown

The blowdown from the reservoir will be scheduled in accordance with the procedure outlined in Section 3.4. The reservoir water makeup will be obtained from the lower Colorado River.

The effect of evaporation of the cooling reservoir water on total dissolved solids is discussed in Section 5.1. Effects of sulfuric acid addition to the condenser cooling water to control pH in the cooling reservoir are discussed in Section 5.4. Effects of chlorine addition to the circulating water to control microbiological growths are also discussed in Section 5.4.

The blowdown operation will be monitored so as to ensure compliance with applicable regulatory standards and to assist in determining reasonable operating procedures and to prevent potential deleterious effects arising from the following:

1. Deviation of the pH beyond the allowable range.

2. High concentrations of free residual chlorine.

To prevent the above situations from arising, the following monitoring operations will be carried out during plant operation:

1. The blowdown pH will be monitored to ensure compliance with applicable liquid effluent regulations.

2. Total residual chlorine levels will be checked to keep the residual within the discharge criteria.

6.2.2.2 Other Waste Streams

All the effluent streams entering the cooling reservoir will be operated and controlled in such a manner as to minimize the effects on the Cooling Reservoir blowdown water quality. Some of the significant sources of these streams are:

1. Low volume waste water from demineralizer neutralization tanks.

2. Low volume waste water from floor and yard drains.

3. Treated sanitary sewage effluent.

4. Boiler blowdown.

5. Metal cleaning waste water.

Monitoring requirements (parameters, sampling methodologies, and sampling frequency) of these waste streams are designed to comply with limitation and requirements of the NPDES permit.

6.2.3 THERMAL EFFLUENT MONITORING

The operational thermal effluent monitoring system is designed to provide a scheme of surveillance of the heated discharge plume to ensure compliance with state and federal regulatory requirements.

Long-term thermal monitoring is included in the surface water monitoring program. These data, in conjunction with short term thermal monitoring, will be used to verify compliance with thermal discharge standards and verify the predictive models described in Section 5.1.

6.2.3.1 Effluent Monitoring

A monitoring system has been established to monitor the blowdown water temperature as it is discharged to the Colorado River. This effluent monitoring station will be utilized to ensure compliance with state and federal requirements concerning heated discharge.

6.2.3.2 Short-Term Monitoring

Detailed thermal measurements to verify the predicted isotherms in both the river and the cooling reservoir will be initiated after the water temperature in the reservoir has been elevated by operation of the plant. These studies will be undertaken during the first year of operation, and will measure the temperature distribution with respect to depth and surface area. A sufficient

number of sampling locations will be selected to adequately describe thermal distribution. This program will be of short duration (two weeks) but may be repeated during different seasons of the year.

6.2.4 METEOROLOGICAL MONITORING

6.2.4.1 The Onsite Meteorological Program

During operation of the STP, the onsite meteorological program will be conducted to provide the following:

1. Real-time meteorological information in the plant control room to be used for decisions concerning routine plant operations.

2. Real-time meteorological information in the control room from which initial estimates of the radiological consequences of an accidental release of radioactive gases into the atmosphere can be made.

3. Meteorological summaries from which the concentrations of radio-nuclides due to atmospheric releases during normal plant operations can be estimated.

To accomplish these goals, the pre-operational meteorological program has been modified as described in Section 6.1.3.1.2. Microprocessor output is provided for future links with the Units 1 and 2 dose assessment system computers in order to provide near-realtime meteorological data for use in atmospheric dispersion modeling. Fifteen and 60-minute averages of all parameters will be provided to the dose assessment system computers. Output will be displayed on printers located in the meteorological shelters until the dose assessment 7
computers are operational. The dose assessment computer will then provide appropriate displays of meteorological data in the control room, technical support center, and emergency operations facility. Both control rooms will also display instantaneous 10-meter wind speed and direction via analog meters. Additional microprocessor output is provided to an auto-answer telephone dial-up port for offsite access of current and past data. The past 72 hours of 15-minute averaged data can be accessed. One-, 15-, and 60-minute average data are also recorded on magnetic tape for system monitoring, data verification, and future processing (e.g., use in semi-annual operating reports).

A computerized accounting system will be established to maintain and update hourly averages of diffusion meteorology, measured effluent release rates, and inventory of fission products released. The system will include the required software to permit plant operators to make short-period dose calculations on demand. For long-period dose calculations, a permanent file of onsite meteorological data will be maintained. 7

6.2.5 NONRADIOLOGICAL ECOLOGICAL MONITORING

The operational monitoring program which will be implemented to assess nonradiological effects of plant operation on aquatic and terrestrial ecosystems is described in this section. Included is a discussion of the methodology to be used during the monitoring program.

6.2.5.1 Aquatic Ecology

Ecological monitoring of surface water parameters during the preoperational program are discussed in detail in Section 6.1.1.2. The objective of operational monitoring is to determine the effect of plant operation on the Colorado River. The operational program will be initiated within 30 days of the date of commercial operation. The operational program will continue until sufficient information has been collected to assess environmental impacts as a result of plant operation. The program will be discontinued only after approval by NRC.

The study area includes the Colorado River in the vicinity of the plant, both upstream and downstream of the intake and discharge points. The biological parameters to be monitored are listed below, and the general sampling locations are shown in Figure 6.2-2.

Physiochemical parameters will be monitored in the various sampling programs and will typically include dissolved oxygen, temperature, salinity, pH and specific conductance. All parameters, with the exception of pH (surface only), will be measured at the surface and at 5 foot intervals to the bottom. 7

The general survey is structured to provided information on plant induced impacts, if any, on fish, ichthyoplankton and macrozooplankton in the Colorado River. Four sampling locations have been selected to monitor populations of the aforementioned groups in the Colorado River. These locations correspond to sampling stations monitored in the baseline survey (see Fig. 6.1-1), so that comparisons between baseline and operational data can be made.

