Table 2.2A-17
cont'd

DIFFERENCES BETWEEN MEAN ZOOPLANKTON BIOMASS (mg/m^3)
ST. LUCIE PLANT

STATION COMPARISON - INTAKE AND DISCHARGE STATIONS, JANUARY-DECEMBER 1977		
Intake	Discharge	Difference
2.8	6.5	3.7*

YEAR COMPARISON - OFFSHORE STATIONS, 1976-1977[a]		
1976	1977	Difference
13.2	24.0	10.8*

DEPTH COMPARISON - OFFSHORE STATIONS, 1976-1977[a]		
Surface	Bottom	Difference
11.8	25.3	13.5*

[a]Analysis includes March, May, June, October, and November, 1976 and 1977.

*Significant at $\alpha = .05$.

Table 2.2A-17
cont'd

ANALYSIS OF VARIANCE FOR ZOOPLANKTON BIOMASS (mg/m^3)
ST. LUCIE PLANT
MARCH 1976 - DECEMBER 1977

Intake and Discharge Stations[a]				
Source	Degrees of freedom	Sum of Squares	Mean Square	F
Year (Y)	1	13.1890	13.18897	0.047
Month (M)	8	387.8169	48.47711	1.92
Station (S)	1	9.4557	9.45565	0.37
Y x M	8	437.6901	54.71126	2.17
Y x S	1	43.4940	43.49394	1.72
M x S	8	235.7218	29.46521	1.17
Error	8	169.2625	21.15781	
Total	35	1296.6300		

Offshore Stations[b]				
Source	Degrees of freedom	Sum of Squares	Mean Square	F
Year (Y)	1	3494.14	3494.143	8.35*
Month (M)	4	16272.06	4068.014	9.73*
Station (S)	5	8223.22	1644.644	3.98*
Depth (D)	1	5470.92	5470.922	13.08*
Y x M	4	4289.58	1072.394	2.56
Y x S	5	3707.31	741.463	1.77
Y x D	1	723.70	723.699	1.73
M x S	20	48668.23	2433.412	5.82*
M x D	4	1745.07	436.268	1.02
S x D	5	11528.24	2305.647	5.51*
Y x M x S	20	10113.11	505.655	1.21
Y x M x D	4	1408.60	352.150	0.84
Y x S x D	5	3460.86	692.172	1.66
M x S x D	20	51655.99	2582.799	6.18*
Error	20	8361.31	418.065	
Total	119	179122.06		

[a]Analysis includes March, May-December, 1976 and 1977.

[b]Analysis includes March, May, June, October, and November, 1976 and 1977.

*Significant at α = .05.

Table 2.2A-17
cont'd

STATISTICAL COMPARISON OF ZOOPLANKTON BIOMASS
OFFSHORE SURFACE
ST. LUCIE PLANT
JANUARY - NOVEMBER 1978

ANALYSIS OF VARIANCE: STATIONS

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	5	15778.94133939	3155.78826788
ERROR	60	112913.30970909	1881.88849515
CORRECTED TOTAL	65	128692.25104848	

SOURCE	DF	TYPE I SS	F VALUE	PR > F
STATION	5	15778.94133939	1.68	0.1530

DUNCAN'S MULTIPLE RANGE TEST: STATIONS

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

ALPHA LEVEL=.05 DF=60 MS=1881.89

GROUPING		MEAN	N	STATION
	A	53.209091	11	1
B	A	23.398182	11	5
B		14.188182	11	4
B		13.376364	11	2
B		10.145455	11	0
B		7.911818	11	3

Table 2.2A-17
cont'd

STATISTICAL COMPARISON OF ZOOPLANKTON BIOMASS
OFFSHORE BOTTOM
ST. LUCIE PLANT
JANUARY - NOVEMBER 1978

ANALYSIS OF VARIANCE: STATIONS

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	5	1843.69409091	368.73881818
ERROR	60	23040.43514545	384.00725242
CORRECTED TOTAL	65	24884.12923636	

SOURCE	DF	TYPE I SS	F VALUE	PR > F
STATION	5	1843.69409091	0.96	0.4503

DUNCAN'S MULTIPLE RANGE TEST: STATIONS

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

ALPHA LEVEL=.05 DF=60 MS=384.007

GROUPING	MEAN	N	STATION
A	29.927273	11	5
A	26.494545	11	1
A	25.434545	11	2
A	25.192727	11	4
A	24.470000	11	3
A	12.928182	11	0

Table 2.2A-18

SIMPLE CORRELATION COEFFICIENTS (r)
FOR ZOOPLANKTON ABUNDANCE AND BIOMASS VS. PHYSICAL PARAMETERS
OFFSHORE STATIONS (0-5)
ST. LUCIE PLANT
MARCH 1976 - DECEMBER 1977

Physical parameter	SURFACE Biomass (mg/m³)	SURFACE Undamaged (No./m³)	SURFACE Damaged (No./m³)	BOTTOM Biomass (mg/m³)	BOTTOM Undamaged (No./m³)	BOTTOM Damaged (No./m³)
Temperature	0.1836*	0.1767*	0.2400*	0.0872	0.1787*	0.2886*
Temperature²	0.1948*	0.1833*	0.2461*	0.0891	0.1958*	0.2808*
Salinity	0.0628	0.0408	-0.1220	-0.0285	0.0786	-0.0082
Salinity²	0.0624	0.0393	-0.1231	-0.0282	0.0778	-0.0104
Dissolved oxygen	-0.1567*	-0.0759	-0.2097*	-0.0440	-0.1710*	-0.2283*
Dissolved oxygen²	-0.1377	-0.0551	-0.1930*	-0.0325	-0.1293	-0.1988*

Table 2.2A-18
cont'd

ZOOPLANKTON CORRELATIONS OF LOG DENSITY AND BIOMASS VS PHYSICAL PARAMETERS
OFFSHORE SURFACE STATIONS
ST. LUCIE PLANT
JANUARY - NOVEMBER 1978

	Stations					
	0		1		2	
Parameter	Density	Biomass	Density	Biomass	Density	Biomass
DENSITY	1.00000[a]	0.65142	1.00000	0.34374	1.00000	0.74550
	0.0000[b]	0.0299	0.0000	0.3007	0.0000	0.0084
	11[c]	11	11	11	11	11
TEMP	0.70181	0.38232	0.43454	0.32276	0.69649	0.64853
	0.0161	0.2459	0.1817	0.3330	0.0173	0.0309
	11	11	11	11	11	11
SALINITY	0.20532	0.09705	0.01459	0.43297	0.04110	0.24923
	0.5693	0.7897	0.9681	0.2113	0.9102	0.4874
	10	10	10	10	10	10
DO	0.02581	-0.23956	-0.06135	-0.15876	-0.10984	-0.32677
	0.9516	0.5677	0.8853	0.7073	0.7957	0.4295
	8	8	8	8	8	8
BIOMASS	0.65142	1.00000	0.34374	1.00000	0.74550	1.00000
	0.0299	0.0000	0.3007	0.0000	0.0084	0.0000
	11	11	11	11	11	11

Table 2.2A-18

(continued)

ZOOPLANKTON CORRELATIONS OF LOG DENSITY AND BIOMASS VS PHYSICAL PARAMETERS
OFFSHORE SURFACE STATIONS
ST. LUCIE PLANT
JANUARY - NOVEMBER 1978

	Stations					
	3		4		5	
Parameter	Density	Biomass	Density	Biomass	Density	Biomass
DENSITY	1.00000	0.78041	1.00000	0.80800	1.00000	0.87154
	0.0000	0.0046	0.0000	0.0026	0.0000	0.0005
	11	11	11	11	11	11
TEMP	0.46951	0.51172	0.70584	0.48154	0.66961	0.54495
	0.1451	0.1076	0.0152	0.1337	0.0242	0.0830
	11	11	11	11	11	11
SALINITY	-0.34297	0.16587	0.32179	0.57277	0.14971	0.10412
	0.3319	0.6470	0.3646	0.0835	0.6798	0.7747
	10	10	10	10	10	10
DO	-0.16262	-0.46677	-0.13959	-0.22749	-0.33908	-0.29440
	0.7004	0.2436	0.7417	0.5879	0.4113	0.4791
	8	8	8	8	8	8
BIOMASS	0.78041	1.00000	0.80800	1.00000	0.87154	1.00000
	0.0046	0.0000	0.0026	0.0000	0.0005	0.0000
	11	11	11	11	11	11

[a] Correlation coefficient.

[b] Probability of a greater R value for the null hypothesis.

[c] Number of observations (n).

Table 2.2A-18
cont'd

ZOOPLANKTON CORRELATIONS OF LOG DENSITY AND BIOMASS VS PHYSICAL PARAMETERS
OFFSHORE BOTTOM STATIONS
ST. LUCIE PLANT
JANUARY - NOVEMBER 1978

	Stations					
	0		1		2	
Parameter	Density	Biomass	Density	Biomass	Density	Biomass
DENSITY	1.00000[a]	0.81178	1.00000	0.68284	1.00000	0.62338
	0.0000[b]	0.0024	0.0000	0.0206	0.0000	0.0404
	11[c]	11	11	11	11	11
TEMP	0.41637	0.51665	0.47668	0.13494	0.06490	0.47795
	0.2004	0.1037	0.1382	0.6924	0.8496	0.1370
	11	11	11	11	11	11
SALINITY	0.24529	0.61286	0.42307	0.26215	0.71706	0.41408
	0.4946	0.0596	0.2231	0.4644	0.0196	0.2342
	10	10	10	10	10	10
DO	-0.03846	-0.30192	-0.07122	-0.27050	-0.67243	-0.29542
	0.9280	0.4674	0.8669	0.5170	0.0677	0.4775
	8	8	8	8	8	8
BIOMASS	0.81178	1.00000	0.68284	1.00000	0.62338	1.00000
	0.0024	0.0000	0.0206	0.0000	0.0404	0.0000
	11	11	11	11	11	11

Table 2.2A-18
cont'd
ZOOPLANKTON CORRELATIONS OF LOG DENSITY AND BIOMASS VS PHYSICAL PARAMETERS
OFFSHORE BOTTOM STATIONS
ST. LUCIE PLANT
JANUARY - NOVEMBER 1978

	Stations					
	3		4		5	
Parameter	Density	Biomass	Density	Biomass	Density	Biomass
DENSITY	1.00000 0.0000 11	0.52400 0.0980 11	1.00000 0.0000 11	0.68903 0.0190 11	1.00000 0.0000 11	0.77307 0.0053 11
TEMP	0.56333 0.0711 11	0.14019 0.6810 11	0.25202 0.4547 11	0.04114 0.9044 11	0.61998 0.0559 10	0.75166 0.0122 10
SALINITY	0.18255 0.6137 10	0.06824 0.8514 10	0.39166 0.2630 10	0.25540 0.4764 10	0.63848 0.0469 10	0.33389 0.3457 10
DO	-0.80707 0.0155 8	-0.64573 0.0837 8	-0.41435 0.3074 8	-0.31094 0.4535 8	-0.74363 0.0344 8	-0.43340 0.2834 8
BIOMASS	0.52400 0.0980 11	1.00000 0.0000 11	0.68903 0.0190 11	1.00000 0.0000 11	0.77307 0.0053 11	1.00000 0.0000 11

[a]Correlation coefficient.

[b]Probability of a greater R value for the null hypothesis.

[c]Number of observations (n).

Table 2.2A-19

MULTIPLE REGRESSION ANALYSIS
OFFSHORE STATIONS (0-5)
ST. LUCIE PLANT
MARCH 1976 - DECEMBER 1977

SURFACE			
Dependent variables	Independent variables	R	R^2
Undamaged density	$Temperature^2$	0.18326	0.03358
	Salinity	0.19697	0.03880
	Temperature	0.20406	0.04164
	Dissolved oxygen	0.20567	0.04230
	Dissolved $oxygen^2$	0.32176	0.10353
Damaged density	$Temperature^2$	0.24606	0.06055
	Dissolved oxygen	0.27594	0.07614
	Dissolved $oxygen^2$	0.33490	0.11216
	Salinity	0.34980	0.12236
Biomass	$Temperature^2$	0.19481	0.03795
	Temperature	0.23104	0.05338
	Dissolved oxygen	0.24806	0.06153
	Dissolved $oxygen^2$	0.31854	0.10147
	$Salinity^2$	0.32556	0.10599

BOTTOM			
Dependent variables	Independent variables	R	R^2
Undamaged density	$Temperature^2$	0.19098	0.03647
	Temperature	0.23912	0.05718
	Dissolved oxygen	0.26083	0.06803
	Dissolved $oxygen^2$	0.27852	0.07757
	Salinity	0.28560	0.08157
Damaged density	$Temperature^2$	0.26027	0.06774
	Dissolved oxygen	0.29218	0.08537
	Dissolved $oxygen^2$	0.32457	0.10535
	$Salinity^2$	0.32783	0.10747
	Temperature	0.32834	0.10781
Biomass	Temperature	0.08720	0.00760
	Salinity	0.08884	0.00789
	$Temperature^2$	0.08929	0.00797

Table 2.2A-19
cont'd

ZOOPLANKTON DENSITY STEPWISE ANALYSIS
OFFSHORE STATIONS (0 through 5)
ST. LUCIE PLANT
JANUARY - NOVEMBER 1978

SURFACE

R SQUARE = 0.33908342

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	3	23.98417832	7.99472611	7.52	0.0004
ERROR	44	46.74820462	1.06245920	.	
TOTAL	47	70.73238294			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	16.92769275				
TEMP	0.23405657	0.05253204	21.09140182	19.85	0.0001
SALINITY	-0.42197538	0.35114575	1.53430484	1.44	0.2359
DO	-0.02268016	0.01060615	4.75309056	4.48	0.0399

BOTTOM

R SQUARE = 0.42235641

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	3	18.58367525	6.19455842	10.48	0.0001
ERROR	43	25.41630901	0.59107695		
TOTAL	46	43.99998427			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-24.28022802				
TEMP	0.16911871	0.04144340	9.84275278	16.65	0.0002
SALINITY	0.79198885	0.29739657	4.19139372	7.09	0.0109
DO	-0.01626301	0.01026448	1.48378863	2.51	0.1204

Table 2.2A-19
cont'd

ZOOPLANKTON BIOMASS STEPWISE ANALYSIS
OFFSHORE STATIONS (0 through 5)
ST. LUCIE PLANT
JANUARY - NOVEMBER 1978

SURFACE

R SQUARE = 0.17419201

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	3	21760.49234406	7253.49744802	3.09	0.0365
ERROR	44	103161.95782261	2344.58995051		
TOTAL	47	124922.45016667			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-1092.41064747				
TEMP	6.07456969	2.46775226	14206.75263817	6.06	0.0178
SALINITY	27.10463843	16.49547152	6330.33546526	2.70	0.1075
DO	-0.12895159	0.50763140	151.29457965	0.06	0.8037

BOTTOM

R SQUARE = 0.14413139

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	3	2867.53008852	962.51002951	2.41	0.0797
ERROR	43	17146.48279658	398.75541387		
TOTAL	46	20034.01289511			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-345.66560027				
TEMP	1.50731008	1.07643213	781.87710122	1.96	0.1686
SALINITY	9.41687225	7.72444407	592.63252692	1.49	0.2295
DO	-0.28908023	0.26660495	468.82036080	1.18	0.2843

Table 2.2A-20

MACROPHYTE SPECIES COLLECTED BY DREDGE AT OFFSHORE STATIONS
ST. LUCIE PLANT
1976

CHLOROPHYTA (green algae)
- *Batophora oerstedi*
- *Cladophora* sp.
- *Enteromorpha* sp.
- *Rhizoclonium* sp.

PHAEOPHYTA (brown algae)
- *Dictyota linearis*
- *Dictyota* sp.
- *Ectocarpus subcorymbosus*
- *Sargassum* spp.
- *Sphacelaria furcigera*
- *S. tribuloides*
- *Sphacelaria* sp.

RHODOPHYTA (red algae)
- *Agardhiella tenera*
- *Agardhiella* spp.
- *Botryocladia pyriformis*
- *Ceramium fastigiatum*
- *Ceramium* sp.
- *Laurencia* sp.
- *Gracillaria* sp.
- *Polysiphonia denudata*
- *P. sphaerocarpa*
- *P. subtilissima*
- *Porphyra umbilicalis*
- *Spermothamnion investiens*

Table 2.2A-20
cont'd

MACROPHYTE SPECIES COLLECTED BY DREDGE AT OFFSHORE STATIONS
ST. LUCIE PLANT
1977

CHLOROPHYTA (green algae)
Chaetomorpha sp.
Cladophora sp.
Cladophoropsis sp.
Codium decorticatum
C. isthmocladum
Halicystis sp.
Lyngbya sp.
Rhizoclonium sp.
Ulothrix sp.
Ulva lactuca

PHAEOPHYTA (brown algae)
Dictyota sp.
Dilophus guineensis
Ectocarpus rhodochortonoides
Sargassum sp.
Sphacelaria furcigera

RHODOPHYTA (red algae)
Acanthophora spicifera
Ceramium sp.
Chondria sp.
Eucheuma sp.
Gracilaria sp.
Grateloupia sp.
Halymenia sp.
Hypnea sp.
Laurencia sp.
Polysiphonia subtilissima
Polysiphonia sp.
Soliera sp.
Wrangelia sp.