6.2.5.1.1 Zooplankton. Ichthyoplankton and macrozooplankton samples will be collected monthly. Surface and near-bottom samples will be collected at all stations (Fig. 6.2-2) during daylight hours. Replicate samples will be taken 7
to provide estimates of variance among samples. All samples will be collected with 0.5 m plankton nets (0.5 mm mesh). For surface samples, the nets will be 7
towed at a speed sufficient to keep the upper rim of the net near the surface. Bottom nets will be equipped with depressors or alternate equipment of equal or superior performance to facilitate sampling near the bottom.

Ichthyoplankton and macrozooplankton will be identified and enumerated. Identification will be to the lowest taxonomic level permitted by specimen condition. Results will be expressed as the number of organisms of each taxon per cubic meter.

6.2.5.1.2 Fish. Fishes will be sampled by seine and trawl, at each of the locations denoted on Figure 6.2-2. Sampling will be performed quarterly throughout the year, during both daylight and at night. Trawl hauls in the river will be made at a near uniform speed, traveling with the current. Seine 7
collections will be made parallel to the shoreline. The seines will be used in combination and may include a 6.35 mm (1/4- in.) mesh, 7.62 m (25-ft) bag seine and a 6.35 mm (1/4-in.) mesh, 3.05 m (10-ft) flat seine. Fishes will be 7
identified and enumerated by species, and representative subsamples measured for length.

6.2.5.2 Terrestrial Ecology

The direct impacts of plant operation on the terrestrial biota are predicted as few (see Sections 5.1 and 5.8). Therefore, no general nonradiological terrestrial ecological monitoring program is planned during operation. However, a program designed to evaluate the impacts resulting from relocation of a portion of Little Robbins Slough and the reduction of the drainage area affected by the South Texas Project, has been established.

The objective of this program is to identify changes of vascular hydrophyte distribution related to salinity changes resulting from reduced freshwater input to the Little Robbins Slough marsh complex. This will be accomplished using indicator species.

The description of the wetland vegetation of the Little Robbins Slough march complex during the baseline investigation has some drawbacks that need to be considered when future monitoring is conducted. That is, it is based on data collected at one point in time, when in fact it has been clearly demonstrated that coastal marshes are dynamic systems whose physical components fluctuate widely through time. Primary factors influencing the distribution of vegetation in these wetlands include: 1) freshwater input from Little Robbins Slough; 2) saltwater input through the outlet to Crab Lake by tidal action; 3) fluctuation of water levels due to seasonal changes in freshwater inputs; 4) burning and grazing; and, 5) natural perturbations such as flooding, high winds and hurricanes.

Water salinity ranged from $\angle$ 0.5 ppt (freshwater) to 12 ppt (moderately brackish) during the baseline studies. Many of the species growing in the march complex have relatively wide tolerance ranges to salinity. Therefore, to evaluate vegetation changes resulting from salinity changes it is necessary to key on species with narrow salinity tolerances. Three species with narrow salinity tolerances have been selected on the basis of their occurrence in the march to provide an adequate sample. The low salinity ranges for the three species (Scirpus validus, Zizaniopsis miliacea and Ceratophyllum demersum) are | 7
based on field measurements during the baseline survey and may not represent the upper range of tolerance for these species.

Ruppia maritima is a submergent type that was only recorded growing in brackish shallow open water west of Crab Lake. If reduced freshwater input results in lowering the water level in this area a significant reduction in the population of this plant should be evident.

Annual fall surveys will be conducted to determine changes in the abundance of Scirpus validus, Ceratophyllum demersum, Ruppia maritima, and Zizaniopsis | 7
miliacea. Where access is possible, sampling will be conducted at the locations where these species were identified as dominants during the baseline survey. Water salinity will be determined at each station at the time of sampling. Soil samples also will be collected to determine salinity.

Relative abundance of the four species will be recorded according to the following classification system:

1 = very rare
2 = rare
3 = infrequent to common

4 = abundant
5 = very abundant

Water salinity regime will be classified using the Ekman system as follows:

0-0.5 ppt = fresh
0.5-3 ppt = slightly brackish
3-10 ppt = moderately brackish
10-17 ppt = highly brackish
>17 ppt = saline

TABLE 6.2-1

MINIMUM OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE MEDIA	COLLECTION: NOMINAL NUMBER OF SAMPLE LOCATIONS	COLLECTION: ROUTINE SAMPLING MODE	COLLECTION: NOMINAL COLLECTION FREQUENCY	ANALYSIS: ANALYSIS TYPE	ANALYSIS: MINIMUM ANALYSIS FREQUENCY
1. Direct Radiation TLD's	Total Stations: 40 16 stations located in sixteen sectors approximately 1 mile from containment. 16 stations located in sixteen sectors 4-6 miles from containment. 6 stations located in special interest areas (e.g. school, population center) within a 14 mile radius of containment. 2 control stations located in areas of minimal wind direction (W,ENE) 10-15 miles from containment.	Continuous	Quarterly	Gamma	Quarterly
2. Airborne a. Air particulate and Charcoal Filters	Total Station: 12 (5) 3 stations located at the exclusion zone, approximately 1 mile from containment, in the N,NNW,NW sectors. 1 Station located in Bay City, 14 miles from containment. 1 control station located in a minimal wind direction (W) 11 miles from containment.	Continuous	Weekly	Radiodine Canister: 1-131 Particulate Saample: Gross Beta Gamma-Isotopic Gamma-Isotopic	 Weekly Weekly Quarterly Quarterly composite (by location)

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TABLE 6.2-1 (Continued)

MINIMUM OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE MEDIA	COLLECTION: NOMINAL NUMBER OF SAMPLE LOCATIONS	COLLECTION: ROUTINE SAMPLING MODE	COLLECTION: NOMINAL COLLECTION FREQUENCY	ANALYSIS: ANALYSIS TYPE	ANALYSIS: MINIMUM ANALYSIS FREQUENCY
b. Soils	(7) 5 same as air stations. 2 stations located on or adjacent to farms within 5 miles of containment.	Grab	Annually	Gamma-Isotopic	According to collection frequency
3. Waterborne a. Surface	Total Stations: 17 (6)				
	1 station located in reservoir at point of reservoir blowdown to Colorado River. 1 control station located above the Site on the Colorado River not influenced by plant discharge. 1 station approximately 2 miles downstream from blowdown entrance into the Colorado River (marker).	Composite	Monthly	Gamma-Isotopic Tritium	Monthly Quarterly composite
	Relief Well discharge exit monitoring				
	1 station located near Site boundary in the Little Robbins Slough.	Grab	Quarterly (if available)	Gross Beta, Tritium	Quarterly or according to collection frequency
	1 station located near Site boundary in the East Fork of Little Robbins Slough.		Quarterly (if available)		
	1 station located near Site boundary in the West Branch of the Colorado River.		Quarterly (if available)		

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TABLE 6.2-1 (Continued)

MINIMUM OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE MEDIA	COLLECTION			ANALYSIS	
	NOMINAL NUMBER OF SAMPLE LOCATIONS	ROUTINE SAMPLING MODE	NOMINAL COLLECTION FREQUENCY	ANALYSIS TYPE	MINIMUM ANALYSIS FREQUENCY
b. Ground	(4) 1 station located at well #603B upgradient from the reservoir in the upper shallow aquifer. 1 station located at well #446A down gradient in the upper shallow aquifer. 1 station located at well #603A upgradient from the reservoir in the lower shallow aquifer. 1 station located at well #446 down gradient in the lower aquifer.	Grab	Quarterly (if available)	Gamma-Isotopic and Tritium	According to collection frequency
c. Drinking	(1) 1 station located on Site.	Grab	Monthly	Gamma-Isotopic Tritium	Monthly
d. Sediment	(6) 1 station located near Site boundary in the Little Robbins Slough. 1 station located near Site boundary in the West Branch of the Colorado River. 1 control station located above the Site on the Colorado River not influenced by plant discharge.	Grab	Semi-annually (if available)	Gamma-Isotopic	According to the collection frequency

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TABLE 6.2-1 (Continued)

MINIMUM OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE MEDIA	COLLECTION: NOMINAL NUMBER OF SAMPLE LOCATIONS	COLLECTION: ROUTINE SAMPLING MODE	COLLECTION: NOMINAL COLLECTION FREQUENCY	ANALYSIS: ANALYSIS TYPE	ANALYSIS: MINIMUM ANALYSIS FREQUENCY
d. Sediment (Cont'd)	1 station located approximately 2 miles downstream from blowdown entrance into the Colorado River. 1 station located in reservoir at point of reservoir blowdown to Colorado River. 1 station located in reservoir near coolant discharge.				
4. Ingestion	Total Stations: 10				
a. Milk	--------------------------	Limited source of sample in vicinity at STPEGS---------------------------------- (Attempts will be made to collect samples when available)			
		Grab	Semimonthly when on pasture, monthly at other times when available.	Gamma-Isotopic & Low Level 1-131	According to collection frequency
b. Broadleaf	(4) 3 station located at the exclusion zone, approximately 1 mile from containment, in the N,NW,NNW sectors. 1 control station located in a minimal wind direction (W), 11 miles from containment.	Grab	Monthly during growing season (when available)	Gamma-Isotopic	Monthly according to collection frequency

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TABLE 6.2-1 (Continued)

MINIMUM OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE MEDIA	COLLECTION: NOMINAL NUMBER OF SAMPLE LOCATIONS	COLLECTION: ROUTINE SAMPLING MODE	COLLECTION: NOMINAL COLLECTION FREQUENCY	ANALYSIS: ANALYSIS TYPE	ANALYSIS: MINIMUM ANALYSIS FREQUENCY
c. Agricultural Projects	----------------------------	No sample stations have been identified in the vicinity of the Site. Presently no agricultural land is irrigated by water into which liquid plant wastes will be discharged. Agricultural products will be considered if these conditions change.			
d. Terrestrial & Aquatic Animals	(3) 1 sample representing commercially and/or recreationally important species in vicinity of STPEGS that may be influenced by plant operation. *1 sample of same or analogous species in area not influenced by STPEGS. 1 sample of same or analagous species in the reservoir (if available).	Grab	Sample in seasons or semiannually if they are not seasonal.	Gamma-Isotopic (Edible portion)	According to collection frequency
e. Pasture Grass	(2) 1 station located at the exclusion zone, NW. 1 control station located 11 miles W.	Grab	Quarterly (when cattle are on pasture)	Gamma-Isotopic	According to collection frequency

*Applies to aquatic samples only.

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TABLE 6.2-1 (Continued)

MINIMUM OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE MEDIA	COLLECTION			ANALYSIS	
	NOMINAL NUMBER OF SAMPLE LOCATIONS	ROUTINE SAMPLING MODE	NOMINAL COLLECTION FREQUENCY	ANALYSIS TYPE	MINIMUM ANALYSIS FREQUENCY
f. Domestic Meat (Edible portion)	(1) 1 sample representing domestic stock fed on crops exclusively grown within 10 miles of containment.		Semiannually	Gamma-Isotopic	According to collection frequency

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CHAPTER 8

BENEFITS AND COST

8.1 BENEFITS

8.1.1 PRIMARY BENEFITS--ENERGY SALES

The South Texas Project (STP), Units 1 and 2, will supply 2,500 Mwe of reliable base-load electric power to meet the projected needs of industrial, commercial, residential, and other customers of the participating utilities. As indicated in Section 1.1.1.2, the current schedule adopted by the participants' Management Committee contemplates one 1250-megawatt nuclear unit beginning commercial operation in 1984 and another in 1986. Each unit will generate 8,212 million kilowatt-hours annually at an assumed capacity factor of 75 percent. An assumed loss factor of 6.7 percent will allow 7,662 million 3
kilowatt-hours to be available for sale each year from each unit or 15,325 million kilowatt-hours for both units. This is shown in Table 8.1-1.