Table 2.2A-20
cont'd

MACROPHYTE SPECIES COLLECTED AT OFFSHORE STATIONS
ST. LUCIE PLANT
1978

Species	March						June						September						November					
	Station																							
	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
CYANOPHYTA (blue-green algae)																								
Microcoleus lyngbyaceous		✓					✓	✓	✓		✓	✓		✓		✓		✓						
CHLOROPHYTA (green algae)																								
Caulerpa mexicana														✓										
C. prolifera								✓																
C. racemosa v. *laetevirens*								✓																
Chaetomorpha sp.								✓																
Cladophora fascicularis											✓													
Cladophora sp.								✓	✓	✓	✓		✓	✓	✓	✓	✓	✓						
Cladophoropsis membranacea							✓	✓						✓										
Codium decorticatum								✓																
Codium sp.															✓	✓								
Enteromorpha plumosa														✓										
Enteromorpha sp.		✓						✓					✓											
PHAEOPHYTA (brown algae)																								
Dictyopteris delicatula							✓	✓						✓						✓				
D. plagiogramma														✓										
Dictyopteris sp.								✓			✓	✓							✓					
Dictyota bartayresii														✓										
D. ciliolata							✓							✓										
D. dichotoma							✓						✓	✓			✓	✓						
D. divaricata														✓										
Dictyota sp.							✓		✓	✓			✓	✓	✓	✓	✓	✓						
Ectocarpus sp.															✓									
Giffordia indica															✓									
G. mitchelliae							✓				✓			✓	✓	✓	✓	✓						
Giffordia sp.										✓	✓		✓	✓		✓	✓							
Lobophora variegata																			✓					
Padina vickersiae								✓																
Rosenvingea intricata											✓		✓	✓	✓	✓	✓	✓						
Sargassum spp.								✓			✓			✓	✓				✓	✓				
Spatoglossum schroederi							✓	✓	✓		✓		✓		✓									
Sphacelaria furcigera											✓				✓		✓	✓						
RHODOPHYTA (red algae)																								
Acanthophora muscoides								✓					✓	✓										
Amphiroa fragilissima							✓	✓																
Amphiroa sp.								✓																
Antithamnion elegans													✓											
Botryocladia occidentalis														✓					✓					
B. pyriformis							✓																	
Bryocladia cuspidata								✓					✓											
Bryothamnion seaforthii							✓	✓											✓	✓				
B. triquetrum																			✓					
Callithamnion byssoides													✓	✓										
Callithamnion sp.														✓										
Centroceras clavulatum								✓																
Ceramium codii								✓																
C. fastigatum								✓	✓		✓					✓								
Ceramium spp.							✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓					
Champia parvula								✓					✓	✓										
Chondria spp.							✓	✓	✓		✓		✓	✓	✓	✓	✓							
Colpomenia sinuosa							✓																	
Cryptarachne sp.							✓																	
Dasya spp.							✓	✓			✓		✓	✓	✓									
Euchema isiforme							✓												✓					
Gigartina acicularis								✓				✓												
Gracilaria foliifera									✓	✓	✓				✓		✓		✓					
G. verrucosa							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓					
Gracilaria spp.								✓					✓	✓	✓	✓	✓							

Table 2.2A-20
cont'd

MACROPHYTE SPECIES COLLECTED AT OFFSHORE STATIONS
ST. LUCIE PLANT
1978

	March						June						September						November					
	Station																							
Species	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
RHODOPHYTA (red algae) (continued)																								
Griffithsia tenuis													✓	✓	✓									
Grinnellia americana											✓													
Halymenia floresia													✓	✓	✓									
Halymenia sp.							✓	✓			✓		✓	✓	✓									
Herposiphonia pecten-veneris v. *laxa*																			✓					
Hypnea cervicornis							✓	✓	✓				✓	✓	✓									
H. cornuta								✓																
H. musciformis							✓	✓		✓				✓	✓		✓		✓					
Jania capillacea								✓																
J. rubens							✓	✓																
Jania sp.		✓										✓	✓	✓										
Kallymenia perforata							✓						✓	✓	✓									
Laurencia papillosa								✓																
Laurencia sp.																			✓					
Nitophyllum sp.											✓			✓										
Polysiphonia denudata											✓		✓	✓	✓		✓	✓						
Polysiphonia spp.							✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓						
Pterocladia americana							✓	✓						✓	✓									
Scinaia complanata											✓		✓		✓		✓							
Solieria tenera							✓	✓					✓	✓	✓			✓						
Spermothamnion investiens v. *cidaricola*																✓								
Spermothamnion sp.																			✓					
Spyridia aculeata									✓		✓													
S. clavata											✓													
S. filamentosa															✓									
Spyridia sp.								✓	✓					✓										

Table 2.2A-21

BENTHIC GRAB MACROINVERTEBRATE AND STATISTICAL DATA BY STATION AND QUARTER
OFFSHORE STATIONS
ST. LUCIE PLANT
1976-1977

		Station and year															
		0		1		2		3		4		5		Mean		Mean (excluding Sta. 0)	
Parameter	Qtr.	1976	1977	1976	1977	1976	1977	1976	1977	1976	1977	1976	1977	1976	1977	1976	1977
No. of taxa	1	96	56	8	51	94	152	14	33	91	91	125	152	71.3	89.2	66.4	95.8
	2	125	38	16	34	127	143	33	38	111	118	92	155	84.3	87.7	76.2	97.6
	3	147	40	34	35	132	141	45	50	117	118	107	158	97.0	90.2	87.0	100.2
	4	104	21	38	20	101	111	37	27	94	92	110	144	80.7	69.2	76.0	78.8
	Total	260	109	75	99	249	259	84	84	219	203	236	303				
	Mean	118.0	38.7	24.5	34.[illegible]	113.5	136.7	32.3	37.0	103.3	104.7	108.5	152.2				
Density (individuals/m²)	1	12042	4483	225	1933	10500	23917	817	858	3817	3817	8275	19425	6779	9072	5743	9990
	2	19292	3100	300	725	18308	14100	1892	2217	9350	9433	14825	17033	10661	7768	8935	8702
	3	14658	950	642	833	24150	14525	3458	6300	22892	12383	11983	17592	12964	8764	12625	10327
	4	10267	575	1058	425	11600	9017	1392	1008	7908	6733	12900	15800	7519	5593	6972	6597
		56259	9108	2225	3916	64558	61559	7559	10383	48967	32366	47983	69850				
		14065	2277	556	979	16140	15390	1890	2596	12242	8091	11996	17463				
Mean number of individuals per sample	1	482±146	179±110	9± 3	77±42	420±163	957±106	33±15	34±12	353±157	153± 17	331± 66	777±440				
	2	772±299	124± 71	12± 8	29± 6	732±432	564± 77	76±53	89±14	374±102	118± 42	593±175	681±188				
	3	586±246	38± 8	26±15	33± 8	966±267	581±218	138±69	252±42	916±181	495±100	479± 59	704±201				
	4	411±112	23± 7	42±11	17± 6	464± 69	361± 49	56± 8	40±13	316±110	269± 45	516±105	632±365				
	Total[a]	6751	1093	267	470	7747	7387	907	1246	5876	3884	5758	8382				

Table 2.2A-21
cont'd
BENTHIC GRAB MACROINVERTEBRATE AND STATISTICAL DATA BY STATION AND QUARTER
OFFSHORE STATIONS
ST. LUCIE PLANT
1976-1977

		Station and year															
		0		1		2		3		4		5		Mean		Mean (excluding Sta. 0)	
Parameter	Qtr.	1976	1977	1976	1977	1976	1977	1976	1977	1976	1977	1976	1977	1976	1977	1976	1977
Biomass (g/m^2)	1	97.303	5.100	2.585	1.610	25.36[illegible]	15.465	2.083	1.233	3.453	0.795	7.460	17.695	23.041	7.150	8.189	7.560
	2	11.985	0.718	3.815	5.795	8.643	9.178	2.240	16.548	10.558	7.800	5.953	13.335	7.199	8.896	6.242	10.531
	3	2.880	7.060	0.995	13.400	9.273	14.100	1.975	4.105	2.643	19.000	6.498	16.220	4.044	12.314	4.277	13.365
	4	10.910	2.620	1.865	1.120	6.080	7.460	1.765	5.320	3.695	1.090	3.200	227.475	4.586	40.847	3.321	48.493
	Total	123.078	15.498	9.260	21.925	[illegible]	47.203	8.063	27.206	20.349	28.68[illegible]	23.110	247.725				
	Mean	30.769	3.875	2.315	5.482	12.[illegible]	11.8[illegible]	2.016	6.802	5.087	7.17[illegible]	5.777	68.681				
Diversity ($\bar{d}$)	1	4.160	3.50[illegible]	1.553	4.80[illegible]	4.21[illegible]	5.5[illegible]	3.025	4.345	4.161	5.464	5.311	5.397	3.705	4.840	3.608	5.107
	2	4.400	3.017	3.636	4.48[illegible]	4.522	5.29[illegible]	3.184	3.360	4.690	5.109	4.244	5.622	4.113	4.479	4.055	4.772
	3	5.389	4.47[illegible]	4.423	4.208	4.74[illegible]	5.22[illegible]	2.694	2.602	4.842	5.146	5.058	5.510	4.526	4.529	4.353	4.539
	4	5.336	3.650	4.388	3.648	4.511	4.5[illegible]	4.316	3.585	5.036	4.13[illegible]	4.284	5.428	4.645	4.185	4.507	4.292
	$\bar{d}$/year	5.561	4.471	5.127	5.612	4.973	5.536	3.838	3.636	5.279	5.505	5.287	6.205				
	Mean	4.821	3.661	3.500	4.286	4.500	5.177	3.305	3.473	4.683	4.963	4.674	5.489				
Equitability (e)	1	0.273	0.29[illegible]	0.464	0.817	0.291	0.[illegible]54	0.819	0.907	0.288	0.728	0.413	0.415	0.425	0.602	0.454	0.664
	2	0.249	0.299	0.997	0.970	0.267	0.410	0.391	0.386	0.347	0.437	0.303	0.477	0.426	0.497	0.461	0.536
	3	0.421	0.824	0.931	0.798	0.302	0.395	0.199	0.167	0.365	0.448	0.465	0.433	0.447	0.511	0.452	0.449
	4	0.582	0.864	0.813	0.355	0.334	0.339	0.793	0.641	0.521	0.279	0.261	0.448	0.551	0.488	0.544	0.412
	e/year	0.273	0.301	0.696	0.742	0.188	0.332	0.247	0.214	0.264	0.336	0.248	0.365				
	Mean	0.385	0.569	0.801	0.735	0.299	0.400	0.551	0.525	0.380	0.473	0.361	0.443				

[a]Total number of individuals collected at Station for year.

Table 2.2A-21
cont'd

BENTHIC GRAB MACROINVERTEBRATE AND STATISTICAL DATA BY STATION AND QUARTER, OFFSHORE STATIONS
ST. LUCIE PLANT
1978

Parameter	Qtr	0	1	2	3	4	5	Mean	Mean (excluding Station 0)
No. of taxa	1	28	21	98	28	107	131	68.8	77.0
	2	31	28	179	50	136	173	99.5	113.2
	3	17	32	173	56	139	181	99.7	116.2
	4	32	21	113	28	124	1[illegible]7	74.2	82.6
	Total	80	72	257	94	231	269	170.5	188.6
	Mean	27	25	141	41	127	1[illegible]3		
Density (individuals/m²)	1	791	433	5,989	991	6,356	9,9[illegible]3	4,087	4,746
	2	1,749	666	35,378	2,291	15,052	27,556	13,782	16,189
	3	400	891	22,907	9,171	17,208	27,5[illegible]1	13,026	15,552
	4	666	475	13,686	866	15,186	14,0[illegible]6	7,486	8,850
	Total	3,606	2,465	77,960	13,319	53,802	79,[illegible]6	38,381	45,337
	Mean	901	616	19,490	3,330	13,451	19,7[illegible]4		
Mean number of individuals per sample	1	32±8	17±5	240±50	40±6	254±100	399±135		
	2	70±43	23±7	1,416±218	92±34	602±200	1,103±170		
	3	16±4	36±9	917±196	367±247	689±220	1,104±513		
	4	27±17	19±7	548±98	35±18	608±118	562±[illegible]4		
	Total[a]	433	296	9,359	1,599	6,459	9,5[illegible]0		
Biomass (g/m²)	1	1.735	2.860	13.010	33.240	4.820	5.770	10.239	11.940
	2	6.285	0.565	10.572	6.389	6.023	15.684	15.920	17.847
	3	0.178	0.252	151.656	4.284	12.050	16.445	30.811	36.937
	4	0.647	0.575	6.550	2.881	8.430	4.487	3.918	4.573
	Total	8.845	4.192	181.788	46.794	31.323	42.386		
	Mean	2.211	1.048	45.447	11.699	7.831	13.097		
Diversity ($\bar{d}$)	1	3.980	3.750	5.150	3.920	5.060	5.537	4.566	4.683
	2	3.420	4.130	5.600	4.530	5.580	5.811	4.845	5.130
	3	3.160	4.147	5.695	1.985	5.787	5.597	4.395	4.642
	4	4.395	3.69[illegible]	4.769	3.971	4.876	4.378	4.348	4.338
	$\bar{d}$/year	4.723	4.9[illegible]1	5.938	3.266	5.884	6.028		
	Mean[b]	3.740	3.931	5.304	3.602	5.326	5.331		

Table 2.2A-21
cont'd

BENTHIC GRAB MACROINVERTEBRATE AND STATISTICAL DATA BY STATION AND QUARTER, OFFSHORE STATIONS
ST. LUCIE PLANT
1978

Parameter	Qtr	0	1	2	3	4	5	Mean	Mean (excluding Station 0)
Equitability (e)	1	0.823	0.929	0.541	0.788	0.465	0.532	0.680	0.651
	2	0.495	0.917	0.407	0.683	0.528	0.486	0.586	0.604
	3	0.745	0.812	0.450	0.093	0.598	0.402	0.517	0.471
	4	0.970	0.894	0.358	0.817	0.352	0.241	0.605	0.532
	e/year	0.490	0.631	0.230	0.146	0.385	0.341		
	Mean	0.758	0.888	0.439	0.595	0.486	0.415		

[a]Total number of individuals collected at station for the year.

[b]Diversity ($\bar{d}$) values greater than 3 generally indicate unpolluted water (EPA, 1973).

Table 2.2A-22

NUMERICAL METHODS

RAREFACTION DIVERSITY (Sanders, 1968)

The rarefaction method of graphically calculating species diversity was formulated to directly compare samples of different sizes. The usual difficulty inherent in such a comparison is that, as the sample size increases, individuals are added at a constant arithmetic rate but species accumulate at a decreasing logarithmic rate. The rarefaction method is dependent on the shape of the species abundance curve rather than on the absolute number of specimens per sample. The procedure is to keep the percentage composition of the component species constant with that of a hypothetical sample of 1000 individuals while reducing the sample size, i.e., to artificially create the results that would have been obtained had smaller samples with identical faunal composition been taken. With this technique, the expected number of species in any size sample can be determined.

THE SPEARMAN PEAK CORRELATIONS [r_s] (Siegel, 1956)

In this test "N" individuals are ranked according to two variables. If the ranking of the independent variables is denoted as X_1, X_2, X_3, ..., X_n and the ranking of the dependent variables is represented by Y_1, Y_2, Y_3, ..., Y_n, a measure of rank correlation may be used to determine the relationship between the X's and the Y's.

Table 2.2A-22
cont'd

$$d_i = X_i - Y_i$$

indicates the disparity between the two sets of rankings.

$$r_s = 1 - \frac{6 \sum_{i=1}^{N} d_i^2}{N^3 - N}$$

is used if no tied rankings are present. When a considerable number of ties are present, the following formula is used:

$$r_s = \frac{\Sigma x^2 + \Sigma y^2 - \Sigma d^2}{2\sqrt{\Sigma x^2 y^2}}$$

where: $\Sigma x^2 = \frac{N^3 - N}{12} - \Sigma T_x$

$\Sigma y^2 = \frac{N^3 - N}{12} - \Sigma T_y$

and $T = \frac{t^3 - t}{12}$

Where t = the number of observations tied at a given rank. Critical values of significance (P=0.05) have been determined for various N (See Siegel, 1956, Table P of Appendix).

DOMINANCE-DIVERSITY CURVES (Whittaker, 1965)

In order to examine the relative abundances of the taxa at each station, all taxa were ranked by abundance and the ranks were then plotted against the log of the number of individuals represented by each rank. A steeply sloping curve indicates a high degree of dominance by a few species, while a gently sloping curve indicates a more equitable distribution of abundances among taxa.

SPECIES SATURATION CURVES (Gaufin et al., 1956)

Gaufin et al. (1956) presented a method for calculating the best average curve based on all possible combinations of randomized replicates. An estimate can be made of the average probability (P_k) of finding a species in the kth set of a set of $k \leq n$ samples, but in no previous sample, given that it has occurred in the total set of n samples, using the formula:

$$P_k = \sum_{i=1}^{n-k+1} \left[\frac{C^i_{n-k+1} \; (i)}{C^i_n \; (n-k+1)}\right] \left[\frac{S_i}{S}\right]$$

where S_i is the number of different species appearing in i out of n samples, S is the total number of species observed, and C is a coefficient derived from the combinatorial formula:

$$C^k_n = n!/k!(n-k)!$$

The coefficient must first be multiplied by a constant defined by:

$$n!/(k-1)!(n-k)!$$

which varies with k.

McCLOSKEY'S (1970) INDEX OF FAUNAL DOMINANCE

This index ranks each species taken in a series of samples to determine the most dominant species. Use of this index disregards sample size. The species in each sample are ranked for dominance by

Table 2.2A-22
cont'd

their "biological index value" (BIV), which is obtained by giving 10 points to the species which numerically dominates that sample, 9 for each second dominant species, and so on. The "scores" of each species in the series of samples are then added to determine the total biological index value. The species having the highest total BIV is then the species of primary dominance.

THE MANN-WHITNEY U-TEST (Elliott, 1971)

This is a non-parametric alternative to the t-test for comparing differences in two sample means. The null hypothesis is that there is no difference between sample means from two independent random samples drawn from populations having the same parent distribution.

The test statistics are calculated as follows:

$$U_1 = n_1 n_2 + \frac{n_2(n_2 + 1)}{2} - R_2$$

$$U_2 = n_1 n_2 + \frac{n_1(n_1 + 1)}{2} - R_1$$

where n_1 = number of elements in sample 1 and n_2 = number of elements in sample 2. Data are pooled and ranked by order of magnitude, so that the lowest ranking element receives a value of 1. If any ranks are equal, they are given the average of the tied ranks. R_1 and R_2 are the sum of ranks in samples 1 and 2, respectively. The smaller

Table 2.2A-22
cont'd

of the two U values is compared to the appropriate value of U in a table of U-statistic values at the desired level of significance.

THE KRUSKAL-WALLIS TEST (Sokal and Rohlf, 1969)

This is another non-parametric test that is used for determining differences in means between several samples, not necessarily of equal size. The null hypothesis is that all samples come from the same population and therefore there is no difference between sample means. The test statistic is computed as follows:

$$H = \frac{12}{(\sum^{a} n_i)(\sum^{a} n_i + 1)} \cdot \frac{\sum^{a} (\sum^{n_i} R)^2 i^2}{n_i} - 3\,(\sum^{a} n_i + 1)$$

where n_i equals the number of items in group i. Counts are again pooled and ranked in order of magnitude and an average given for tied ranks. The sum of the ranks equals $(\sum^{n_i} R)_i$. An adjustment for tied ranks is calculated as follows:

$$D = 1 - \frac{\sum^{m} T_j}{(\sum^{a} n_i - 1)\sum^{a} n_i (\sum^{a} n_i + 1)}$$

where T_j is a function of t_j, the number of variations in the j^{th} group of ties.

$$T_j = (t_j^3 - t_j)$$

$$\text{Adjusted } H = \frac{H}{D}$$

The adjusted H value is compared to $\chi^2(a-1)$ tables at the desired level of significance.

Table 2.2A-22
cont'd

DIVERSITY AND EQUITABILITY

Diversity indices are an additional tool for measuring the quality of the environment and the effect of induced stress on the structure of a community of macroinvertebrates. Their use is based on the generally observed phenomenon that undisturbed environments support communities having large numbers of species with no individual species represented in overwhelming abundance (EPA, 1973). Many forms of stress tend to reduce diversity by making the environment unsuitable for some species or by giving other species a competitive advantage.

The Shannon-Weaver index of diversity ($\overline{d}$) (Lloyd, Zar, and Karr, 1968) calculates mean diversity and is recommended by the EPA (1973):

$$\overline{d} = \frac{C}{N} (N \log_{10} N - \Sigma n_i \log_{10} n_i)$$

where: C = 3.321928 (converts base 10 log to base 2)

N = total number of individuals

n_i = total number of individuals of the i^{th} species.

Mean diversity as calculated above is affected both by the number of species and the distribution of individuals among the species. The value may range from 0 to 3.321928 $\log_{10} n$.

To evaluate the component of diversity due to the distribution of individuals among the species (equitability), the calculated $\overline{d}$ is compared with a hypothetical maximum $\overline{d}$ based on a maximum species distribution obtained from MacArthur's "broken stick" model (Lloyd and Ghelardi, 1964). The MacArthur model results in distribution quite frequently observed in nature: one with a few abundant species and increasing numbers of species represented by only a few individuals. Sample data are not expected to conform to the MacArthur model, since it is only being used as a measure against which the distribution of abundances is compared. Equitability values may range from zero to one, except in rare cases where the distribution in the sample is more equitable than that in the MacArthur model.

Equitability is computed by: $e = \frac{s^i}{s}$

where: s = number of taxa in the sample

s^i = hypothetical maximum number of taxa in the sample based on a table devised by Lloyd and Ghelardi (1964)

MORISITA'S (1959) INDEX OF COMMUNITY SIMILARITY: $C\lambda$

This index is used with semi-quantitative data such as trawl samples. It compares two samples by taking into account the abundances of common species, total abundances in each sample, and their respective diversities.

Table 2.2A-22
cont'd

Morisita's index is based on Simpson's index of diversity (λ):

$$\lambda = \frac{\Sigma n_i(n_i-1)}{N(N-1)}$$

where: N = total number of individuals

n_i = importance value (abundance, biomass, etc.) of the i^{th} species.

Using subscripts 1 and 2, the λ values of two samples may be differentiated:

$$\lambda_1 = \frac{\Sigma n_{i1}(n_{i1}-1)}{N_1(N_1-1)} \quad \text{and} \quad \lambda_2 = \frac{\Sigma n_{i2}(n_{i2}-1)}{N_2(N_2-1)}$$

Morisita's index of similarity between communities may then be calculated by the following formula:

$$C\lambda = \frac{2\Sigma n_{i1}n_{i2}}{(\lambda_1+\lambda_2)N_1N_2}$$

This index is almost uninfluenced by the sizes of N_1 and N_2. The value of $C\lambda$ will approach unity when samples demonstrate similarity in species abundance and diversity. Conversely, as $C\lambda$ approaches zero, the samples will have fewer species in common, which suggests that the samples have been drawn from dissimilar habitats.

Table 2.2A-23

TOP-RANKED[a] DOMINANT TAXA OF BENTHIC MACROINVERTEBRATES
FROM GRAB SAMPLES AT SIX OFFSHORE STATIONS
ST. LUCIE PLANT
1976-1978

	Station and year																	
	0			1			2			3			4			5		
Taxa	1976	1977	1978	1976	1977	1978	1976	1977	1978	1976	1977	1978	1976	1977	1978	1976	1977	1978
PLATYHELMINTHES									10						7			
NEMERTINA	10	1	1	1	1	1	4	2	2		4	3	8	3	2	5	3	2
ANNELIDA																		
Apoprionospio dayi					8	2												
Armandia agilis		5	7															
Axiothella mucosa																	7	
Brania wellfleetensis											5							
Exogene dispar	2																4	3
Filogranula sp.	1						1	4	3	10			1	2	3	1	1	1
Goniada littorea		8				3												
Goniadides carolinae	3				7		6	5					6	4	8	2		
Hemipodus roseus				8														
Loimia medusa	7																	
Lumbrineris cruzensis						9												
Macrochaeta sp.								8						10				
Marionina sp.													9	5				
Mediomastus californiensis		2			10		10	9									2	8
Oligochaeta spp.							7						7			4		
Parapionosyllis longicirrata									5		10	10						7
Peloscolex sp. C													10					
Poecilochaetus johnsoni															10			

Table 2.2A-23
cont'd
TOP-RANKED[a] DOMINANT TAXA OF BENTHIC MACROINVERTEBRATES
FROM GRAB SAMPLES AT SIX OFFSHORE STATIONS
ST. LUCIE PLANT
1976-1978

	Station and year																	
	0			1			2			3			4			5		
Taxa	1976	1977	1978	1976	1977	1978	1976	1977	1978	1976	1977	1978	1976	1977	1978	1976	1977	1978
ANNELIDA (continued)																		
Polycirrus eximius								10										
Polygordius sp.	9																	
Prionospio cristata	6			3			8											
Eunice vittata																		9
MOLLUSCA																		
Ischnochiton hartmeyeri								6										
I. papillosus								3	4					6				
Macoma brevifrons												8						
Olivella floralia					3													
Tellina iris			2	4	2	6												
ARTHROPODA																		
Balanus trigonus									9									
B. venustus													5					
Cyclaspus pustula ?		9			6	8												
C. varians		3			5													
Eurydice littoralis				7						8	8	7						
Melita sp. A									8									
Microcerberus sp. A																10		
Oxyurostylis smithi		4																
Protohaustorius sp. A										7	6							
Pseudoplatyishnopus sp. A		6	3	5		4												
Synchelidium americanum		7	4		9	5												

Table 2.2A-23
cont'd

TOP-RANKED[a] DOMINANT TAXA OF BENTHIC MACROINVERTEBRATES
FROM GRAB SAMPLES AT SIX OFFSHORE STATIONS
ST. LUCIE PLANT
1976-1978

	Station and year																	
	0			1			2			3			4			5		
Taxa	1976	1977	1978	1976	1977	1978	1976	1977	1978	1976	1977	1978	1976	1977	1978	1976	1977	1978
ARTHROPODA (continued)																		
Trichophoxus sp. A										4								
Trichophoxus sp. B			5															
PUNCULIDA	5		8	2	4		2	1	1				2	1	1	3	6	5
HORONIDA																		10
ECHINODERMATA																		
Amphiodia pulchella																	10	
Clypeasteroida										6	9	9						
Mellitidae sp.						7												
Ophiuroidea													4					
CEPHALOCHORDATA																		
Branchiostoma caribaeum				6						3								

[a]Ranked according to McCloskey (1970) biological index values.

Table 2.2A-23
cont'd

TOP-RANKED[a] DOMINANT TAXA OF BENTHIC INVERTEBRATES
FROM TRAWL SAMPLES AT SIX OFFSHORE STATIONS
ST. LUCIE PLANT
1976-1978

Station	Species	1976	1977	1978
0	*Trachypenaeus constrictus*	1	1	1
	Crepidula fornicata	2		
	Mellita quinquiesperforata	3	2	
	Anomia simplex	3		
	Portunus spinimanus	4		
	Trachypenaeus sp.		3	2
	Turbo castanea		4	
	Loligo plei		5	
	Leptochela serratorbita			5
	Periclimenes longicaudatus			3
	Processa hemphilli			4
1	*Trachypenaeus constrictus*	1	1	1
	Sicyonia dorsalis	2		
	Leptochela serratorbita	3	4	4
	Mellita quinquiesperforata	4		
	Squilla neglecta	5		
	Periclimenes longicaudatus		2	3
	Loligo plei		3	
	Trachypenaeus sp.		5	2
	Portunus spinimanus			5
2	*Crepidula fornicata*	1	3	
	Trachypenaeus constrictus	2	2	1
	Anomia simplex	3		
	Portunus spinimanus	4	5	3
	Processa hemphilli	5		5
	Periclimenes longicaudatus		1	2
	Loligo plei		4	
	Trachypenaeus sp.			4

Table 2.2A-23
cont'd

TOP-RANKED[a] DOMINANT TAXA OF BENTHIC INVERTEBRATES
FROM TRAWL SAMPLES AT SIX OFFSHORE STATIONS
ST. LUCIE PLANT
1976-1978

Station	Species	1976	1977	1978
3	*Trachypenaeus constrictus*	1	1	1
	Trachypeneopsis mobilispinis	2	2	3
	Portunus anceps	3		
	Leptochela serratorbita	4	4	
	Encope michelini	5		
	Periclimenes longicaudatus		3	5
	Processa sp. A		5	2
	Mellita quinquiesperforata			4
4	*Mellita quinquiesperforata*	1	1	1
	Trachypenaeus constrictus	2	5	3
	Chaetopleura apiculata	3		
	Portunus spinimanus	4		5
	Anomia simplex	5		
	Periclimenes longicaudatus		2	2
	Turbo castanea		3	
	Loligo plei		4	
	Processa hemphilli			5
	Metapenaeopsis goodei			4
5	*Crepidula fornicata*	1		
	Trachypenaeus constrictus	2		1
	Turbo castanea	3	2	
	Anomia simplex	4		
	Portunus spinimanus	5		3
	Lytechinus variegatus		1	2
	Chaetopleura apiculata		3	
	Arbacia punctulata		4	
	Chione grus		5	
	Periclimenes longicaudatus			4
	Metapenaeopsis goodei			5

[a]Ranked according to McCloskey (1970) biological index values.

Table 2.2A-24

KRUSKAL-WALLIS AND SNK COMPARISONS OF GRAB REPLICATE
DATA BETWEEN 1976, 1977, AND 1978
ST. LUCIE PLANT

Paramater	Year	Station 0	1	2	3	4	5
Grab efficiency	1976-77	*decrease	*decrease	NS[a]	NS	NS	*decrease
	1977-78	*decrease	NS	NS	NS	NS	NS
	1976-78	*decrease	*decrease	NS	NS	NS	*decrease
Number of taxa	1976-77	*decrease	NS	NS	NS	NS	*increase
	1977-78	*decrease	NS	NS	NS	*increase	NS
	1976-78	*decrease	NS	*increase	NS	*increase	*increase
Number of individuals	1976-77	*decrease	NS	NS	NS	NS	*increase
	1977-78	*decrease	NS	NS	NS	NS	NS
	1976-78	*decrease	NS	NS	NS	NS	*increase

[a]NS = Not significant.
*Significant correlation (p=0.05).

Table 2.2A-25

SPEARMAN RANK CORRELATIONS (r_s) FOR VARIOUS COMBINATIONS OF NUMBER OF TAXA, DENSITY AND WATER TEMPERATURE
OFFSHORE STATIONS
ST. LUCIE PLANT
1976 - 1978

Station	Taxa vs. Temperature	Density vs. Temperature	Density vs. Biomass	Taxa vs. Density
0 (n=8)	NS[a]	NS	NS	**
1 (n=12)	NS	NS	NS	**
2 (n=12)	*	*	NS	**
3 (n=12)	**	**	NS	**
4 (n=12)	**	**	*	**
5 (n=12)	NS	NS	**	**
All Stations (excl. Sta. 0)(n=12)	*	**	NS	**

[a]NS = Not significant
*Significant correlation (p=0.05).
**Highly significant correlation (p=0.01).

Table 2.2A-26

SCIENTIFIC AND COMMON NAMES OF FISHES
COLLECTED IN THE VICINITY OF THE ST. LUCIE PLANT
1976

ORDER SQUALIFORMES

Orectolobidae-carpet sharks

Ginglymostoma cirratum	nurse shark

Carcharhinidae-requiem sharks

Carcharhinus maculipinnis	spinner shark
Rhizoprionodon terraenovae	Atlantic sharpnose shark

Sphyrnidae-hammerhead sharks

Sphyrna lewini	scalloped hammerhead
S. mokarran[a]	great hammerhead
S. tiburo	bonnethead

ORDER RAJIFORMES

Torpedinidae-electric rays

Narcine brasiliensis	lesser electric ray

Dasyatidae-stingrays

Gymnura micrura	smooth butterfly ray

Myliobatidae-eagle rays

Rhinoptera bonasus	cownose ray

Mobulidae-mantas

Manta birostris	Atlantic manta

ORDER ELOPIFORMES

Elopidae-tarpons

Elops saurus	ladyfish
Megalops atlantica[a]	tarpon

Table 2.2A-26
cont'd

SCIENTIFIC AND COMMON NAMES OF FISHES
COLLECTED IN THE VICINITY OF THE ST. LUCIE PLANT
1976

ORDER ANGUILLIFORMES

Congridae-conger eels

Ariosoma impressa	bandtooth conger

Ophichthidae-snake eels

Bascanichthys terres	sooty eel
Myrophis punctatus	speckled worm eel
Mystriophis intertinctus	spotted spoon-nose eel
Ophichthus ocellatus	palespotted eel

ORDER CLUPEIFORMES

Clupeidae-herrings

Brevoortia smithi	yellowfin menhaden
B. tyrannus	Atlantic menhaden
B. smithi x tyrannus	menhaden (hybrid)
Harengula pensacolae	scaled sardine
Opisthonema oglinum	Atlantic thread herring
Sardinella anchovia	Spanish sardine

Engraulidae-anchovies

Anchoa cubana	Cuban anchovy
A. hepsetus	striped anchovy
A. lamprotaenia	bigeye anchovy
A. mitchilli	bay anchovy
A. nasuta	longnose anchovy
Anchoviella perfasciata	flat anchovy
Engraulis eurystole	silver anchovy

ORDER MYCTOPHIFORMES

Synodontidae-lizardfishes

Synodus foetens	inshore lizardfish
Trachinocephalus myops	snakefish

Table 2.2A-26
cont'd
SCIENTIFIC AND COMMON NAMES OF FISHES
COLLECTED IN THE VICINITY OF THE ST. LUCIE PLANT
1976

ORDER SILURIFORMES	
Ariidae-sea catfishes	
Arius felis	sea catfish
Bagre marinus	gafftopsail catfish
ORDER BATRACHOIDIFORMES	
Batrachoididae-toadfishes	
Porichthys porosissimus	Atlantic midshipman
ORDER LOPHIIFORMES	
Antennariidae-frogfishes	
Histrio histrio	sargassumfish
Ogcocephalidae-batfishes	
Ogcocephalus sp.	batfish
ORDER GADIFORMES	
Ophidiidae-cusk-eels	
Lepophidion sp.	cusk-eel
Ophidion holbrooki	bank cusk-eel
Oophidium omostigmum	polka-dot cusk-eel
ORDER GASTEROSTEIFORMES	
Fistulariidae-cornetfishes	
Fistularia tabacaria	bluespotted cornetfish

Table 2.2A-26
cont'd
SCIENTIFIC AND COMMON NAMES OF FISHES
COLLECTED IN THE VICINITY OF THE ST. LUCIE PLANT
1976

ORDER GASTEROSTEIFORMES
(continued)

Syngnathidae-pipefishes and seahorses	
Hippocampus erectus	lined seahorse
Oostethus lineatus	opossum pipefish
Syngnathus louisianae	chain pipefish
S. pelagicus	sargassum pipefish
S. springeri	bull pipefish

ORDER PERCIFORMES

Centropomidae-snooks	
Centropomus undecimalis	snook
Serranidae-sea basses	
Centropristis philadelphica	rock sea bass
C. striata	black sea bass
Diplectrum bivittatum	dwarf sand perch
D. formosum	sand perch
Epinephelus itajara	jewfish
E. morio	red grouper
Hypoplectrus sp.	hamlet
Mycteroperca bonaci	black grouper
Serraniculus pumilio	pygmy sea bass
Serranus baldwini	lantern bass
Grammistidae-soapfishes	
Rypticus saponaceus	greater soapfish
R. subbifrenatus	spotted soapfish
Priacanthidae-bigeyes	
Pristigenys alta	short bigeye

Table 2.2A-26
cont'd

SCIENTIFIC AND COMMON NAMES OF FISHES
COLLECTED IN THE VICINITY OF THE ST. LUCIE PLANT
1976

ORDER PERCIFORMES
(continued)

Apogonidae-cardinalfishes	
Apogon binotatus	barred cardinalfish
A. pseudomaculatus	twospot cardinalfish
Astrapogon alutus	bronze cardinalfish
A. puncticulatus	blackfin cardinalfish
Phaeoptyx pigmentaria	dusky cardinalfish
Pomatomidae-bluefishes	
Pomatomus saltatrix	bluefish
Rachycentridae-cobias	
Rachycentron canadum	cobia
Echeneidae-remoras	
Echeneis naucrates	sharksucker
Carangidae-jacks and pompanos	
Alectis crinitus	African pompano
Caranx bartholomaei	yellow jack
C. crysos	blue runner
C. hippos	crevalle jack
C. latus	horse-eye jack
Chloroscombrus chrysurus	Atlantic bumper
Selar crumenophthalmus	bigeye scad
Selene vomer	lookdown
Seriola dumerili	greater amberjack
S. zonata	banded rudderfish
Trachinotus carolinus	Florida pompano
T. goodei	palometa
Vomer setapinnis	Atlantic moonfish
Lutjanidae-snappers	
Lutjanus analis	mutton snapper
L. griseus	gray snapper
L. synagris	lane snapper
Rhomboplites aurorubens	vermilion snapper
Lobotidae-tripletails	
Lobotes surinamensis	tripletail

Table 2.2A-26
cont'd

SCIENTIFIC AND COMMON NAMES OF FISHES
COLLECTED IN THE VICINITY OF THE ST. LUCIE PLANT
1976

ORDER PERCIFORMES
(continued)

Gerreidae-mojarras	
Diapterus olisthostomus	Irish pompano
D. plumieri	striped mojarra
Eucinostomus argenteus	spotfin mojarra
E. gula	silver jenny
Gerres cinereus	yellowfin mojarra
Pomadasyidae-grunts	
Anisotremus surinamensis	black margate
A. virginicus	porkfish
Haemulon aurolineatum	tomtate
H. chrysargyreum	smallmouth grunt
H. flavolineatum	French grunt
H. parrai	sailors choice
H. plumieri	white grunt
H. sciurus	bluestriped grunt
Orthopristis chrysoptera	pigfish
Sparidae-porgies	
Archosargus probatocephalus	sheepshead
A. rhomboidalis	sea bream
Calamus bajonado	jolthead porgy
Diplodus argenteus	silver porgy
Lagodon rhomboides	pinfish
Sciaenidae-drums	
Bairdiella chrysura	silver perch
B. sanctaeluciae	striped croaker
Cynoscion nothus	silver seatrout
C. regalis	weakfish
Equetus acuminatus	high-hat
Larimus fasciatus	banded drum
Leiostomus xanthurus	spot
Menticirrhus americanus	southern kingfish
M. littoralis	Gulf kingfish
Micropogon undulatus	Atlantic croaker
Odontoscion dentex	reef croaker
Pogonias cromis	black drum
Sciaenops ocellata	red drum
Umbrina coroides	sand drum

Table 2.2A-26
cont'd
SCIENTIFIC AND COMMON NAMES OF FISHES
COLLECTED IN THE VICINITY OF THE ST. LUCIE PLANT
1976

ORDER PERCIFORMES
(continued)

Ephippidae-spadefishes	
Chaetodipterus faber	Atlantic spadefish
Scaridae-parrotfishes	
Cryptotomus roseus	bluelip parrotfish
Sparisoma sp.	parrotfish
Mugilidae-mullets	
Mugil cephalus	striped mullet
M. curema	white mullet
Sphyraenidae-barracudas	
Sphyraena barracuda	great barracuda
S. borealis	northern sennet
S. guachancho	guaguanche
Polynemidae-threadfins	
Polydactylus virginicus	barbu
Opistognathidae-jawfishes	
Opistognathus sp.	jawfish
Dactyloscopidae-sand stargazers	
Dactyloscopus crossotus	bigeye stargazer
Uranoscopidae-stargazers	
Astroscopus y-graecum	southern stargazer
Clinidae-clinids	
Labrisomus nuchipinnis	hairy blenny
Blenniidae-blennies	
Blennius marmoreus	seaweed blenny
Hypleurochilus aequipinnis	oyster blenny
H. bermudensis	barred blenny

Table 2.2A-26
cont'd
SCIENTIFIC AND COMMON NAMES OF FISHES
COLLECTED IN THE VICINITY OF THE ST. LUCIE PLANT
1976

ORDER PERCIFORMES
(continued)

Gobiidae-gobies	
Bathygobius sp.	goby
Gobiosoma ginsburgi	seaboard goby
Lophogobius cyprinoides	crested goby
Microgobius sp.	goby
Acanthuridae-surgeonfishes	
Acanthurus chirurgus	doctorfish
Trichiuridae-cutlassfishes	
Trichiurus lepturus	Atlantic cutlassfish
Scombridae-mackerels and tunas	
Auxis thazard	frigate mackerel
Euthynnus alletteratus	little tunny
Scomberomorus cavalla	king mackerel
S. maculatus	Spanish mackerel
S. regalis	cero
Stromateidae-butterfishes	
Peprilus paru	harvestfish
P. triacanthus	butterfish
Scorpaenidae-scorpionfishes	
Scorpaena brasiliensis	barbfish
S. grandicornis	plumed scorpionfish
S. plumieri	spotted scorpionfish
Triglidae-searobins	
Prionotus carolinus	northern searobin
P. evolans	striped searobin
P. roseus	bluespotted searobin
P. scitulus	leopard searobin
P. tribulus	bighead searobin
Dactylopteridae-flying gurnards	
Dactylopterus volitans	flying gurnard