The relative shares of the participants in the project is as follows:

City of Austin (COA)	16.0 Percent
City Public Service Board of San Antonio (CPS)	28.0 Percent
Central Power and Light Company (CPL)	25.2 Percent
Houston Lighting & Power Company (HL&P)	30.8 Percent
Total	100.0 Percent

A projected proration of the kilowatt-hour sales for each unit of the STP is shown by major user classes on lines eight through eleven of Table 8.1-1. Each user class kwh is the summation of the energy proration of the four participants. A consumption allocation for each of the four participants is shown on Table 8.1-2 through 8.1-5.

The average annual growth in the peak demand and the total net system generating capability for the participating utilities has been projected in Chapter 1.

The revenues resulting from the sale of this electricity constitutes a measure of the primary benefit of the South Texas Project. The projected amount to be paid by users is shown on Table 8.1-6. That amount is $14.5 billion, discounted to the present value as of 1984, the first year of operation of Unit 1. This amount is based on a forecast of a composite 5.87 cents/kwh in 1984 with this rate escalated for the 32-year period at 1.058 percent annually. A 3
discount rate of 10 percent is used to convert these annual revenues to present worth. The 10 percent rate is the estimated composite cost of capital of the participating systems.

8.1.2 OTHER SOCIAL AND ECONOMIC BENEFITS

8.1.2.1 Payments to Government Agencies

A variety of taxes and franchise and other payments will be collected by the appropriate governmental authorities.

Property owned by CPS and COA, which is 44 percent of the property value, is public property and therefore exempt from property taxation. 7
In early 1978 Matagorda County, on behalf of itself, the State of Texas, and other political subdivisions for which it collects taxes filed suit asserting that the undivided interests owned by CPS and COA are subject to property taxes. CPS and COA requested and were granted a summary judgment by the state trial court holding the interests of CPS and COA to be exempt. Matagorda County appealed 3
that decision through the appellate courts of the state, which appellate courts sustained the decision of the trial court. 4

As shown on Table 8.1-7, maximum annual property taxes resulting from the STP are estimated to be $28.75 million. Table 8.1-9 presents STP taxable value as a percentage of the total taxable value of each major jurisdiction. 7

Part of the revenues of the participants will be subject to state, city, and Metropolitan Transit Authority (MTA) sales taxes. The state sales taxes are $180.2 million life-of-plant benefit or $18.8 million annualized. 3
The city sales taxes are $77.5 million life-of-plant benefit or $8.1 million annualized. MTA taxes, which are collected by CPS and HL&P, are $15.0 million life-of-plant benefit or $1.6 million annualized.

The transmission circuits are described in Section 3.9.1. Those subject to ad valorem taxes are the circuits from the site to Velasco Substation, the site to Blessing Substation, and CPL and HL&P's portion of the site to Danevang Tie Point. The combined county ad valorem taxes on these transmission lines are estimated to be $11,677 during the first year of operation. 3
The combined school ad valorem taxes are estimated to be $37,390 during the first year of operation.

Franchise payments to incorporated cities are estimated to amount to $129.9 million for the life of the plant. 3
The annualized or levelized payment is $13.6 million.

The State of Texas gross receipts tax paid by HL&P and CPL would amount to $74.1 million for the life of the plant or an annualized amount of $7.7 million. COA and CPS do not pay the state a gross receipts tax.

Total additional benefits to the municipal participants, including transfers of revenues to the general funds of San Antonio and Austin from the utilities systems in these municipalities, may be estimated to be a life-of-plant amount of $557.2 million for San Antonio and $454.9 million for Austin. Based upon revenues estimated in Table 8.1-6, the annualized or levelized amounts are $58.2 million for San Antonio and $47.5 million for Austin. 3

8.1.2.2 Payrolls and Employment

The operation and maintenance of the STP will require a presently estimated 252 permanent employees. The net present life-of-plant value of wages will amount to $155.4 million. The levelized wage amount is estimated to be $16.4 million annually. For the first full year of operation of both units, the 3
wages are estimated to be $8.86 million (in 1986 dollars).

The STP will cause an increase in employment for the area over and above that of the permanent staff employment. It is estimated that approximately 680 new
permanent service jobs will be created in the region of the State of Texas 2
surrounding the plant (Ref. 8.1-1). The net present life-of-plant value of Q340
the wages of these jobs amounts to $176.3 million or a levelized annual rate .12
of $18.5 million. 3

8.1.2.3 Value Added in Regional Production

The installation of the STP generating units will make available the power needed by regional manufacturing industry to provide for the production of
goods amounting to an estimated $3.3 billion of value added each year. The 3
determination of this value is described in Table 8.1-8.

8.1.2.4 Other Benefits

A visitors' center has been constructed at the site to provide the public with 3
information about the plant. The profile of the plant can be clearly seen
from the visitors' center and from relocated FM 521. The lowland habitat 3
between the reservoir and the Colorado River will remain in its present natural state.

TABLE 8.1-7

Estimate of Major STP Property Tax Payments by Jurisdiction

Houston Lighting & Power Company and Central Power & Light Company

Taxing Authority	1984	1985	1986	1987	1988	1989	1990 and after
Matagorda County:							
General Fund	$1,858,000	$ 2,630,000	$ 3,551,000	$ 4,506,000	$ 5,332,000	$ 5,625,000	$ 5,722,000
Navigation District No. 1	806,000	1,140,000	1,540,000	1,954,000	2,312,000	2,439,000	2,481,000
Palacios Seawall Commission	804,000	1,138,000	1,537,000	1,950,000	2,307,000	2,434,000	2,476,000
Hospital District	744,000	1,054,000	1,423,000	1,805,000	2,136,000	2,254,000	2,293,000
Special Ad Valorem (Road)	543,000	768,000	1,037,000	1,316,000	1,557,000	1,643,000	1,671,000
Drainage District No. 3	521,000	737,000	996,000	1,263,000	1,495,000	1,577,000	1,604,000
Palacios Independent School District	4,059,000	5,747,000	7,760,000	9,846,000	11,651,000	12,291,000	12,503,000
Estimated Total Taxes	$9,335,000	$13,214,000	$17,844,000	$22,640,000	$26,790,000	$28,263,000	$28,750,000

7

Assumptions:

(1) Taxes are estimated for each year from expected project balances as of December 31st of the preceding year. Payment of taxes will normally be at the end of January of the year following the tax year. (e.g., 1984 taxes are based on project expenditures through December 31, 1983 and will be paid at the end of January 1985.)