Table 2.2A-26
cont'd
SCIENTIFIC AND COMMON NAMES OF FISHES
COLLECTED IN THE VICINITY OF THE ST. LUCIE PLANT
1976

ORDER PLEURONECTIFORMES	
Bothidae-lefteye flounders	
Ancylopsetta quadrocellata	ocellated flounder
Bothus ocellatus	eyed flounder
B. robinsi	flounder
Citharichthys macrops	spotted whiff
C. spilopterus	bay whiff
Paralichthys albigutta	Gulf flounder
P. lethostigma	southern flounder
P. squamilentis	broad flounder
Syacium gunteri	shoal flounder
S. micrurum	channel flounder
S. papillosum	dusky flounder
Soleidae-soles	
Achirus lineatus	lined sole
Gymnachirus melas	naked sole
Cynoglossidae-tonguefishes	
Symphurus civitatus	offshore tonguefish
S. diomedianus	spottedfin tonguefish
S. plagiusa	blackcheek tonguefish
ORDER TETRAODONTIFORMES	
Balistidae-triggerfishes and filefishes	
Aluterus monoceros	unicorn filefish
A. schoepfi[a]	orange filefish
Balistes capriscus	gray triggerfish
Cantherhines pullus	orangespotted filefish
Monacanthus hispidus	planehead filefish
Ostraciidae-boxfishes	
Lactophrys quadricornis	scrawled cowfish
L. trigonus	trunkfish

Table 2.2A-26
cont'd
SCIENTIFIC AND COMMON NAMES OF FISHES
COLLECTED IN THE VICINITY OF THE ST. LUCIE PLANT
1976

ORDER TETRAODONTIFORMES (continued)	
Tetraodontidae-puffers	
Sphoeroides nephelus	southern puffer
S. spengleri	bandtail puffer
Diodontidae-porcupinefishes	
Diodon holocanthus	balloonfish

[a] observational record

Table 2.2A-26
cont'd

SCIENTIFIC AND COMMON NAMES OF FISHES COLLECTED IN THE VICINITY OF THE ST. LUCIE PLANT DURING 1978 WHICH HAD NOT PREVIOUSLY BEEN FOUND BY APPLIED BIOLOGY, INC.[a]

	ORDER RAJIFORMES
	Dasyatidae-stingrays
Dasyatis centroura	roughtail stingray
	ORDER CLUPEIFORMES
	Clupeidae-herrings
Etrumeus teres	round herring
	ORDER BATRACHOIDIFORMES
	Batrachoididae-toadfishes
Opsanus pardus	leopard toadfish
Porichthys plectrodon[b]	Atlantic midshipman
	ORDER LOPHIIFORMES
	Antennariidae-frogfishes
Antennarius scaber	splitlure frogfish
	ORDER ATHERINIFORMES
	Poeciliidae-livebearers
Poecilia latipinna	sailfin molly
	ORDER PERCIFORMES
	Serranidae-sea basses
Serranus subligarius	belted sandfish
	Echeneidae-remoras
Remora remora	remora

Table 2.2A-26
cont'd

SCIENTIFIC AND COMMON NAMES OF FISHES COLLECTED IN THE VICINITY OF THE ST. LUCIE PLANT DURING 1978 WHICH HAD NOT PREVIOUSLY BEEN FOUND BY APPLIED BIOLOGY, INC.[a]

ORDER PERCIFORMES	
Carangidae-jacks and pompanos	
Caranx ruber	bar jack
Uraspis secunda	cottonmouth jack
Lutjanidae-snappers	
Lutjanus apodus	schoolmaster
Sparidae-porgies	
Calamus bajonado	whitebone porgy
Sciaenidae-drums	
Menticirrhus saxatilis	northern kingfish
Stellifer lanceolatus	star drum
Chaetodontidae-butterflyfishes	
Holacanthus bermudenis[c]	blue angelfish
Opistognathidae-jawfishes	
Opistognathus whitehursti	dusky jawfish
Clinidae-clinids	
Labrisomus gobio	palehead goby
Gobiidae-gobies	
Nes longus	orangespotted goby
Acanthuridae-surgeonfishes	
Acanthurus bahianus	ocean surgeon
Scorpaenidae-scorpionfishes	
Scorpaena calcarata[d]	smoothhead scorpionfish
ORDER PLEURONECTIFORMES	
Bothidae-lefteye flounders	
Cyclopsetta fimbriata	spotfin flounder
Etropus rimosus	gray flounder

Table 2.2A-26
cont'd
SCIENTIFIC AND COMMON NAMES OF FISHES COLLECTED IN THE VICINITY OF THE ST. LUCIE PLANT DURING 1978 WHICH HAD NOT PREVIOUSLY BEEN FOUND BY APPLIED BIOLOGY, INC.[a]

ORDER TETRAODONTIFORMES	
Balistidae-triggerfishes and filefishes	
Balistes vetula	queen triggerfish
Tetraodontidae-puffers	
Lagocephalus laevigatus	smooth puffer

[a]This list is supplemental to Appendix Table J-1A. Scientific and common names of fishes collected in the vicinity of the St. Lucie Plant, December 1975 - December 1977 (ABI, 1978).

[b]Changed from *P. porosissimus* in Appendix Table J-1A (ABI, 1978).

[c]Observational record.

[d]Misidentified as *S. albifimbria* in Appendix Table J-1A (ABI, 1978).

Table 2.2A-27

NUMBER OF INDIVIDUALS AND PERCENTAGE COMPOSITION OF FISHES
BY STATION COLLECTED DURING BEACH SEINING
ST. LUCIE PLANT
1976 - 1978

Year	Parameter	Station 6	Station 7	Station 8	Total
1976[a]	Number of individuals	679	169	363	1211
	Percentage composition	56.1	13.9	30.0	100.0
1977[b]	Number of individuals	476	220	123	819
	Percentage composition	58.1	26.9	15.0	100.0
1978[b]	Number of individuals	302	549	352	1203
	Percentage composition	25.1	45.6	29.3	100.0
Total	Number of individuals	1457	938	838	3233
	Percentage composition	45.1	29.0	25.9	100.0

[a] 10 months sampled.

[b] 12 months sampled.

Table 2.2A-27
cont'd

NUMBER OF INDIVIDUALS AND PERCENTAGE COMPOSITION OF FISHES
BY TAXON COLLECTED DURING BEACH SEINING
ST. LUCIE BEACH
1976-1978

Taxon	1976[a]		1977[b]		1978[b]	
	Number of individuals	Percentage composition	Number of individuals	Percentage composition	Number of individuals	Percentage composition
herring	510	42.1	171	20.9	340	28.3
mojarra	8	0.7	81	9.9	280	23.3
sand drum	105	8.7	173	21.1	194	16.1
kingfish	108	8.9	172	21.0	172	14.3
spot	101	8.3	0	0.0	147	12.2
Florida pompano	43	3.6	22	2.7	27	2.2
Atlantic bumper	28	2.3	44	5.4	1	0.1
other jacks	73	6.0	42	5.1	23	1.9
anchovy	159	13.1	60	7.3	0	0.0
other fish	76	6.3	54	6.6	19	1.6
Total fish	1211	100.0	819	100.0	1203	100.0

[a]Total of 10 sampling periods.

[b]Total of 12 sampling periods.

Table 2.2A-27

cont'd

TOTAL NUMBER OF SHELLFISHES AND FISHES COLLECTED BY BEACH SEINE
(COMBINATION OF THREE REPLICATES PER STATION PER MONTH), ST. LUCIE
MARCH-DECEMBER 1976

	29 MAR			12 APR			10 MAY			11 JUN			7 JUL			25 AUG			8 SEP			OCT(1 NOV)[a]			16 NOV			20 DEC		
	Station			Station			Station			Station			Station			Station			Station			Station			Station			Station		
Species	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8
speckled crab	1				1	2				12	3	1	9	2	1	1	17	6		6		3	1	4		2				3
other crabs										1						1	1													
herring							1	1	1			17	486												1	1	2			
anchovy												152	7																	
Atlantic bumper		9	1									1				4	3	1	8	1										
Florida pompano			2						1	4	1	1	1	6	3				10	8	1			3			1	1		
other jacks			5		5		1	6		2	1	2	39	2			2								2	3	2	1		
kingfish		1	4	5	1	2	8	6	22	6	2	3	4	17	1				2	5	9				2		2			6
sand drum			1			1	21			4	4	2	25	3	1	1	21	1	3	7	10									
spot																			18	9	71								3	
sea catfish										1	4	1		1		2	7				2						1			1
porgy		11														1					2									
sennet													1		14															
other fishes		2	1				1	2		3	4	1	2	4	5			1	1	5							2		1	
total fishes	0	23	14	5	6	3	32	15	24	20	16	180	565	33	24	8	33	3	42	35	95	0	0	3	5	4	10	2	4	7

[a] Delayed due to inclement weather.

Table 2.2A-27
cont'd

TOTAL NUMBER OF SHELLFISH AND FISHES COLLECTED BY BEACH SEINE[a]
ST. LUCIE PLANT
1977

Taxon	Date and station																				
	7 Jan			17 Feb			18 Mar			29 Apr			16 May			16 Jun			27 Jul		
	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8
speckled crab			1														2	3	3	1	1
sand drum							1			6	5	1	1	1	3	60	4	1	12	7	
kingfish	2					2	1			12	1		7	2	3			2	7	20	
herring						1								2		13	1		11	35	38
mojarra										1						3					8
anchovy										2	12					46					
Atlantic bumper																					
Florida pompano						1							1	4		5	2		1		
other jacks														1		1					
other fish				2						15	3					1	1		2		
TOTAL FISH	2	0	0	2	0	4	2	0	0	36	21	1	9	10	6	129	8	3	33	62	46

[a] Combination of three replicates per station per month.

Table 2.2A-27
cont'd
TOTAL NUMBER OF SHELLFISH AND FISHES COLLECTED BY BEACH SEINE[a]
ST. LUCIE PLANT
1977

	Date and station																			
	26 Aug			23 Sep			27 Oct			9 Nov			15 Dec			Total/station			Total by	%
Taxon	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	taxon	composition
speckled crab	3			1	1		1	3	1				2	2		10	9	6	25	100.0
sand drum	9	11	2	35	4	1	8							1		132	33	8	173	21.1
kingfish	29	12		14	10		27	7	2	2	1		4	2	3	105	55	12	172	21.0
herring	69							1								93	39	39	171	20.9
mojarra				9	31	24							4		1	17	31	33	81	9.9
anchovy																48	12	0	60	7.3
Atlantic bumper										12			32			44	0	0	44	5.4
Florida pompano			1					3	3		1					7	10	5	22	2.7
other jacks	2		2		23	2	2	5			2	1			1	5	31	6	42	5.1
other fish	1		15	3				3	3	1		1		2	1	25	9	20	54	6.6
TOTAL FISH	110	23	20	61	68	27	37	19	8	15	4	2	40	5	6	476	220	123	819	100.0

[a] Combination of three replicates per station per month.

Table 2.2A-27
cont'd

TOTAL NUMBER OF INDIVIDUALS AND PERCENTAGE COMPOSITION
BY TAXON OF FISHES COLLECTED BY BEACH SEINE
ST. LUCIE PLANT
1976-1977

Taxon	1976[a] No. of individuals	1976[a] % composition	1977[b] No. of individuals	1977[b] % composition
sand drum	105	8.7	173	21.1
kingfish	108	8.9	172	21.0
spot	101	8.3	0	0.0
herring	510	42.1	171	20.9
mojarra	8	0.7	81	9.9
anchovy	159	13.1	60	7.3
Atlantic bumper	28	2.3	44	5.4
Florida pompano	43	3.6	22	2.7
other jacks	73	6.0	42	5.1
other fish	76	6.3	54	6.6
TOTAL FISH	1,211	100.0	819	100.0

[a] Total of 10 sampling periods.
[b] Total of 12 sampling periods.

Table 2.2A-27
cont'd

NUMBER OF FISHES COLLECTED BY BEACH SEINING
(COMBINATION OF 3 REPLICATES PER STATION PER MONTH)
ST. LUCIE PLANT
1978

Taxon	Date and station																				
	Jan (1 Feb)			24 Feb			10 Mar			18 Apr			30 May			30 Jun			28 Jul		
	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8
speckled crab	1			1			1				1	1			3						1
herring								1								73		3	41	108	112
mojarra																3				271	6
sand drum							1										5	3	101	19	15
kingfish	2			2			3	1			1		9		2		1	2	8	33	9
spot																			3	6	137
Florida pompano		2			2	1	1		1								6	2		3	3
other jacks								5					2				1			3	2
other fish	1	1							1				8		2						
Total fish	3	3	0	2	2	1	5	7	2	0	1	0	19	0	4	76	13	10	153	443	284

Taxon	Date and station															Total by station			Total by taxon	Percentage composition
	18 Aug			29 Sep			Oct (6 Nov)			27 Nov			Dec (8 Jan)							
	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8		
speckled crab	4			4	7	21	1	2	3			2		1		12	11	31	54	-
herring				1		1										115	109	116	340	28.3
mojarra																3	271	6	280	23.3
sand drum	1	16	31		1	1										103	41	50	194	16.1
kingfish	24	52	6		2	5	3		2		1	1	2	1		53	92	27	172	14.3
spot			1													3	6	138	147	12.2
Florida pompano		1		1	1	1	1						1			4	15	8	27	2.2
other jacks		1		6		1	1						1			10	10	3	23	1.9
other fish				1				2		1	1			1	1	11	5	4	20	1.7
Total fish	25	70	38	9	4	9	5	2	2	1	2	1	4	2	1	302	549	352	1203	100.0

Table 2.2A-27
cont'd

NUMBER OF INDIVIDUALS, SIZE AND PERCENTAGE COMPOSITION
OF FISHES COLLECTED BY BEACH SEINING
ST. LUCIE PLANT
1978

Species	Number of individuals	Range of standard lengths (mm)	Total weight (g)	Percentage composition	
				Number of individuals	Total weight
speckled crab	54	28-154	2370	-	-
scaled sardine	221	64-147	2097	18.4	5.7
sand drum	194	36-130	2422	16.1	6.5
gulf kingfish	169	23-298	3614	14.0	9.8
silver jenny	167	53-112	1775	13.9	4.8
spot	147	132-176	13884	12.2	37.5
spotfin mojarra	112	63-95	1529	9.3	4.1
Atlantic thread herring	51	63-94	450	4.2	1.2
sardine (*Harengula* sp.)	45	77-87	446	3.7	1.2
Florida pompano	27	23-214	1504	2.2	4.1
Spanish sardine	23	71-110	176	1.9	0.5
palometa	9	70-181	375	0.7	1.0
permit	9	18-164	503	0.7	1.4
sea bream	9	214-238	4336	0.7	11.7
blue runner	2	75-89	100	0.2	0.3
southern kingfish	2	219-250	446	0.2	1.2
sea catfish	2	142-149	95	0.2	0.2
black drum	2	176-180	294	0.2	0.8
crevalle jack	2	146-174	188	0.2	0.4
northern kingfish	1	114	22	0.1	0.1
barbu	1	104	24	0.1	0.1
silver porgy	1	207	347	0.1	0.9
ladyfish	1	298	247	0.1	0.7
snook	1	432	1302	0.1	3.5
lookdown	1	234	392	0.1	1.1
Atlantic bumper	1	167	81	0.1	0.2
striped burrfish	1	116	118	0.1	0.3
Atlantic spadefish	1	109	78	0.1	0.2
Irish pompano	1	181	196	0.1	0.5
Total fish	1203	-	37,041	100.0	100.0

Table 2.2A-28

NUMBER OF INDIVIDUALS AND PERCENTAGE COMPOSITION OF FISHES
BY STATION COLLECTED DURING OFFSHORE GILL NETTING
ST. LUCIE PLANT
1976-1978

Year	Parameter	Station						Total
		0	1	2	3	4	5	
1976	Number of individuals	532	814	116	70	62	140	1734
	Percentage composition	30.7	46.9	6.7	4.0	3.6	8.1	100.0
1977	Number of individuals	305	351	304	10	55	198	1223
	Percentage composition	24.9	28.7	24.9	0.8	4.5	16.2	100.0
1978	Number of individuals	372	215	123	24	36	104	874
	Percentage composition	42.6	24.6	14.1	2.7	4.1	11.9	100.0
Total	Number of individuals	1209	1380	543	104	153	442	3831
	Percentage composition	31.6	36.0	14.2	2.7	4.0	11.5	100.0

Table 2.2A-29

NUMBER OF INDIVIDUALS AND PERCENTAGE COMPOSITION OF FISHES
BY TAXON COLLECTED DURING TRAWLING
ST. LUCIE PLANT
1976-1978

Taxon	1976[a]		1977[b]		1978[b]	
	Number of individuals	Percentage composition	Number of individuals	Percentage composition	Number of individuals	Percentage composition
anchovy	18	2.7	22	1.1	459	18.3
flatfish[c]	129	19.6	220	10.7	302	12.0
searobin, scorpionfish	129	19.6	170	8.3	293	11.7
grunt	61	9.3	178	8.7	263	10.5
cusk-eel	72	11.0	47	2.3	202	8.0
seatrout	0	0.0	606	29.6	176	7.0
other croakers	13	2.0	250	12.2	114	4.5
mojarra	26	4.0	139	6.8	83	3.3
sand perch	86	13.1	141	6.9	61	2.4
lizardfish	9	1.4	45	2.2	47	1.9
other fish	113	17.3	230	11.2	513	20.4
Total fish	656	100.0	2048	100.0	2513	100.0

[a]Total of 10 sampling periods.

[b]Total of 12 sampling periods.

[c]Flounder, sale, tonguefish.

Table 2.2A-29
cont'd

NUMBER OF INDIVIDUALS AND PERCENTAGE COMPOSITION OF FISHES
BY STATION COLLECTED DURING TRAWLING
ST. LUCIE PLANT
1976-1978

Year	Parameter	Station 0	1	2	3	4	5	Total
1976[a]	Number of individuals	143	124	90	70	79	150	656
	Percentage composition	21.8	18.9	13.7	10.7	12.0	22.9	100.0
1977[b]	Number of individuals	250	1049	175	127	108	339	2048
	Percentage composition	12.2	51.2	8.5	6.2	5.3	16.6	100.0
1978[b]	Number of individuals	532	520	346	221	377	517	2513
	Percentage composition	21.2	20.7	13.7	8.8	15.0	20.6	100.0
Total	Number of individuals	925	1693	611	418	564	1006	5217
	Percentage composition	17.7	32.5	11.7	8.0	10.8	19.3	100.0

[a]10 months sampling.

[b]12 months sampling.

Table 2.2A-29
cont'd

TOTAL NUMBER OF FISHES COLLECTED BY TRAWL
(15-MINUTE TRAWL PER STATION PER MONTH), ST. LUCIE
MARCH-DECEMBER 1976

	MAR(5 APR)[a]						22 APR						18 MAY						3 JUN						1 JUL					
	Station						Station						Station						Station						Station					
Species	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
flatfish[b]	1	2	2	1				2	1	1	1	3	5	2	1	9	8	11	8	1	4	1		1	3	2	3	4	2	4
searobin							5	2	1			1	10	5	4	10	3	12	4		7		2	1	1	1	2		1	1
cusk-eel							1	9				2	13	2	8	7	6	8	1								3		1	
sand perch													5	5	8		9	19	1		7		3	1			2		3	5
grunt	1	1					5					4						3							1	5				
snapper								4																						
mojarra										1		1					1									1				
other fish	6						3	9			1	3	4	8		2	2	9			1		1		2	2	2		5	2
total fish	8	3	2	1	0	0	14	26	2	2	2	14	37	22	21	28	29	62	14	1	19	1	6	3	7	11	12	4	12	12

	18 AUG						8 SEP						5 OCT						11 NOV						12 DEC					
	Station						Station						Station						Station						Station					
Species	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
flatfish[b]			1	9	1	1	3	1		1			3		3	5	3	8	1				1	1				3		1
searobin	2		2	2							1	1	6		4	2	7	2				1	2	3			1			3
cusk-eel	1			1							1			1			1					1		1	1			1		2
sand perch			3			7	1						1		2		2	2												
grunt	1	19	1			2		5					1					1	2		2			4	2					1
snapper	1						4						8	1	4		2	3												
mojarra	1	15	1					1											3					1						
other fish	3	7	5	1	2	2	5	7		1		1	3		4	1	1	8	7	4	1	4	6	1	3			1		3
total fish	9	41	13	13	3	12	13	14	0	2	2	2	22	2	17	8	16	24	13	4	3	6	9	11	6	0	1	5	0	10

[a] Delayed due to inclement weather.
[b] Flounder, sole, tonguefish.

Table 2.2A-29
cont'd

TOTAL NUMBER OF FISHES COLLECTED BY TRAWL
(ONE 15-MINUTE TRAWL PER STATION PER MONTH)
ST. LUCIE PLANT
1977

	Date and station																													
	6 Jan						22 Feb						16 Mar						26 Apr						17 May					
Taxon	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
seatrout																														
other croakers																									3					1
flatfish[a]		1	2	1	2	1					1					9		19						1	6	1	3	7	1	1
grunt	1					4	1	1			2			1				1								2				
searobin, scorpionfish			3		5	2					3					1					1	1		3	1	3	2	4		
sand perch																										9		1	2	1
mojarra																										2				
cusk-eel		2				2					1					3									1			1		
lizardfish	1		3	1	2	1				1												1								
other fish	1	5				1		22		1	4			4		2		3		1	3				1	3	4		5	2
TOTAL FISH	3	8	8	2	9	11	1	23	0	2	11	0	0	5	0	15	0	23	0	1	4	2	0	4	12	20	9	13	8	5

[a] Flounder, sole, tonguefish.

Table 2.2A-29
cont'd
TOTAL NUMBER OF FISHES COLLECTED BY TRAWL
(ONE 15-MINUTE TRAWL PER STATION PER MONTH)
ST. LUCIE PLANT
1977

Taxon	Date and station																													
	20 Jun						20 Jul						24 Aug						19 Sep						20 Oct					
	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
seatrout																														
other croakers					1																			1						
flatfish[a]		2	9	8	10	3	5	4	25	10			2	4	7	3	1	1	1		4	5	1	4		1	1	4	3	1
grunt		1					11	69						5					30	14				20						2
searobin, scorpionfish			4	6	4	2	3	1	2	1			1		7		1	2	1		4	3	2	7			1	1	3	7
sand perch	1		19		11	11	12	4	15		1	3			2	1		2	1		12		3	20						5
mojarra	6	1			4		16	1					3	2					81	9				2						
cusk-eel			1	3		1	1	4	1		1								1				1					1		
lizardfish				1				1	2	1				1		3					3	4	3				1	2	1	1
other fish		6	4	2	5	1	3	5	7		6	9	2	10	4	2	4	3	6		1	1	2	12		8	4			7
TOTAL FISH	7	10	37	20	35	18	51	89	52	12	8	12	8	22	20	9	6	8	121	23	24	13	12	66	0	9	7	8	7	23

[a] Flounder, sole, tonguefish.

Table 2.2A-29
cont'd
TOTAL NUMBER OF FISHES COLLECTED BY TRAWL
(ONE 15-MINUTE TRAWL PER STATION PER MONTH)
ST. LUCIE PLANT
1977

Taxon	Date and station																	
	9 Nov						14 Dec						Total by station					
	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
seatrout	16	536				54							16	536	0	0	0	54
other croakers	9	232					3						15	232	0	0	1	2
flatfish[a]	2	11	2	7	2	2	2		1	7	3	6	18	24	54	61	24	39
grunt	1	1				6	2	2				1	46	96	0	0	2	34
searobin, scorpionfish		17	1		2	29	3	8	3	5	3	7	9	29	28	22	23	59
sand perch		1				4							14	14	48	2	17	46
mojarra		1			1	10							106	16	0	0	5	12
cusk-eel	2	13				1		1	3	1		1	5	20	5	9	3	5
lizardfish	1			2						6	1	1	2	2	9	22	7	3
other fish	3	12	1	3		44	3	4	3			3	19	80	31	11	26	85
TOTAL FISH	34	824	4	12	5	150	13	15	10	19	7	19	250	1049	175	127	108	339

[a] Flounder, sole, tonguefish.

Table 2.2A-29
cont'd
TOTAL NUMBER OF FISHES COLLECTED BY TRAWL
(ONE 15-MINUTE TRAWL PER STATION PER MONTH)
ST. LUCIE PLANT
1977

Taxon	Total by taxon	Percentage composition
seatrout	606	29.6
other croakers	250	12.2
flatfish[a]	220	10.7
grunt	178	8.7
searobin, scorpionfish	170	8.3
sand perch	141	6.9
mojarra	139	6.8
cusk-eel	47	2.3
lizardfish	45	2.2
other fish	252	12.3
TOTAL FISH	2,048	100.0

[a] Flounder, sole, tonguefish.

Table 2.2A-29
cont'd

TOTAL NUMBER OF INDIVIDUALS AND PERCENTAGE COMPOSITION
BY TAXON OF FISHES COLLECTED BY TRAWL
ST. LUCIE PLANT
1976-1977

Taxon	1976[a] No. of individuals	1976[a] % composition	1977[b] No. of individuals	1977[b] % composition
seatrout	0	0.0	606	29.6
other croakers	13	2.0	250	12.2
flatfish[c]	129	19.6	220	10.7
grunt	61	9.3	178	8.7
searobin, scorpionfish	129	19.6	170	8.3
sand perch	86	13.1	141	6.9
mojarra	26	4.0	139	6.8
cusk-eel	72	11.0	47	2.3
lizardfish	9	1.4	45	2.2
other fish	131	20.0	252	12.3
TOTAL FISH	656	100.0	2,048	100.0

[a] Total of 10 sampling periods.
[b] Total of 12 sampling periods.
[c] Flounder, sole, tonguefish.

Table 2.2A-29
cont'd

NUMBER OF FISHES COLLECTED BY TRAWLING
(ONE 15 MINUTE TRAWL PER STATION PER MONTH)
ST. LUCIE PLANT
1978

Taxon	Date and station																													
	30 Jan						14 Feb						28 Mar						Apr (1 May)						17 May					
	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
anchovy								8																						
flatfish[a]	3	7	3	3	2	1	6	10	2	4	3	3	2	5	4	1	2	2	3	9	5	13	9		8	4	4	13	3	5
searobin, scorpionfish	8	6		4	2	2	1			1		5	1		2	9		3	2	4	2	16	2	1	10	4	5	5	5	5
grunt	4	4				2	15	8	2			6	2						2						2	8				1
cusk-eel	2	13	3	5	1	2	8	6					1			1		2	2	3									1	
seatrout								1																						
other croakers	4	1					2	2											3	1					1					1
mojarra							1																			1				
sand perch	1																							1	1					
lizardfish	1	1	3		2				1	2	1	2			1					3	1	1		1	1			1		
other fish	3	2	3	1		3	3	2	4	1	1	9	1		1	4		2	3	17	5	3	15	12	4	5	3	4	3	7
Total fish	26	34	12	13	7	10	36	37	9	8	5	25	7	5	8	15	2	9	15	37	13	33	26	15	27	22	12	23	12	19

Taxon	Date and station																													
	28 Jun						25 Jul						23 Aug						28 Sep						Oct (5 Nov)					
	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
anchovy																				21	3		1		155		34	17	23	17
flatfish[a]	1		7	19	14	4	2		1	6	1	6	1		5	12	2	4		15	3	5	14			9	2		1	3
searobin, scorpionfish	5		5	14	12	4			1	1	2	3	1			2	2	4		16	7	1	25	3	3		12	1	5	14
grunt	21	1	5			80		1						34				11		7	2		14	8			3		1	
cusk-eel	1			3	3					2		1	1	2	1					3		1	12		6	8	17	7	15	10
seatrout																									8	26	29	2	7	87
other croakers			7									1								4			6		18	34	1			2
mojarra	1					1		2							1					53	1		15	1		1				1
sand perch	1		2			4	2			1					1			1		4	11		25	3			1			1
lizardfish			2	3	2	2				4													2				2	3	2	
other fish	2	18	7	4	4	11	4	7	2		3	1	85	1	7	5	3	12		21	15	2	42	17	6	12	4	1	7	6
Total fish	32	19	35	43	35	106	8	10	4	14	6	12	88	37	15	19	7	32	0	144	42	9	156	32	196	90	105	31	61	141

	Date and station												Total by station						Total by taxon	Percentage composition
	16 Nov						6 Dec													
	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5		
anchovy	45	21	48	2	48	16							200	50	85	19	72	33	459	18.3
flatfish[a]	5	9		1		6	2	1	1	1			33	69	37	78	51	34	302	12.0
searobin, scorpionfish	4	1			1	27	1		3	4	3	1	36	31	37	58	59	72	293	11.7
grunt		1	1		1	7	5	1				3	51	65	13	0	16	118	263	10.5
cusk-eel	7	7	1	1	1	40		2					28	44	22	20	33	55	202	8.0
seatrout	3	13											11	40	29	2	7	87	176	7.0
other croakers	10	10					4	2					42	54	8	0	6	4	114	4.5
mojarra							2	1				1	4	58	2	0	15	4	83	3.3
sand perch						1							5	4	15	1	25	11	61	2.4
lizardfish										3			2	4	10	17	9	5	47	1.9
other fish	3	2	5	1	1	10	6	14	32		5	4	120	101	88	26	84	94	513	20.4
Total fish	77	64	55	5	52	107	20	21	36	8	8	9	532	520	346	221	377	517	2513	100.0

[a]Flounder, sole, tonguefish.

Table 2.2A-29
cont'd

NUMBER OF INDIVIDUALS, SIZE AND PERCENTAGE COMPOSITION
OF FISHES COLLECTED BY TRAWLING
ST. LUCIE PLANT
1978

Species	Number of individuals	Range of standard lengths (mm)	Total weight (g)	Percentage composition Number of individuals	Total weight
anchovy	410	20-78	95	16.3	0.2
tomtate	189	17-167	1169	7.5	1.9
silver seatrout	154	17-220	280	6.1	0.4
bank cusk-eel	144	57-270	6130	5.7	9.7
leopard searobin	137	36-186	4334	5.5	6.9
pigfish	73	40-213	8957	2.9	14.2
flounder (*B. robinsi*)	71	15-113	510	2.8	0.8
sea catfish	69	134-296	10605	2.7	16.8
sand perch	61	11-128	189	2.4	0.3
eyed flounder	59	22-134	681	2.3	1.1
lane snapper	56	17-154	206	2.2	0.3
mojarra	54	15-34	17	2.1	<0.1
barbfish	52	21-144	518	2.1	0.8
flounder	51	13-79	98	2.0	0.2
northern searobin	50	26-106	299	2.0	0.5
Cuban anchovy	49	31-43	17	1.9	<0.1
spotted whiff	40	26-148	761	1.6	1.2
inshore lizardfish	38	31-288	2618	1.5	4.2
blotched cusk-eel	36	91-249	1637	1.4	2.3
banded drum	29	17-100	64	1.1	0.1
kingfish (*Menticirrhus* sp.)	23	17-36	10	0.9	<0.1
sand drum	23	23-183	876	0.9	1.4
seatrout	22	6-34	8	0.9	<0.1
searobin	22	9-27	11	0.9	<0.1
cusk-eel	22	38-88	23	0.9	<0.1
twospot cardinalfish	21	14-30	9	0.8	<0.1
Atlantic midshipman	20	22-107	149	0.8	0.2
stargazer	20	27-42	11	0.8	<0.1
spotfin mojarra	20	18-65	36	0.8	0.1
planehead filefish	19	10-106	158	0.8	0.3
Atlantic spadefish	18	78-149	2196	0.7	3.5
Seminole goby	18	17-36	10	0.7	<0.1
blackwing searobin	16	27-168	672	0.6	1.1
bronze cardinalfish	15	11-35	10	0.6	<0.1
bigeye stargazer	14	25-72	23	0.6	<0.1
dusky flounder	13	58-220	907	0.5	1.4
star drum	13	28-71	58	0.5	0.1
spottedfin tonguefish	13	76-125	167	0.5	0.3
offshore tonguefish	12	104-132	200	0.5	0.3
blackedge moray	11	135-343	424	0.4	0.7
rock sea bass	11	23-146	462	0.4	0.7
fringed flounder	10	79-114	197	0.4	0.3
snakefish	9	76-190	376	0.4	0.6
gray triggerfish	8	18-142	472	0.3	0.7
high-hat	8	15-38	8	0.3	<0.1
silver jenny	8	24-115	177	0.3	0.3
smoothhead scorpionfish	7	42-119	186	0.3	0.3
scorpionfish	7	80-109	209	0.3	0.3
blackcheek tonguefish	7	109-142	153	0.3	0.2
bandtooth conger	6	82-276	79	0.2	0.1
palespotted eel	6	198-315	54	0.2	0.1
round herring	6	25-28	1	0.2	<0.1
snapper	6	14-22	4	0.2	<0.1
cardinalfish	6	10-26	5	0.2	<0.1
goby	5	17-35	2	0.2	<0.1
croaker	5	12-19	2	0.2	<0.1
bay whiff	5	65-116	54	0.2	0.1
gulf kingfish	4	149-273	681	0.2	1.1
sheepshead	4	217-263	2150	0.2	3.4
gulf flounder	4	195-244	663	0.2	1.1
naked sole	4	92-139	178	0.2	0.3
whiff	4	23-39	3	0.2	<0.1
pygmy sea bass	4	29-31	3	0.2	<0.1
lesser electric ray	3	71-175	344	0.1	0.5
striped croaker	3	181-192	535	0.1	0.8
filefish	3	9-12	2	0.1	<0.1
bank sea bass	3	41-70	16	0.1	<0.1

Table 2.2A-29
cont'd
NUMBER OF INDIVIDUALS, SIZE AND PERCENTAGE COMPOSITION
OF FISHES COLLECTED BY TRAWLING
ST. LUCIE PLANT
1978

Species	Number of individuals	Range of standard lengths (mm)	Total weight (g)	Percentage composition: Number of individuals	Percentage composition: Total weight
pipefish	3	51-85	2	0.1	<0.1
belted sandfish	3	25-27	2	0.1	<0.1
southern puffer	2	161-182	364	0.1	0.6
coral scorpionfish	2	71-76	30	0.1	<0.1
Florida pompano	2	213-214	622	0.1	1.0
ocellated flounder	2	83-233	297	0.1	0.5
summer flounder	2	47-88	15	0.1	<0.1
spot	2	109-166	138	0.1	0.2
herring	2	24-25	1	0.1	<0.1
orange filefish	2	365-368	1360	0.1	2.2
flamefish	2	15	2	0.1	<0.1
spotted goatfish	2	38-42	2	0.1	<0.1
bull pipefish	1	141	1	<0.1	<0.1
lined seahorse	1	47	1	<0.1	<0.1
seahorse	1	160	22	<0.1	<0.1
gray flounder	1	83	11	<0.1	<0.1
porkfish	1	132	87	<0.1	0.1
flying gurnard	1	47	3	<0.1	<0.1
bandtail puffer	1	36	2	<0.1	<0.1
puffer	1	7	1	<0.1	<0.1
redtail parrotfish	1	56	4	<0.1	<0.1
bluelip parrotfish	1	37	1	<0.1	<0.1
parrotfish	1	18	1	<0.1	<0.1
queen triggerfish	1	109	60	<0.1	0.1
chubbyu	1	12	1	<0.1	<0.1
dwarf wrasse	1	11	1	<0.1	<0.1
short bigeye	1	47	7	<0.1	<0.1
snook	1	749	6700	<0.1	10.6
whitebone porgy	1	127	70	<0.1	0.1
blackfin cardinalfish	1	14	1	<0.1	<0.1
northern sennet	1	34	1	<0.1	<0.1
scrawled cowfish	1	73	26	<0.1	<0.1
southern kingfish	1	167	79	<0.1	0.1
black drum	1	292	640	<0.1	1.0
Atlantic croaker	1	167	72	<0.1	0.1
margintail conger	1	130	3	<0.1	<0.1
Atlantic bumper	1	16	1	<0.1	<0.1
striped mojarra	1	172	182	<0.1	0.3
black sea bass	1	54	4	<0.1	<0.1
unidentified fishes	127	7-27	10	5.1	<0.1
Total fishes	2,513	-	62,986	100.0	100.0

Table 2.2A-30

PERCENTAGE COMPOSITION OF THE MAJOR CATEGORIES OF FISH LARVAE BY STATION AND SEASON ST. LUCIE PLANT 1976

Season	Category	Station 0	1	2	3	4	5	11	12
Spring (MAR, APR, MAY)	Gerreidae	4.4	3.4	5.9	6.0	4.6	3.4	1.5	14.0
	Sciaenidae	0.1	0.1	1.0	2.4	1.3	0.5		
	Blenniidae	17.2	7.9	16.1	18.4	16.1	23.8	5.3	30.7
	Tetraodontiformes	3.7	1.5	20.0	5.4	4.0	2.9	0.9	11.2
	Clupeiformes	48.1	77.9	22.0	47.9	53.7	43.6	79.3	5.0
	Carangidae	3.4	0.2	18.1	8.9	10.6	4.9		
	Gobiidae	0.2	0.1		0.4	0.8	0.4	0.2	2.2
	Pleuronectiformes	0.2	0.1	0.1		0.1	0.2		1.7
	Gobiesocidae	0.5	0.1	0.2	0.1		1.9		4.5
	Dactyloscopidae	11.7	3.5	2.2	0.9	4.6	2.9	0.2	
	Serranidae				0.1				
	Scorpaenidae	0.1		0.1	0.2	0.1			
	Atherinidae	1.6	0.1		0.3	0.2	0.1	1.4	5.0
	All others	8.6	5.5	14.2	9.0	3.9	15.4	11.1	25.7

Table 2.2A-30
cont'd

PERCENTAGE COMPOSITION OF THE MAJOR CATEGORIES OF FISH LARVAE
BY STATION AND SEASON
ST. LUCIE PLANT
1976

Season	Category	Station 0	1	2	3	4	5	11	12
Summer (JUN, JUL, AUG)	Gerreidae	10.6	5.7	27.4	18.1	24.5	14.7	5.3	
	Sciaenidae		2.0	6.0	3.4	1.1	4.1	2.1	12.7
	Blenniidae	11.4	8.2	9.3	10.1	5.2	6.0	7.9	14.5
	Tetraodontiformes	22.6	3.5	3.1	4.2	3.2	9.1	2.1	
	Clupeiformes	28.6	49.7	18.1	37.6	39.2	29.6	66.8	27.3
	Carangidae	0.7	1.5	0.3	2.3	0.5	3.1		
	Gobiidae	1.2	1.9	2.0	2.2	2.5	3.3		25.4
	Pleuronectiformes	1.1	2.4	2.5	0.9	0.5	2.7	9.5	
	Gobiesocidae	0.6	0.2	0.3	0.3			1.0	
	Dactyloscopidae	0.6	2.0	0.9	0.9	0.5	1.9	1.0	
	Serranidae	3.0		0.3		0.6			5.4
	Scorpaenidae		2.3	0.5	0.2			1.0	
	Atherinidae	2.8	8.2	1.7	3.9	5.7	9.1		
	All others	16.8	12.2	27.7	15.9	16.3	16.4	3.2	14.5