(2) Estimated taxes represent the combined amounts applicable to Houston Lighting & Power Company's 30.8% ownership interest and Central Power & Light Comapny's 25.[illegible] ownership interest. The remaining 44% of the South Texas Project is owned by tax exempt entities.

(3) The above estimates assume continuation of 1983 tax rates through the 1984-89 period (except for Palacios Seawall Commission, which was created during 1984, and will levy taxes at a statutory 10¢ per $100 tax rate). The South Texas Project's large annual additions to the listed jurisdictions' tax base would normally be expected to offer the opportunity for tax rate reductions. While the listed estimates may be overstated to the extent of future tax rate reductions, the amounts and timing of such rate reductions, if any, are not presently determinable.

(4) The estimates assume continuation of the valuation methodology currently being used.

TABLE 8.1-9

PROJECT VALUE AS A PERCENTAGE OF TOTAL TAXABLE VALUE
MAJOR STP JURISDICTIONS
1984

Jurisdiction	Jurisdiction's Total 1984 Taxable Value	South Texas Project (STP) 1984 Taxable Value[c]	STP Taxable Value as a Percentage of Total Taxable Value
Matagorda Country:			
General Fund	$2,489,826,816[a]	$803,895,360	32.3%
Hospital District	2,489,826,816[a]	803,895,360	32.3
Special Ad Valorem (Road)	2,489,826,816[a]	803,895,360	32.3
Navigation District No. 1	1,023,807,118[b]	803,246,240	78.5
Palacios Seawall Commission	1,023,807,118[b]	803,246,240	78.5
Drainage District No. 3	1,023,807,118[b]	803,246,240	78.5
Palacios Independent School District	1,183,547,839[b]	803,246,240	67.9

a Includes $26,000,000 estimate of unfinalized value for bank stock and shrimp boats.

b Includes $10,000,000 estimate of unfinalized value for bank stock and shrimp boats.

c Taxable values shown are the combined amount applicable to Houston Lighting & Power Company's 30.8% ownership interest and Central Power & Light Company's 25.2% ownership interest. The remaining 44% of the South Texas Project is owned by tax-exempt participants.

7

CHAPTER 9

ALTERNATIVE ENERGY SOURCES AND SITES

Alternative energy sources and sites were described in Chapter 9 of the Environment Report-Construction Permit Stage and were evaluated by the NRC during the Construction Permit review. The approved alternatives have been implemented. In accordance with 10CFR51.53, no discussion of alternative 7
energy sources and sites is required in the Environmental Report-Operating License stage.

CHAPTER 10

PLANT DESIGN ALTERNATIVES

Plant design alternatives were described in Chapter 10 of the Environmental Report-Construction Permit Stage and were evaluated by the NRC during the Construction Permit review. The approved alternatives have been implemented, therefore no updating of plant design alternatives is necessary. 7

CHAPTER 12

ENVIRONMENTAL APPROVALS AND CONSULTATION

12.1 INTRODUCTION

The purpose of this chapter is to identify and relate the status of those licenses, permits, or approvals which were obtained before and after construction of the South Texas Project (STP) commenced. It must be noted that because of the complexity of the project and the extent of data required to satisfy permit requirements, the majority of licenses were applied for following formal submission of an application to the Atomic Energy Commission in May, 1974, for a Construction Permit. Table 12.1-1 presents the status of various permits and licenses required for the completion of the South Texas Project.

TABLE 12.1-1

SOUTH TEXAS PROJECT LICENSES/PERMITS AND STATUS

Agency	Permit or Approval	Status	
Nuclear Regulatory Commission	Construction Permit	Issued December 22, 1975	
	Operating License	Pending	
Environmental Protection Agency	Permit for construction waste discharges	Issued April 13, 1976 Expired April 6, 1981	7
	Operational discharge permit	Issued June 12, 1977 Renewed December 20, 1982	7
	Approval for construction of auxiliary boiler	Issued January 16, 1980	3
U. S. Army Corps of Engineers	Permit for construction of the intake and discharge structures on the Colorado River	Issued July 30, 1975	
	Amendment of permit issued July 30, 1975, to enlarge barge slip area	Issued August 12, 1976	7
	Permit for installation of temporary cofferdam in navigable waters (Colorado River)	Issued April 12, 1976	
	Permit for maintenance dredging in river make-up pumping facility	Issued March 17, 1981	
	Permit for small boat ramp within the equipment barge slip	Issued November 17, 1981	
	Amendment of permit to perform maintenance dredging of the barge slips	Issued May 24, 1984	

TABLE 12.1-1 (Continued)

SOUTH TEXAS PROJECT LICENSES/PERMITS AND STATUS

Agency	Permit or Approval	Status	
Texas Water Rights Commission (now the Texas Department of Water Resources)	Permit for appropriation and diversion of water from the Colorado River	Issued February 24, 1976	
	Permit for construction of the reservoir and intake and discharge structures on the Colorado River	Issued February 24, 1976	7
	Contractual Permit recogninzing water supply contract between LCRA and HL&P dated January 1, 1976	Issued August 5, 1977	
Texas Water Quality Board (now the Texas Department of Water Resources)	Permits for construction and operational discharges of wastes (i.e., sanitary waste, metal cleaning waste, blowdown)	Issued April 22, 1975 Renewed September 2, 1980	3 7
	Permit for construction discharges from sanitary treatment facilities and dewatering waste	Issued April 22, 1975 Renewed September 2, 1980	
	Approval for solid waste disposal area	Approved July 1, 1976	7
	Section 401 FWPCA Certification	Granted August 16, 1976	7
	Registration as genertor of industrial solid waste	Registered August 16, 1976 Revised June 28, 1984	
Texas Highway Department	Approval necessary for rerouting of FM 521	Granted June 20, 1975	
Texas Air Control Board	Construction permit for solid waste incinerator (C-3924)	Issued January 2, 1976	
	Operating Permit for solid waste incinerator (R-3924)	Issued May 4, 1976	