Table 2.2A-30
cont'd
PERCENTAGE COMPOSITION OF THE MAJOR CATEGORIES OF FISH LARVAE
BY STATION AND SEASON
ST. LUCIE PLANT
1976

Season	Category	Station 0	1	2	3	4	5	11	12
Fall	Gerreidae	44.3	19.9	56.1	67.9	22.4	11.3		1.4
(SEP, OCT, NOV)	Sciaenidae	19.1	47.7	9.2	3.7	22.8	29.6		1.4
	Blenniidae	0.4	1.6	6.3	0.4	1.8	1.6	0.7	11.2
	Tetraodontiformes	0.2	0.5	0.6	1.2	0.4	1.4	0.4	
	Clupeiformes	5.6	11.2	5.4	1.3	13.8	2.5	94.1	63.6
	Carangidae	23.2	5.6	18.0	21.5	33.4	47.4	0.4	2.9
	Gobiidae	0.1		0.1	0.1	0.1			2.9
	Pleuronectiformes	1.2	7.0	0.6	0.4	0.8	1.7	3.0	6.3
	Gobiesocidae	0.1	0.2	0.1	0.1	0.1	0.2		
	Dactyloscopidae	0.3	1.1	0.7	0.6	0.9	1.3		
	Serranidae	2.3			0.1	0.2	0.1		
	Scorpaenidae			0.5		0.1	0.1		
	Atherinidae	0.1	1.4	0.6	0.1	0.4			8.7
	All others	3.2	3.8	1.8	2.6	2.8	2.8	1.4	1.4

Table 2.2A-30
cont'd

PERCENTAGE COMPOSITION OF THE MAJOR CATEGORIES OF FISH LARVAE
BY STATION
ST. LUCIE PLANT
WINTER (DECEMBER 1976-FEBUARY 1977)

CATEGORY	STATION 0	1	2	3	4	5	11	12
GERREIDAE	1.3	0.3	5.4	6.4	0.9	2.2	7.7	5.3
SCIAENIDAE	1.4	0.7	9.1	22.7	0.6	2.7	19.2	5.3
BLENIIDAE	0.8	0.6	5.5	6.2	1.4	1.0	26.9	47.4
TETRAODONTIDAE	0.0	0.0	0.5	0.3	0.0	0.2	0.0	0.0
CLUPEIFORMES	95.0	96.2	70.3	49.4	93.6	89.8	23.1	26.3
CARANGIDAE	0.0	0.0	0.9	0.8	0.2	0.2	0.0	0.0
GOBIIDAE	0.4	0.4	0.5	0.8	0.4	1.2	7.7	5.3
BOTHIDAE	0.1	0.2	0.3	0.1	0.1	0.4	0.0	0.0
GOBIESOCIDAE	0.0	0.0	0.7	0.0	0.0	0.1	0.0	0.0
OPHIDIIDAE	0.2	0.1	2.1	5.6	0.9	0.9	0.0	0.0
SERRANIDAE	0.0	0.0	0.4	0.1	0.0	0.0	0.0	0.0
SCORPAENIDAE	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0
ATHERINIDAE	.	.	.	.	.	.	.	.
ALL OTHER LARVAE	0.8	1.5	4.4	7.2	1.6	1.2	15.4	10.5

Table 2.2A-30
cont'd

PERCENTAGE COMPOSITION OF THE MAJOR CATEGORIES OF FISH LARVAE
BY STATION
ST. LUCIE PLANT
SPRING (MARCH 1977-MAY 1977)

CATEGORY	STATION 0	1	2	3	4	5	11	12
GERREIDAE	8.8	20.6	12.4	8.7	10.5	24.7	0.0	0.0
SCIAENIDAE	0.0	0.0	3.4	1.1	2.0	0.0	0.0	0.0
BLENIIDAE	2.2	1.9	1.5	7.5	14.7	34.1	0.0	0.0
TETRAODONTIDAE	5.5	2.9	7.2	6.3	5.9	1.0	0.0	0.0
CLUPEIFORMES	40.3	59.4	37.1	57.2	22.0	24.7	94.6	100
CARANGIDAE	5.5	1.4	0.0	0.7	2.4	0.0	5.4	0.0
GOBIIDAE	0.0	0.0	1.8	0.9	1.5	2.5	0.0	0.0
BOTHIDAE	0.8	0.0	0.0	0.0	2.2	2.0	0.0	0.0
OPHIDIIDAE	7.5	0.0	1.8	0.7	2.4	0.0	0.0	0.0
SERRANIDAE	1.3	2.5	3.1	3.7	2.1	2.6	0.0	0.0
SCORPAENIDAE	2.7	0.0	14.7	1.4	0.0	0.0	0.0	0.0
ATHERINIDAE	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL OTHER LARVAE	24.1	11.3	17.0	11.8	34.5	8.5	0.0	0.0

Table 2.2A-30
cont'd

PERCENTAGE COMPOSITION OF THE MAJOR CATEGORIES OF FISH LARVAE
BY STATION
ST. LUCIE PLANT
SUMMER (JUNE 1977–AUGUST 1977)

CATEGORY	STATION 0	1	2	3	4	5	11	12
GERREIDAE	2.8	0.5	0.9	3.3	3.9	1.9	0.0	0.0
SCIAENIDAE	0.0	0.2	0.0	1.1	2.1	3.3	0.0	0.0
BLENIIDAE	1.4	0.5	0.9	1.0	0.5	0.8	0.0	0.0
TETRAODONTIDAE	2.3	1.5	0.8	1.8	1.8	0.5	0.0	0.0
CLUPEIFORMES	82.9	81.1	93.0	74.8	87.1	85.5	92.3	94.7
CARANGIDAE	0.0	0.0	0.1	0.8	0.3	0.2	0.0	0.0
GOBIIDAE	3.1	4.4	1.8	5.4	1.9	2.2	0.0	5.3
BOTHIDAE	0.9	2.0	0.2	0.4	0.3	0.4	7.7	0.0
GOBIESOCIDAE	0.0	0.0	0.0	0.3	0.0	0.3	0.0	0.0
OPHIDIIDAE	0.0	1.5	0.4	0.4	0.0	0.3	0.0	0.0
SERRANIDAE	1.7	1.0	1.1	1.0	0.1	1.8	0.0	0.0
SCORPAENIDAE	0.0	2.3	0.0	0.6	0.2	0.2	0.0	0.0
ALL OTHER LARVAE	4.8	4.6	0.9	9.1	1.9	2.7	0.0	0.0

Table 2.2A-30
cont'd

PERCENTAGE COMPOSITION OF THE MAJOR CATEGORIES OF FISH LARVAE
BY STATION
ST. LUCIE PLANT
FALL (SEPTEMBER 1977-NOVEMBER 1977)

CATEGORY	STATION 0	1	2	3	4	5	11	12
GERREIDAE	9.1	2.1	6.8	2.8	9.5	3.8	0.0	0.0
SCIAENIDAE	10.9	9.3	5.9	3.6	4.7	6.7	0.0	0.0
BLENIIDAE	2.2	0.2	3.9	1.5	1.2	1.4	0.0	0.0
TETRAODONTIDAE	2.8	1.7	5.8	0.3	8.4	4.3	0.0	0.0
CLUPEIFORMES	57.6	69.9	29.9	68.3	52.7	40.1	0.0	0.0
CARANGIDAE	1.9	1.4	6.4	5.7	3.2	10.5	0.0	0.0
GOBIIDAE	3.5	1.2	5.3	3.6	1.7	6.0	0.0	0.0
BOTHIDAE	2.5	9.0	5.7	0.8	1.4	2.6	100	100
GOBIESOCIDAE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OPHICIIDAE	5.3	2.5	17.8	6.1	10.9	8.0	0.0	0.0
SERRANIDAE	0.0	0.4	0.0	0.6	0.0	4.1	0.0	0.0
SCORPAENIDAE	1.2	0.7	3.1	0.0	0.0	6.4	0.0	0.0
ALL OTHER LARVAE	2.8	1.5	9.4	6.6	6.3	6.1	0.0	0.0

Table 2.2A-30
cont'd

PERCENTAGE COMPOSITION OF LARVAL FISH TAXA
BY STATION
ST. LUCIE PLANT
WINTER (14 DECEMBER 1977-19 MARCH 1978)

TAXON	STATION 0	1	2	3	4	5	11	12
CLUPEIFORMES	56.1	78.5	35.1	35.3	70.9	55.4	50.0	42.9
SERRANIDAE	0.9	0.3	3.1	1.6	0.9	0.0	0.0	0.0
CARANGIDAE	1.9	0.0	1.0	1.1	0.9	0.0	0.0	0.0
GERREIDAE	0.9	0.3	0.0	0.0	1.8	0.0	12.5	0.0
SCIAENIDAE	12.1	8.4	24.7	26.2	10.0	10.8	12.5	42.9
POLYNEMIDAE	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0
DACTYLOSCOPIDAE	6.5	0.8	8.2	4.3	0.0	3.6	0.0	0.0
BLENNIIDAE	2.8	0.8	1.0	1.1	2.7	7.2	0.0	0.0
GOBIIDAE	0.9	1.4	3.1	9.6	0.9	7.2	0.0	0.0
SCORPAENIDAE	0.9	0.0	1.0	3.7	0.9	0.0	0.0	0.0
FLATFISHES	0.0	0.3	8.2	1.1	0.0	1.2	12.5	0.0
PLECTOGNATHS	0.0	0.0	1.0	1.1	0.9	2.4	0.0	14.3
ALL OTHER LARVAE	16.8	9.2	13.4	15.0	10.0	10.8	12.5	0.0

Table 2.2A-30
cont'd

PERCENTAGE COMPOSITION OF LARVAL FISH TAXA
BY STATION
ST. LUCIE PLANT
SPRING (20 MARCH 1978-20 JUNE 1978)

	STATION							
TAXON	0	1	2	3	4	5	11	12
CLUPEIFORMES	90.6	88.8	85.9	77.4	82.6	89.9	41.0	63.2
ATHERINIDAE	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SERRANIDAE	0.2	0.1	0.2	0.0	0.4	0.6	0.0	0.0
CARANGIDAE	0.2	0.0	0.0	0.8	0.0	0.0	1.0	0.0
GERREIDAE	2.0	9.1	3.5	4.5	3.6	1.5	5.1	0.0
SCIAENIDAE	0.3	1.4	2.1	0.8	4.2	1.2	1.5	5.3
DACTYLOSCOPIDAE	0.3	0.0	1.7	1.9	2.3	0.9	0.5	0.0
BLENNIIDAE	2.1	0.1	1.5	6.0	2.6	4.3	7.2	5.3
GOBIIDAE	0.2	0.0	1.7	0.8	1.3	0.3	3.6	5.3
SCORPAENIDAE	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0
FLATFISHES	0.3	0.0	0.2	0.0	0.0	0.0	27.7	0.0
PLECTOGNATHS	0.3	0.0	0.8	1.5	0.4	0.0	0.5	5.3
ALL OTHER LARVAE	3.3	0.4	2.3	6.0	2.6	1.2	11.8	15.8

Table 2.2A-30
cont'd

PERCENTAGE COMPOSITION OF LARVAL FISH TAXA
BY STATION
ST. LUCIE PLANT
SUMMER (21 JUNE 1978-22 SEPTEMBER 1978)

	STATION							
TAXON	0	1	2	3	4	5	11	12
CLUPEIFORMES	66.0	55.1	73.5	57.4	73.3	37.5	0.0	0.0
GOBIESOCIDAE	0.0	0.2	0.2	0.0	0.1	0.0	0.0	0.0
SERRANIDAE	0.3	5.5	0.4	0.9	0.2	0.3	0.0	0.0
CARANGIDAE	1.3	4.2	1.1	1.5	0.3	6.0	0.0	0.0
GERREIDAE	9.2	9.3	8.6	12.6	10.1	10.8	0.0	0.0
SCIAENIDAE	5.0	1.7	3.4	4.1	1.6	0.8	0.0	0.0
DACTYLOSCOPIDAE	3.0	1.6	0.8	2.6	1.7	13.2	0.0	0.0
BLENNIIDAE	1.7	4.4	4.0	3.2	6.6	7.7	0.0	0.0
GOBIIDAE	0.3	3.2	1.9	5.0	0.9	5.1	0.0	0.0
SCORPAENIDAE	1.3	0.5	0.2	0.9	0.2	0.0	0.0	0.0
FLATFISHES	2.6	4.4	0.4	0.9	0.4	0.2	50.0	0.0
PLECTOGNATHS	2.6	0.8	1.3	4.7	0.9	2.3	50.0	0.0
ALL OTHER LARVAE	6.6	9.3	4.2	6.2	3.8	16.2	0.0	100

Table 2.2A-30
cont'd

PERCENTAGE COMPOSITION OF LARVAL FISH TAXA
BY STATION
ST. LUCIE PLANT
FALL (23 SEPTEMBER 1978-28 NOVEMBER 1978)

	STATION							
TAXON	0	1	2	3	4	5	11	12
CLUPEIFORMES	74.5	76.9	36.8	28.8	10.2	40.6	0.0	0.0
GOBIESOCIDAE	0.0	0.0	2.6	0.0	1.7	0.0	0.0	0.0
ATHERINIDAE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SERRANIDAE	0.0	0.0	0.0	3.8	1.7	0.0	0.0	0.0
CARANGIDAE	0.7	0.9	10.5	1.9	3.4	0.0	0.0	0.0
GERREIDAE	12.1	4.6	5.3	19.2	37.3	9.4	0.0	0.0
SCIAENIDAE	2.8	1.9	2.6	7.7	6.8	0.0	0.0	0.0
DACTYLOSCOPIDAE	1.4	0.0	15.8	17.3	18.6	3.1	0.0	0.0
BLENNIIDAE	1.4	0.0	5.3	5.8	1.7	12.5	0.0	0.0
GOBIIDAE	0.0	0.0	0.0	0.0	3.4	0.0	0.0	0.0
SCORPAENIDAE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FLATFISHES	5.7	13.9	10.5	3.8	5.1	21.9	100.0	0.0
PLECTOGNATHS	0.0	0.0	0.0	1.9	1.7	3.1	0.0	0.0
ALL OTHER LARVAE	1.4	1.9	10.5	9.6	8.5	9.4	0.0	0.0

Table 2.2A-31

ANALYSIS OF VARIANCE:
EGG DISTRIBUTION AT STATIONS 0 - 5 BY SEASON
ST. LUCIE PLANT
1977

Season	Source	DF	Sum of squares	Mean square
Winter	Model	5	2450.23066326	490.04613265
	Error	66	20805.87951359	315.24059869
	Corrected total	71	23256.11017685	

Source	DF	Type I SS	F value	PR > F
Station	5	2450.23066326	1.55	0.1843

Season	Source	DF	Sum of squares	Mean square
Spring	Model	5	2596.51143285	519.30228657
	Error	65	23831.11567317	366.63254882
	Corrected total	70	26427.62710602	

Source	DF	Type I SS	F value	PR > F
Station	5	2596.51143285	1.42	0.2293

Season	Source	DF	Sum of squares	Mean square
Summer	Model	5	1823.34219367	364.66843873
	Error	54	9338.11900295	172.92812968
	Corrected total	59	11161.46119662	

Source	DF	Type I SS	F value	PR > F
Station	5	1823.34219367	2.11*	0.0777

Season	Source	DF	Sum of squares	Mean square
Fall	Model	5	9.44608719	1.88921744
	Error	88	126.95678021	1.44269068
	Corrected total	93	136.40286740	

Source	DF	Type I SS	F Value	PR > F
Station	5	9.44608719	1.31	0.2666

* Significant at $\alpha = 0.10$.

Table 2.2A-31
cont'd

DUNCAN'S MULTIPLE-RANGE TEST:
SUMMER DISTRIBUTION OF EGGS AT STATIONS 0-5
ST. LUCIE PLANT
1977

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

ALPHA LEVEL=.05 DF=54 MS=0.336318

GROUPING	MEAN	N	STA
A	16.220653	10	0
B	2.004158	10	2
B			
B	1.903364	10	5
C	1.350259	10	4
C			
C	1.212331	10	1
C			
C	0.861241	10	3

Table 2.2A-31
cont'd

ANALYSIS OF VARIANCE:
LARVAL DISTRIBUTION AT STATIONS 0 - 5 BY SEASON
ST. LUCIE PLANT
1977

Season	Source	DF	Sum of squares	Mean square	
Winter	Model	5	31.78464144	6.35692829	
	Error	66	214.78128866	3.25426195	
	Corrected total	71	246.56593010		
	Source	DF	Type I SS	F value	PR > F
	Station	5	31.78464144	1.95*	0.0964
Season	Source	DF	Sum of squares	Mean square	
Spring	Model	5	1.18766380	0.23753276	
	Error	64	37.97546783	0.59336668	
	Corrected total	69	39.16313164		
	Source	DF	Type I SS	F value	PR > F
	Station	5	1.18766380	0.40	0.8479
Season	Source	DF	Sum of squares	Mean square	
Summer	Model	5	18.21219054	3.64243811	
	Error	54	113.00258667	2.09264049	
	Corrected total	59	131.21477721		
	Source	DF	Type I SS	F value	PR > F
	Station	5	18.21219054	1.74	0.1401
Season	Source	DF	Sum of squares	Mean square	
Fall	Model	5	2.08539346	0.41707869	
	Error	88	17.99035855	0.20443589	
	Corrected total	93	20.07575201		
	Source	DF	Type I SS	F value	PR > F
	Station	5	2.08539346	2.04*	0.0799

* Significant at $\alpha = 0.10$.

Table 2.2A-31
cont'd

DUNCAN'S MULTIPLE-RANGE TEST:
WINTER AND FALL DISTRIBUTION OF LARVAE AT STATIONS 0-5
ST. LUCIE PLANT
1977

WINTER 1976-1977

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

ALPHA LEVEL=.05 DF=66 MS=3.25426

GROUPING		MEAN	N	STA
	A	2.033758	12	0
	A			
B	A	1.321229	12	1
B	A			
B	A	0.740972	12	4
B	A			
B	A	0.478467	12	5
B				
B		0.206096	12	2
B				
B		0.168346	12	3

FALL 1977

ALPHA LEVEL=.05 DF=88 MS=4.0E-04

GROUPING	MEAN	N	STA
A	0.520724	16	1
B	0.314102	15	0
B			
B	0.313313	16	3
C	0.193173	15	5
D	0.098756	16	2
D			
D	0.096680	16	4

Table 2.2A-31
cont'd

ANALYSIS OF VARIANCE:
COMPARISON OF EGG AND LARVAL DENSITIES AT STATIONS 0 THROUGH 5
ST. LUCIE PLANT
14 DECEMBER 1977 THROUGH 28 NOVEMBER 1978

EGGS

Source	DF	Sum of squares	Mean square	
Model	5	4.09896326	0.81979265	
Error	267	383.33660867	1.43571764	
Corrected total	272	387.43557192		
Source	DF	Type I SS	F value	PF > F
Station	5	4.09896326	0.57	0.7247

LARVAE

Source	DF	Sum of squares	Mean square	
Model	5	3.14696024	0.62939205	
Error	267	41.40454472	0.15507320	
Corrected total	272	44.55150496		
Source	DF	Type I SS	F value	PF > F
Station	5	3.14696024	4.06	0.0015[a]

[a]Significant.

Table 2.2A-31
cont'd

ANALYSIS OF VARIANCE:
EGG DISTRIBUTION AT STATIONS 0 THROUGH 5 BY SEASON
ST. LUCIE PLANT
1977-1978

Season	Source	DF	Sum of squares	Mean square	
Winter	Model	5	7.95389513	1.59077903	
	Error	54	22.59637263	0.41845135	
	Corrected total	59	30.55026776		
	Source	DF	Type I SS	F value	PR > F
	Station	5	7.95389513	3.80	0.0052[a]
Season	Source	DF	Sum of squares	Mean square	
Spring	Model	5	16.30101913	3.26020383	
	Error	66	107.78387283	1.63308898	
	Corrected total	71	124.08489196		
	Source	DF	Type I SS	F value	PR > F
	Station	5	16.30101913	2.00	0.0898
Season	Source	DF	Sum of squares	Mean square	
Summer	Model	5	7.85638351	1.57127670	
	Error	63	93.08392435	1.47752261	
	Corrected total	68	100.94030786		
	Source	DF	Type I SS	F value	PR > F
	Station	5	7.85638351	1.06	0.3895
Season	Source	DF	Sum of squares	Mean square	
Fall	Model	5	2.60426368	0.52085274	
	Error	66	42.18331174	0.63914109	
	Corrected total	71	44.78757542		
	Source	DF	Type I SS	F value	PR > F
	Station	5	2.60426368	0.81	0.5451

[a]Significant.

Table 2.2A-31
cont'd

DUNCAN'S MULTIPLE-RANGE TEST:
WINTER DISTRIBUTION OF EGGS AT STATIONS 0 THROUGH 5
ST. LUCIE PLANT
14 DECEMBER 1977 THROUGH 19 MARCH 1978

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT

Alpha Level=0.05 DF=54 MS=0.418451

Grouping	Geometric mean	N	Station
A	4.632	10	1
B	2.119	10	5
B	1.488	10	0
B	1.270	10	2
B	1.044	10	4
B	0.909	10	3

Table 2.2A-31
cont'd

ANALYSIS OF VARIANCE:
LARVAL DISTRIBUTION AT STATIONS 0 THROUGH 5 BY SEASON
ST. LUCIE PLANT
1977-1978

Season	Source	DF	Sum of squares	Mean square	
Winter	Model	5	0.54502388	0.10900478	
	Error	54	3.40530930	0.06306128	
	Corrected total	59	3.95033318		
	Source	DF	Type I SS	F value	PR > F
	Station	5	0.54502388	1.73	0.1428
Season	Source	DF	Sum of squares	Mean square	
Spring	Model	5	3.78936543	0.75787309	
	Error	66	14.27378698	0.21626950	
	Corrected total	71	18.06315241		
	Source	DF	Type I SS	F value	PR > F
	Station	5	3.78936543	3.50	0.0073[a]
Season	Source	DF	Sum of squares	Mean square	
Summer	Model	5	1.59520048	0.31904010	
	Error	63	9.11264428	0.14464515	
	Corrected total	68	10.70784476		
	Source	DF	Type I SS	F value	PR > F
	Station	5	1.59520048	2.21	0.0641
Season	Source	DF	Sum of squares	Mean square	
Fall	Model	5	0.16096942	0.03219388	
	Error	66	1.25325114	0.01898865	
	Corrected total	71	1.41422057		
	Source	DF	Type I SS	F value	PR > F
	Station	5	0.16096942	1.70	0.1470

[a]Significant.

Table 2.2A-31
cont'd

DUNCAN'S MULTIPLE-RANGE TEST:
DISTRIBUTION OF LARVAE AT STATIONS 0 THROUGH 5
ST. LUCIE PLANT
14 DECEMBER 1977 THROUGH 28 NOVEMBER 1978

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT

Alpha Level=0.05 DF=267 MS=0.155073

Grouping	Geometric mean	N	Station
A	0.765	46	1
B	0.486	46	4
B	0.365	44	0
B	0.345	46	2
B	0.324	46	5
B	0.285	45	3

Table 2.2A-31
cont'd

DUNCAN'S MULTIPLE-RANGE TEST:
SPRING DISTRIBUTION OF LARVAE AT STATIONS 0 THROUGH 5
ST. LUCIE PLANT
20 MARCH 1978 THROUGH 20 JUNE 1978

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT

Alpha Level=0.05 DF=66 MS=0.216269

Grouping	Geometric mean	N	Station
A	1.616	12	1
B	0.610	12	0
B	0.591	12	4
B	0.560	12	2
B	0.405	12	5
B	0.257	12	3

Table 2.2A-32

CORRELATION ANALYSIS OF DENSITY OF ICHTHYOPLANKTON
WITH VARIOUS PHYSICAL PARAMETERS
ST. LUCIE PLANT
1976

Correlation	Error degrees of freedom	Correlation Coefficient
Larvae/m^3		
water temperature	82	0.408[a]
salinity	83	0.076
dissolved oxygen	107	0.263[a]
turbidity	70	-0.077
percent transmittance	54	0.176
Eggs/m^3		
water temperature	83	-0.335[a]
salinity	83	-0.113
dissolved oxygen	82	0.363[a]
turbidity	70	0.073
percent transmittance	73	0.043

[a] Significant at $\alpha = 0.001$.

Table 2.2A-32
cont'd

CORRELATION COEFFICIENTS BETWEEN DENSITIES OF EGGS AND LARVAE AND FOUR PHYSICAL PARAMETERS
ST. LUCIE PLANT
1977

	EGGS	LARVAE	DO	TURB	TEMP	SALINITY
EGGS	1.00000	-0.04155	0.18020*	-0.11094*	-0.24271*	0.01413
	0.0000	0.4757	0.0033	0.0558	0.0001	0.8093
	298	297	264	298	286	294
LARVAE		1.00000	-0.21176*	0.13605*	-0.07265	-0.04909
		0.0000	0.0005	0.0190	0.2214	0.4024
		297	264	297	285	293
DO			1.00000	0.14501*	-0.57923*	-0.04255
			0.0000	0.0184	0.0001	0.4946
			264	264	252	260
TURB				1.00000	-0.20870*	-0.10261
				0.0000	0.0004	0.0790
				298	286	294
TEMP					1.00000	0.11628*
					0.0000	0.0511
					286	282
SALINITY						1.00000
						0.0000
						294

*Significant at $\alpha = 0.05$.

Table 2.2A-32
cont'd

CORRELATION COEFFICIENTS BETWEEN DENSITIES OF EGGS AND LARVAE AND FOUR PHYSICAL PARAMETERS
ST. LUCIE PLANT
14 DECEMBER 1977 THROUGH 28 NOVEMBER 1978

	Eggs	Larvae	Salinity	Turbidity	Dissolved oxygen	Temperature
Eggs	1.00000[a] 0.0000[b] 273[c]	0.14012[d] 0.0206 273	0.33839[d] 0.0001 273	-0.01919 0.7522 273	0.36144[d] 0.0001 259	-0.00517 0.9325 271
Larvae		1.00000 0.0000 273	0.04458 0.4632 273	0.06039 0.3201 273	0.22537[d] 0.0008 259	0.08642 0.1560 271
Salinity			1.00000 0.0000 273	-0.04647 0.4445 273	0.33965[d] 0.0001 259	-0.23411[d] 0.0001 271
Turbidity				1.00000 0.0000 273	-0.16618[d] 0.0074 259	0.22171[d] 0.0002 271
Dissolved oxygen					1.00000 0.0000 259	-0.19990[d] 0.0012 259
Temperature						1.00000 0.0000 271

[a]Correlation coefficients.

[b]Probability > /R/ under HO:RHO = 0.

[c]Number of observations.

[d]Significant.

Table 2.2A-33

STEPWISE REGRESSION PROCEDURE FOR DEPENDENT VARIABLE LOG-DENSITY OF EGGS
ST. LUCIE PLANT
DECEMBER 1977 - NOVEMBER 1978

STEP 1 VARIABLE DO ENTERED R SQUARE = 0.13054144

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	1	50.51624804	50.51624804	36.62	0.0001[a]
ERROR	257	336.16234696	1.30802470		
TOTAL	258	385.67859500			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-2.52632718				
DO	0.54497524	0.09759115	50.51624804	38.62	0.0001[a]

THE ABOVE MODEL IS THE BEST 1 VARIABLE MODEL FOUND.

STEP 2 VARIABLE SALINITY ENTERED R SQUARE = 0.18555752

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	2	71.78979871	35.89489435	29.18	0.0001[a]
ERROR	256	314.88880629	1.23003440		
TOTAL	258	385.67859500			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-23.78929152				
SALINITY	0.52231095	0.14953945	21.27354357	17.30	0.0001[a]
DO	0.41723174	0.09040131	26.19751030	21.30	0.0001[a]

THE ABOVE MODEL IS THE BEST 2 VARIABLE MODEL FOUND.

STEP 3 VARIABLE TEMP ENTERED R SQUARE = 0.19753535

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	3	75.38259318	25.45039773	20.92	0.0001[a]
ERROR	255	310.29590182	1.21684667		
TOTAL	258	385.67859500			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-26.65969720				
SALINITY	0.57184005	0.15100274	24.03734579	19.80	0.0001[a]
DO	0.44104643	0.09074918	28.74213598	23.62	0.0001[a]
TEMP	0.03875158	0.01995156	4.59290447	3.77	0.0531[a]

THE ABOVE MODEL IS THE BEST 3 VARIABLE MODEL FOUND.

STEP 4 VARIABLE TURBIDITY ENTERED R SQUARE = 0.19772285

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	4	76.45519555	19.11379889	15.65	0.0001[a]
ERROR	254	310.22339945	1.22135197		
TOTAL	258	385.67859500			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-26.61147538				
SALINITY	0.57010921	0.15144873	23.91116499	19.58	0.0001[a]
TURB	0.01236903	0.05076682	0.07250237	0.06	0.8077
DO	0.44395299	0.09159634	28.62930495	23.44	0.0001[a]
TEMP	0.03759171	0.02055718	4.08411473	3.34	0.0685

THE ABOVE MODEL IS THE BEST 4 VARIABLE MODEL FOUND.

[a]Significant.

Table 2.2A-33
cont'd

STEPWISE REGRESSION PROCEDURE FOR DEPENDENT VARIABLE LOG-DENSITY OF LARVAE
ST. LUCIE PLANT
DECEMBER 1977 - NOVEMBER 1978

STEP 1 VARIABLE DO ENTERED R SQUARE = 0.05079025

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	1	2.09653764	2.09653764	13.75	0.0003[a]
ERROR	257	39.22135714	0.15261112		
TOTAL	258	41.31969479			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-0.44352633				
DO	0.11106236	0.02994962	2.09653764	13.75	0.0003[a]

THE ABOVE MODEL IS THE BEST 1 VARIABLE MODEL FOUND.

STEP 2 VARIABLE TURBIDITY ENTERED R SQUARE = 0.06457572

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	2	2.66824924	1.33412462	8.84	0.0002[a]
ERROR	256	38.65144555	0.15098221		
TOTAL	258	41.31959479			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-0.57020073				
TURB	0.03370979	0.01735520	0.55961159	3.77	0.0532[a]
DO	0.12081332	0.03020940	2.41474385	15.99	0.0001[a]

THE ABOVE MODEL IS THE BEST 2 VARIABLE MODEL FOUND.

STEP 3 VARIABLE TEMP ENTERED R SQUARE = 0.06955237

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	3	2.87388288	0.95796096	6.35	0.0004[a]
ERROR	255	38.44581191	0.15076789		
TOTAL	258	41.31959479			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-0.90470300				
TURB	0.02894129	0.01751704	0.39780775	2.64	0.1055
DO	0.12672044	0.03060877	2.53410738	17.14	0.0001[a]
TEMP	0.00830503	0.00711129	0.20563364	1.36	0.2440

THE ABOVE MODEL IS THE BEST 3 VARIABLE MODEL FOUND.

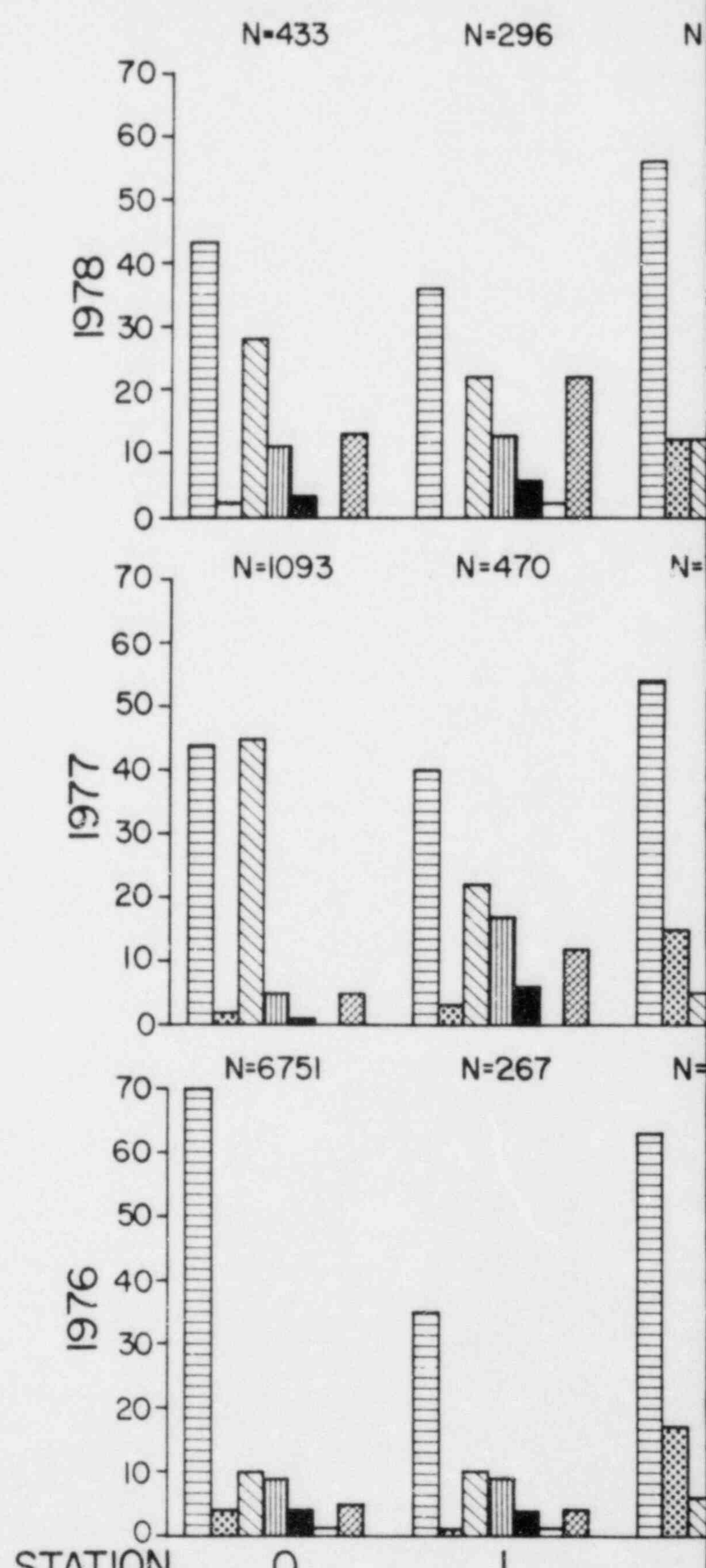
STEP 4 VARIABLE SALINITY ENTERED R SQUARE = 0.06978617

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	4	2.88354320	0.72088580	4.76	0.0010[a]
ERROR	254	38.43615159	0.15132343		
TOTAL	258	41.31959479			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-0.33556665				
SALINITY	-0.01345918	0.05330673	0.00966033	0.06	0.8007
TURB	0.02915307	0.01736951	0.40276299	2.66	0.1040
DO	0.12926499	0.03227637	2.42715787	16.04	0.0001[a]
TEMP	0.00795520	0.00723596	0.13428299	1.22	0.2709

THE ABOVE MODEL IS THE BEST 4 VARIABLE MODEL FOUND.

[a]Significant.



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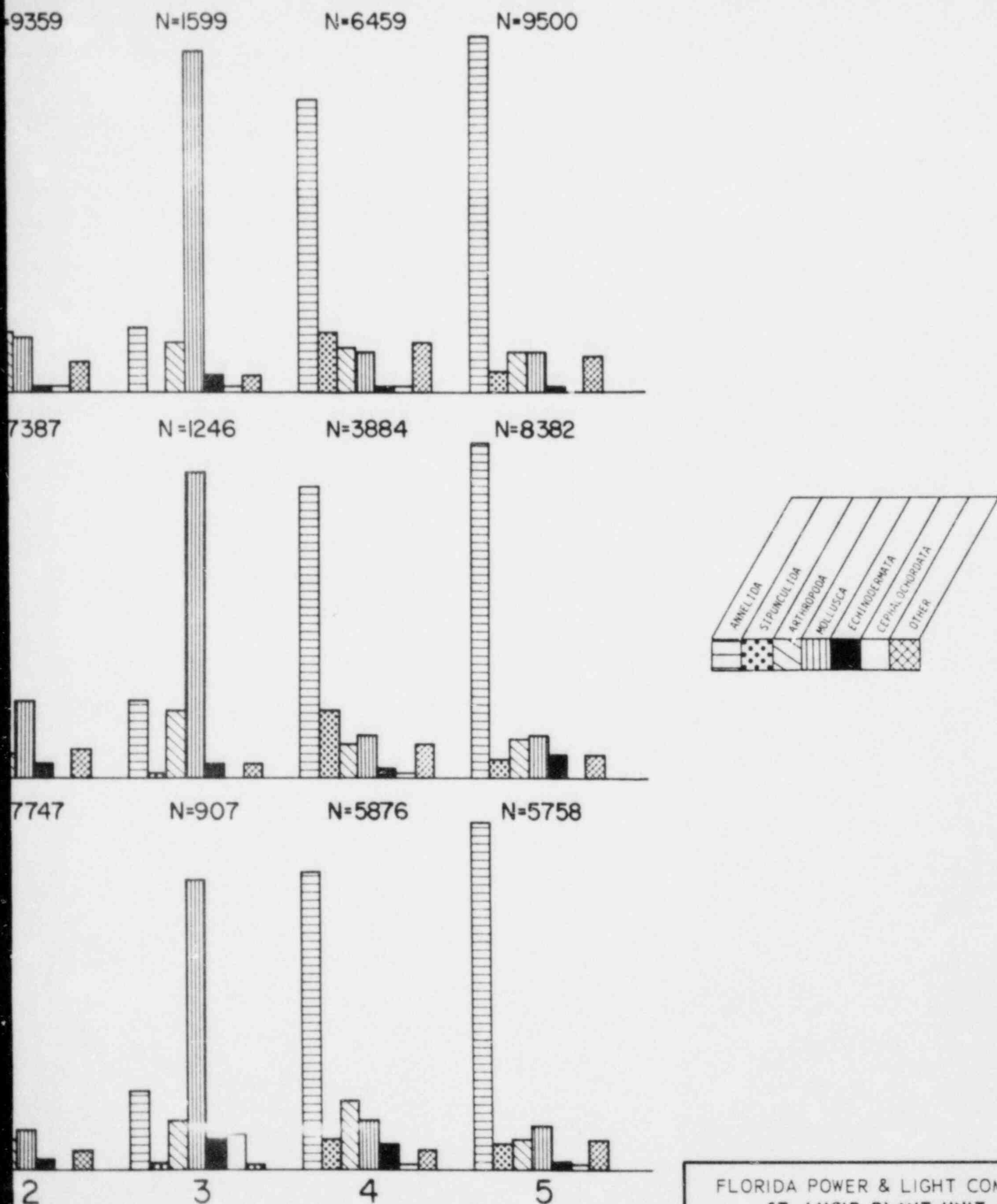
1976
STATION
0
1