TABLE 12.1-1 (Continued)

SOUTH TEXAS PROJECT LICENSES/PERMITS AND STATUS

Agency	Permit or Approval	Status	
Texas Air Control Board (Cont'd)	Construction Permit for concrete batch plant and main plant (C-3570)	Issued August 21, 1975	
	Operating Permit for concrete batch plant and main plant (R-3570)	Issued April 1, 1976	
	Construction Permit for soil-cement pugmills	Issued June 7, 1977	
	Operating Permit for soil-cement pugmills	Issued November 15, 1977	
	Construction permit for auxiliary boiler	Issued June 27, 1979	7
	Permit exemption for sandblasting (No.X-4014)	Issued February 19, 1983	3
Texas Parks & Wildlife	Permit for dredging and removal of material from state-owned river bottom	Issued June 18, 1975 Renewed annually until June 18, 1982 Expired June 18, 1982	7
Public Utility Commission	Certificate of Convenience and Necessity for transmission lines	Issued August 20, 1976 (to City Public Service Board of San Antonio, docket #59)	
	Certificate of Convenience and Necessity for transmission lines	Issued April 29, 1977 (to Houston Lighting & Power, docket #44)	3
	Certificate of Convenience and Necessity for transmission lines	Issued April 29, 1977 (to Central Power & Light of Corpus Christi, docket #44)	

12.2 AGENCY APPROVALS

12.2.1 FEDERAL AGENCY APPROVALS

Permits or approvals from the following federal authorities must be obtained before authorization is given for construction. These agencies were notified of the STP before all permits had been applied for.

12.2.1.1 Nuclear Regulatory Commission

The Nuclear Regulatory Commission (NRC), formerly the Atomic Energy Commission (AEC), is responsible for regulation of design as well as for the construction and operation of any nuclear power facility to be installed within the boundaries of the United States or possessions of the United States.

The procedure for environmental study is set forth in 10CFR51. Each applicant filing for an initial construction permit must submit its own Environmental Report (construction permit stage) to the Commission. This report presents the applicant's assessment of the environmental impact of the planned facility and possible alternatives which would alter the impact. The Commission receives the applicant's assessment and issues its own preliminary environmental impact statement. This statement is then circulated to other responsible agencies and made available to the general public. After comments are received from these sources, the Commission prepares a final environmental impact statement and makes a final recommendation on the utility's application for a construction permit.

When application is made for an operating license, the applicant updates the Environmental Report (ER) (contruction permit stage), noting any changes which have occurred since the original report. The utility then resubmits the updated construction permit ER to the Commission. Then, a new detailed statement is prepared by the Commission, and a final recommendation on the applicant's operating license is prepared. When all environmental and safety questions have been satisfactorily answered, the applicant is granted an operating license.

12.2.1.2 U. S. Army Corps of Engineers

The Corps of Engineers is responsible for issuance of the permits for construction of the intake and discharge structures on the Colorado River. The Corps of Engineers reviews construction permits in connection with installation of water intake and discharge structures (Federal Water Pollution Control Act of 1972, Section 404, and River and Harbor Act of 1899, Section 10, 33 USC 403) and coordinates its review with state agencies, the Environmental Protection Agency (EPA), and the Department of Interior, which advises the Corps on fish and wildlife questions pursuant to the Fish and Wildlife Coordinating Act.

12.2.1.3 Environmental Protection Agency

In October, 1972, Congress passed the Federal Water Pollution Control Act Amendments of 1972 (FWPCAA). The FWPCAA have consolidated the bulk of federal authority in the EPA. FWPCAA effectively requires that the EPA, through its administrator, be charged with enforcement of the Act, and set up national water quality and effluent standards. The FWPCAA also provides, under Title

VI, Permits and Licenses, that a system of permits for waste discharges will be administered by those states that have received EPA approval of their permit programs. At present, Texas maintains its own permitting authority through Sections 26.001 et seq., of the Texas Water Code. Pending any agreements with Texas to act in EPA's behalf, present and subsequent federal water standards as set forth under EPA authority will be complied with, in addition to state requirements.

12.2.1.4 Federal Aviation Administration

Notification to the Federal Aviation Administration (FAA) on construction of the STP containment building is required under the conditions stipulated in article 77.13 of the Federal Aviation Regulations. This notification was made by submission of FAA Form 7460-1, "Notice of Proposed Construction or Alteration."

12.2.2 TEXAS LICENSES, PERMITS, AND OTHER APPROVALS

The following state agencies require issuance of licenses and/or permits.

12.2.2.1 Texas Department of Water Resources

Effective September 1, 1977, jurisdiction previously held by the Texas Water Development Board (TWDB), the Texas Water Rights Commission (TWRC), and the Texas Water Quality Board (TWQB) is now vested in the Texas Department of Water Resources (TDWR) and its judicial branch, the Texas Water Commission (TWC). The TWDB now serves as the administrative arm of the Texas Department of Water Resources, and the TWQB no longer exists.

Section 5.121 of the Texas Water Code requires the issuance of a permit for the appropriation and diversion of waters from rivers or streams in Texas. A permit from the TWRC for appropriation and diversion of a maximum 102,000 acre-feet of water annually from the Colorado River for cooling lake makeup was issued on February 24, 1976.

The TWRC also gave its approval before construction began on the intake and discharge structures and on the reservoir. The application approved on February 24, 1976, gives authorization for the location of these facilities.

The Texas Water Code, Sections 26.001 et seq., is the major legislation relating to water quality in the streams, rivers, lakes, underground water, estuaries, etc., within the territorial limits of Texas. The Texas Department of Water Resources (TDWR) is charged with enforcement of the code and is the principal authority in the state on matters relating to water quality. A permit (construction phase - #01918, operating phase - #01908) for the discharge of sanitary, chemical, and cooling lake effluent was approved on April 22, 1975, by the TWQB. The TDWR is also the principal authority in the state on matters pertaining to industrial solid waste. 7

12.2.2.2 Lower Colorado River Authority

The Lower Colorado River Authority (LCRA), which holds rights in stored waters of the Colorado River above STP, has contracted to provide stored waters when "necessary for the normal operation of [STP]," thus providing insurance against having to shutdown STP due to extended low flow conditions in the

Colorado River. As required by state regulation and after hearing on the issues, a contractual permit based on this contract with the LCRA has been obtained from the Texas Water Rights Commission (TWRC), now the Texas Water Commission, the judicial branch of the Texas Department of Water Resources. The Attorney General of Texas appealed the decision of the TWRC in issuing this contractual permit. This appeal was dismissed by the State District Court considering same, and the appellate courts of this State affirmed the action of the District Court. 3

12.2.2.3 Texas Parks and Wildlife Department

The Texas Parks and Wildlife Department (TPWD) enforces the provisions of the Texas Water Code to the extent that aquatic life or wildlife is affected in violation of the code. TPWD permit 2005 was issued June 18, 1975, and authorizes dredging for a barge slip and material removal from a state-owned river bottom. This permit was renewed annually until the work was completed in 1981. 7

12.2.2.4 Texas Department of Health

The Texas Department of Health (TDH) investigates and makes recommendations concerning the health aspects of potable water quality matters and municipal solid waste disposal. The TDH exercises licensing authority over the use of source and special nuclear material used for calibration of nuclear equipment. 7

12.2.2.5 Texas Air Control Board

The Texas Air Control Board (TACB) issues permits for construction and operation of new facilities which may affect air quality pursuant to the Texas Clean Air Act, as amended (Article 4477-5, V.T.C.S.). A permit exemption exists for the emergency stand-by diesel power source. In addition, the TACB issues the construction permit for the auxiliary boilers. After construction, the TACB also issues the operating license. 7

12.2.3 LOCAL AGENCIES

The economic and social consequences of plant construction and operation have been studied by the Houston-Galveston Area Council. Various officials in Matagorda County have been briefed on the project in meetings which were conducted within the county. The local office of the Soil Conservation Service has been similarly briefed. Several other meetings have been conducted with interested citizen groups and professional societies to provide information concerning the project.

12.3 TRANSMISSION SYSTEM CONTROLS

There are at the present time no state or local laws or ordinances regulating the design, construction, or location of transmission systems. Except where more strict standards are required by Article 1436a of the Texas Statutes, the National Electrical Safety Code will be followed throughout the development of the transmission system. The only other authorizations to be obtained are as follows:

1. The railroad companies for easement and clearances of railroad tracks that will be crossed

2. The Corps of Engineers for river clearance of navigable streams that are traversed by transmission lines

3

REFERENCES

All references used in the STP Environmental Report--Operating License Stage are listed at the end of the individual sections in which they are referenced. 7

CHAPTER 14

SUMMARY OF ACTIONS TAKEN

This chapter describes the actions taken in fulfilling environmental requirements imposed by the Final Environmental Statement - Construction Permit (FES-CP) and the Atomic Safety Licensing Board (ASLB).

14.1 FES-CP ENVIRONMENTAL REQUIREMENTS

FES-CP environmental requirements are reflected in the STP Construction Permits (CPPR-128 & CPPR-129). These requirements and the actions taken to fulfill each of them are described in the following sections.

14.1.1 The Applicant shall take the necessary mitigating actions, including those summarized in Section 4.5 of the Final Environmental Statement, during construction of the facility and associated transmission lines to avoid unnecessary adverse environmental impacts from construction activities as clarified on page 1 of Staff Exhibit 3 (Final Environmental Statement Summary and Conclusion Changes) and further clarified by testimony of the Nuclear Regulatory Commission Staff.

Action: All necessary mitigating actions were taken and are documented as a part of the Environmental Protection Control Program (EPCP), (See Section 4.1.1.1).

14.1.2 7

The Applicant shall establish a control program which shall include written procedures and instructions to control all construction activities as prescribed herein and shall provide for periodic management audits to determine the adequacy of implementation of environmental conditions. The Applicant shall maintain sufficient records to furnish evidence of compliance with all the environmental conditions herein.

Action: HL&P implemented an Environmental Protection Control Program (EPCP) to monitor and document the status of compliance with FES commitments related to construction of the facility and associated transmission lines (see Section 4.1.1.1). Periodic management surveillance inspections are performed and records are maintained as evidence of compliance.

14.1.3

Before engaging in a construction activity not evaluated by the Commission, the Applicant will prepare and record an environmental evaluation of such activity. When the evaluation indicates that such activity may result in a significant adverse environmental impact that was not evaluated, or that is significantly greater then that evaluated in the Final Environmental Statement, the Applicant shall provide a written evaluation of such activities and obtain prior approval of the Director of Reactor Licensing for the activities.

Action: Several construction related activities not evaluated by the Commission in the FES have occurred after issuance of the Construction Permit and its amendment. Before engaging in each activity, the applicant prepared an assessment of environmental impact. These activities and the results of the assessments are summarized as follows:

1. Construction Workforce Increases

   The FES assessed the socioeconomic impacts of a peak workforce of 2100 in 1978-79. The projected workforce peaks were revised several times in conjunction with revised construction schedules. Prior to increasing the construction workforce levels, a comprehensive socioeconomic impact assessment was performed. These assessments indicated that these workforce increases would not result in a significant adverse environmental impact.

2. Modified transmission line routing

   After issuance of the Construction Permit, modifications to two transmission line routes were proposed. The applicant performed a comprehensive environmental impact assessment and concluded that these modified lines would have no significant adverse environmental impact. The modified routes and the environmental impact are described in ER-OL Sections 3.9 and 4.2.

3. HVDC facilities

   In compliance with a Federal Energy Regulatory Commission order, the
   southern terminal of a High Voltage Direct Current (HVDC) interconnection 7
   will be constructed on the STP site as described in ER-OL Section 2.1. In addition, a 345-kV transmission line approximately 2500 feet long connecting the HVDC terminal to the STP switchyard will also be constructed on the site. The applicant performed an environmental impact assessment and concluded that no significant adverse environmental impact is expected from this activity.

4. County road

   An environmental impact assessment of the construction and maintenance of an all-weather county road along the west boundary of the STP site was performed in September 1978. The road was proposed to provide property owners access to property south of the STP. The assessment concluded that the construction and maintenance of the county road would have no significant adverse environmental impact.

14.1.4

If unexpected harmful effects or evidence of irreversible damage is detected during facility construction, the Applicant shall provide to the Staff an acceptable analysis of the problem and a plan of action to eliminate or significantly reduce the harmful effects or damage.

Action: No unexpected harmful effects or evidence of irreversible damage have been detected during construction.

14.1.5

In addition to the preoperational monitoring program described in Section 6.1 of the Environmental Report, with amendments, the recommendations included in Section 6.1 of the Final Environmental Statement shall be followed. These monitoring programs shall include the following special studies:

(a) A study program, as outlined in Section 5.5.2.1.1 and 6.1.3.2 of the Final Environmental Statement, will be implemented to obtain data necessary to assess the potential significance of the loss of icthyoplankton and crustacean larvae through entrainment.

(b) A study program, as outlined in Section 6.1.3.2 of the Final Environmental Statement shall be implemented to obtain the data necessary to assess the value of Little Robbins Slough as a nursery. Construction activities shall be limited so as not to reduce the water shed area by more than approximately 1% (about 80 acres) to maintain the freshwater inflow to the slough until after December 1, 1975. After December 1, 1975, construction activities shall be performed so as to minimize watershed removal until completion of the study program.

Action: Special studies as outlined in FES Sections 5.5.2.1.1 and 6.1.3.2 have been completed or are ongoing.

14.1.6 7

The turbine building shall be designed to insure liquid releases are continuously monitored as specified in 10 CFR Part 50, Appendix A, Criterion No. 64.

Action: The design of the turbine building is described in the Final Safety Analysis Report (FSAR) Section 3.1.2.6.5.

14.2 ASLB ENVIRONMENTAL REQUIREMENTS

The ASLB did not impose requirements beyond those specified in the FES-CP and the Construction Permits described in Section 14.1 above.

Question 372.09

Section 6.2.4.2 states that "the environmental impact of the Cooling Reservoir will be verified by observing wind, temperature and relative humidity together with observations of fogging and icing at points around the reservoir." Identify the "points around the reservoir" where these measurements and observations will be made, the heights above ground for measurements and observations, and the instrumentation and data reduction procedures to be used.

Response

Section 6.2.4.2 has been deleted. As discussed in Section 5.1.5.1 of the STP Environmental Report-Construction Permit Stage (ER-CP), approximately a third of the land to be occupied by the STP cooling reservoir is currently used in rice farming each year and is therefore flooded from March through October. Thus, it is expected that the increase in low visibility fogging occurrences from the cooling reservoir will be minimal and localized to the immediate lake vicinity where only very lightly travelled transportation routes might be briefly affected. However, calculations were made using the CRFP fogging model with meteorology from Victoria which has been shown to be representative of the site. The CRFP model has been verified (see ER-CP Section 6.1.3.2.3) using data gathered from studies performed at Dresden Nuclear Power station in Illinois and Four Corners Power Plant in Arizona. 7

Because the assessment of measured fogging at the STP Site has been performed using a twice verified model, there are no plans to assess the on-site occurrence of fog prior to or after construction of the cooling reservoir by performing a comprehensive on-site study.

Terrestrial Ecology Question 6

What are the acreages for prime or unique farmlands remaining on the site?

Response

Prime farmland in the site area is comprised of the following soil series, as currently interpreted by the Soil Conservation Service (SCS) in accordance with criteria established by the U. S. Department of Agriculture:

a. 125-Asa silty clay loam, 0-1% slopes, rarely flooded;

b. 7A-Beaumont clay, 0-1% slopes (if drained);

c. 34A-Brazoria clay, shallow phase, 0-1% occasionally flooded;

d. 100A-Brazoria clay, 0-1% slopes occasionally flooded;

e. 100B-Brazoria clay, 1-3% slopes, rarely flooded:

f. 3A-Clemville silty clay loam, occasionally flooded;

g. 20A-Katy fine sandy loam, 0-1% slopes;

h. 20B-Katy fine sandy loam, 1-3% slopes; 7

i. 8A-Lake Charles clay, 0-1% slopes;

j. 44A-Norwood silty clay loam, 0-1% slopes rarely flooded;

k. 39 Norwood very fine sandy loam, occasionally flooded.

It is important to note that Unit 7A-Beaumont clay is prime only if drained. However, in as much as this unit was used extensively for rice production on the STP site prior to construction (i.e., making agricultural drainage necessary), that flood frequency studies on low lying soils such as Norwood, Brazoria and Clemville have not been conducted in Matagorda County. Therefore, it is possible that occasionally flooded units currently considered prime farmland soils could prove to be frequently flooded, thereby disqualifying them from prime farmland soil consideration.

See figure 2.7-8 for prime farmland soil located within the site boundary.

The site consists nominally of 12,300 acres, of which approximately 1,700 acres remain as a natural lowland habitat. Approximately 4,169 acres, not including the area occupied by the sedimentation pond or U. S. Army Corps of Engineers spoil area, of land on the site are considered prime farmlands. The cooling pond and the exclusion area make up approximately 2,900 acres, while the other 1,200 acres is comprised of the peripheral area.