FLORIDA POWER & LIGHT COMPANY

ST. LUCIE PLANT UNIT 2

DISTRIBUTION BY GROUP OF BENTHIC MACROINVERTEBRATES COLLECTED BY GRAB

FIGURE 2.2A-1

1976

	0	1	2	3	4	5
0						
1	.34					
2	.59	.21				
3	.05	.09	.07			
4	.58	.34	.88	.07		
5	:62	.23	.89	.07	.92	

1977

	0	1	2	3	4	5
0						
1	.44					
2	.17	.41				
3	.02	.07	.03			
4	.09	.38	.88	.04		
5	.26	.36	.66	.02	.70	

1978

	0	1	2	3	4	5
0						
1	.57					
2	.15	.19				
3	.03	.03	.02			
4	.17	.24	.88	.02		
5	.13	.19	.74	.01	.65	

.00 - .25

.26 - .50

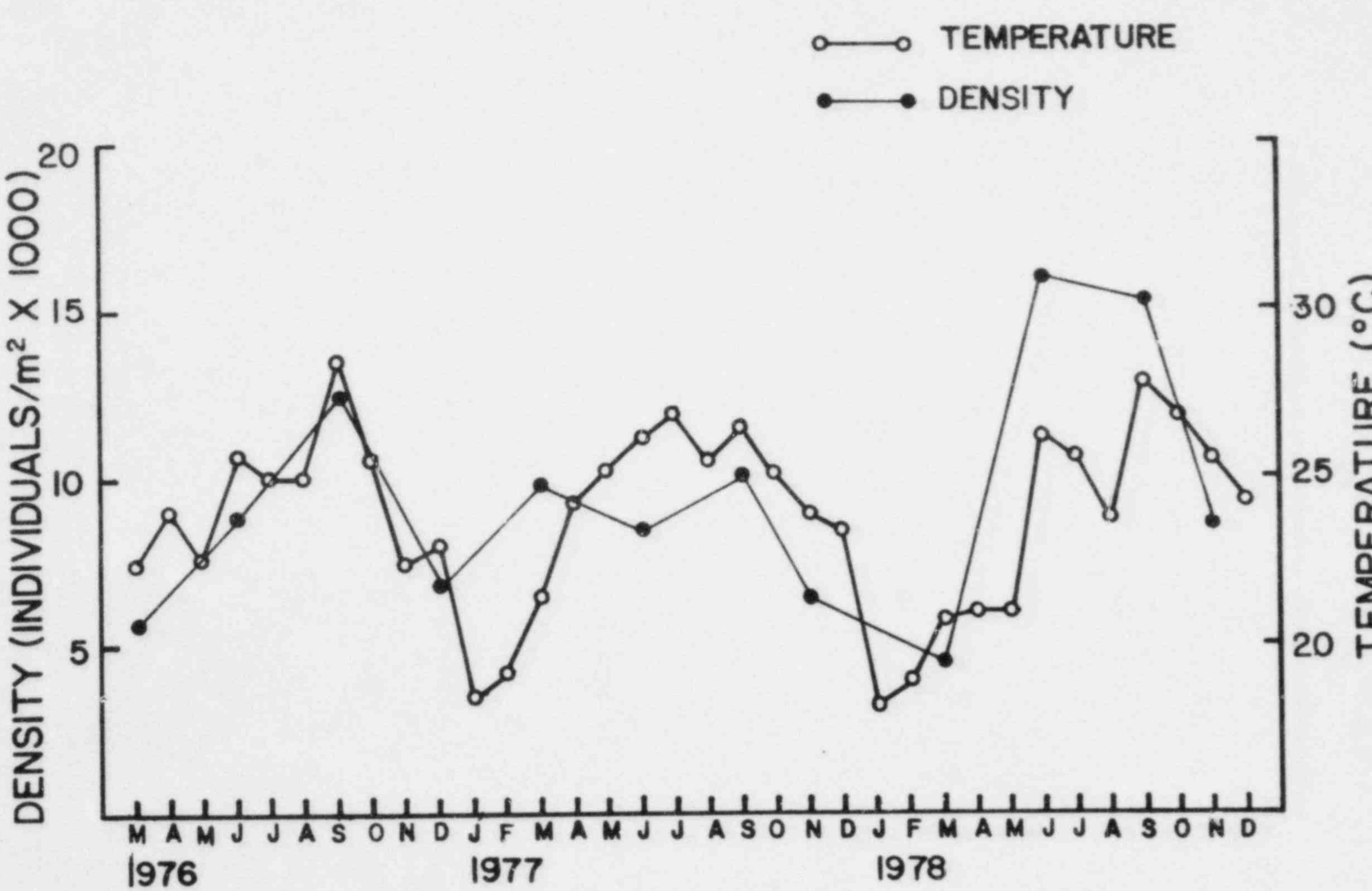
.51 - .75

.76 - 1.00

NOTE: ALL QUARTERS COMBINED FOR EACH YEAR.

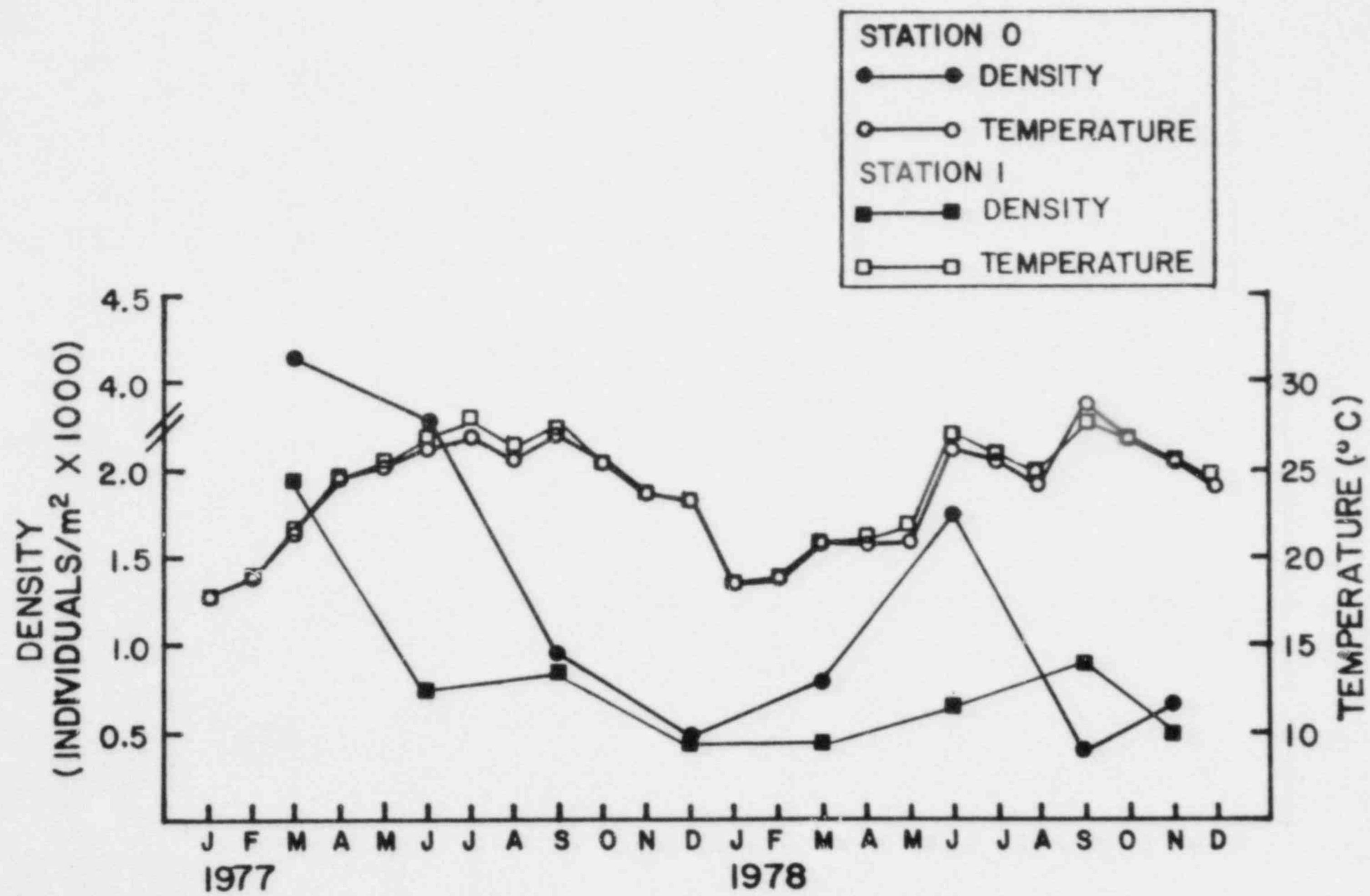
FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

MORISITA INDICES OF SIMILARITY BETWEEN OFFSHORE STATIONS BASED ON GRAB DATA
FIGURE 2.2A-2



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

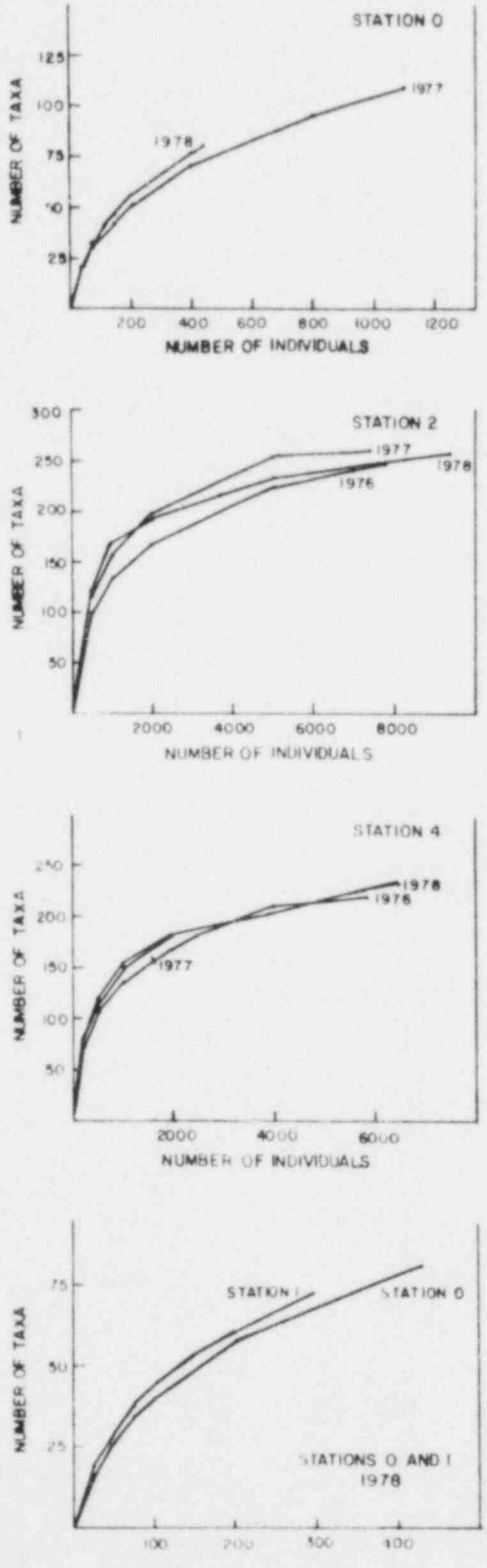
MEAN MO. BOTTOM TEMP. & MEAN DENSITY OF MACROINVERTEBRATES COLLECTED BY GRAB AT OFFSH. STA.
FIGURE 2.2A-3



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

MEAN MO. BOTTOM TEMP. & MEAN DENSITY OF MACROINVERTEBRATES COLLECTED BY GRAB AT STA. 0 & 1

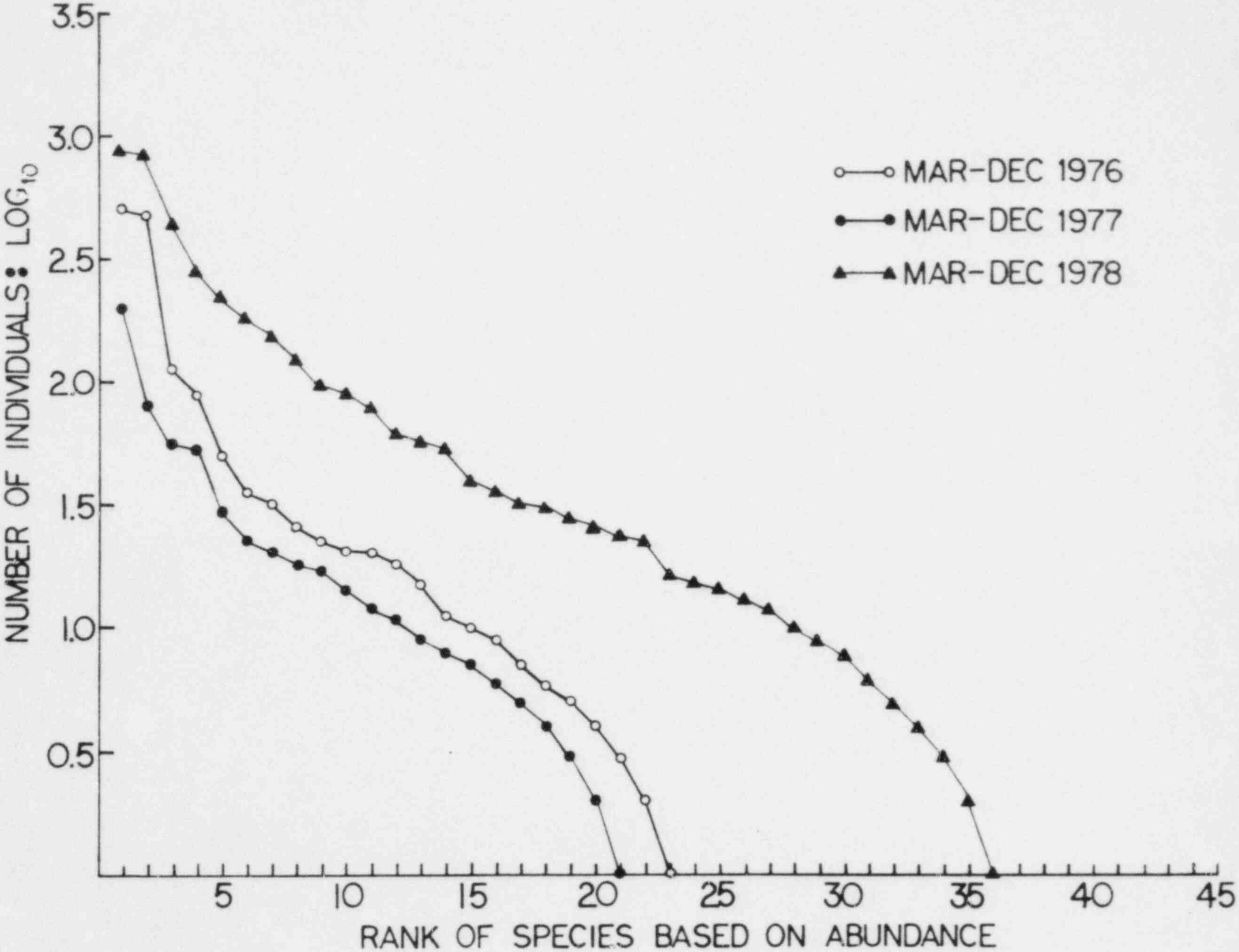
FIGURE 2.2A-4



NOTE: STATION 0 WAS MOVED IN MARCH 1976 AND DATA FOR THAT YEAR ARE EXCLUDED.

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

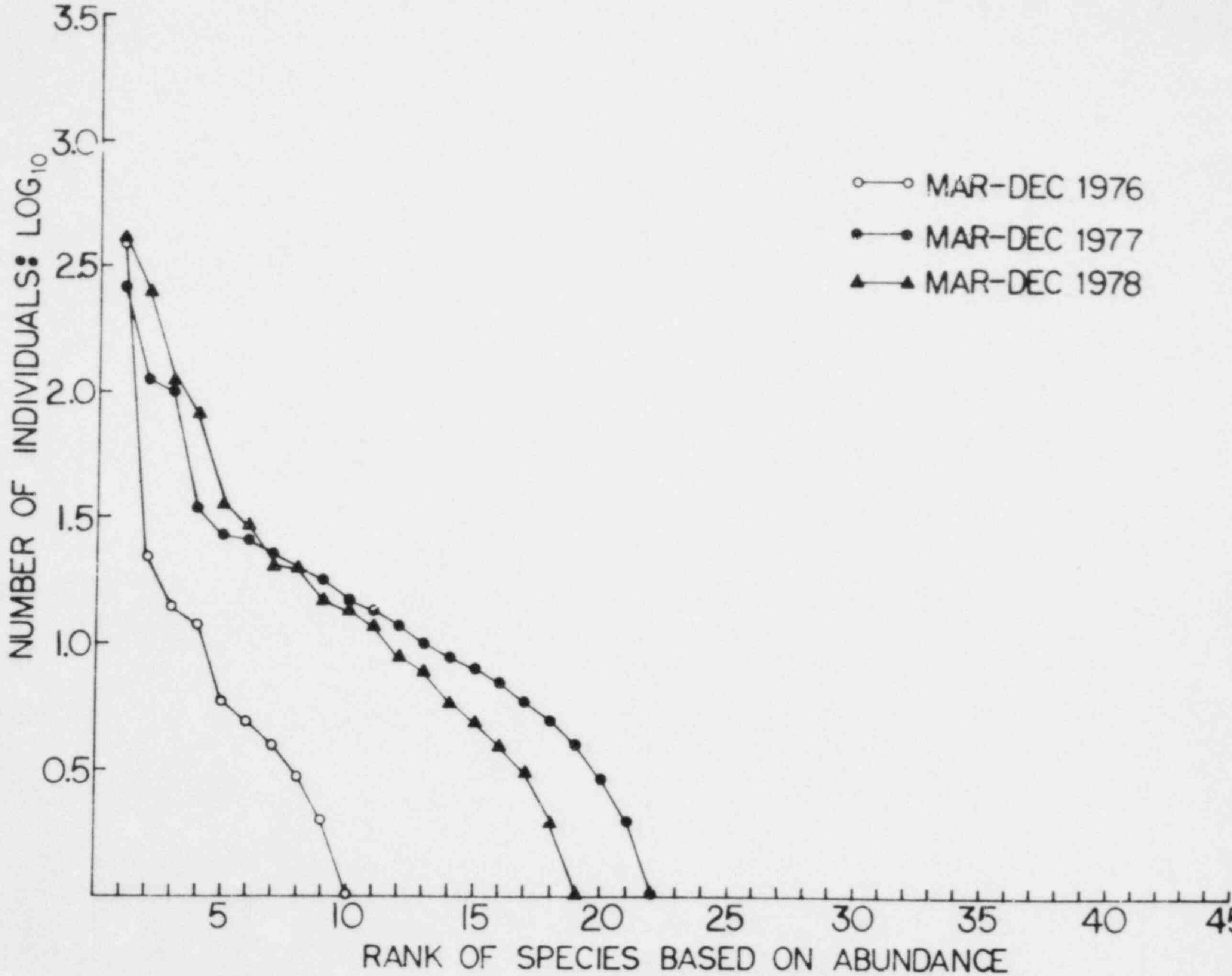
RAREFACT'N CURVES FOR OFFSH. GRAB SAMPL. STA. INDICATING NO. EXPECTED TAXA FOR VARIOUS POP. LEVELS OF BENTHIC MACROINVERTEBRATES
FIGURE 2.2A-5



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

DOMINANCE-DIVERSITY CURVES FOR TRAWL COLLECTIONS AT STATION 0

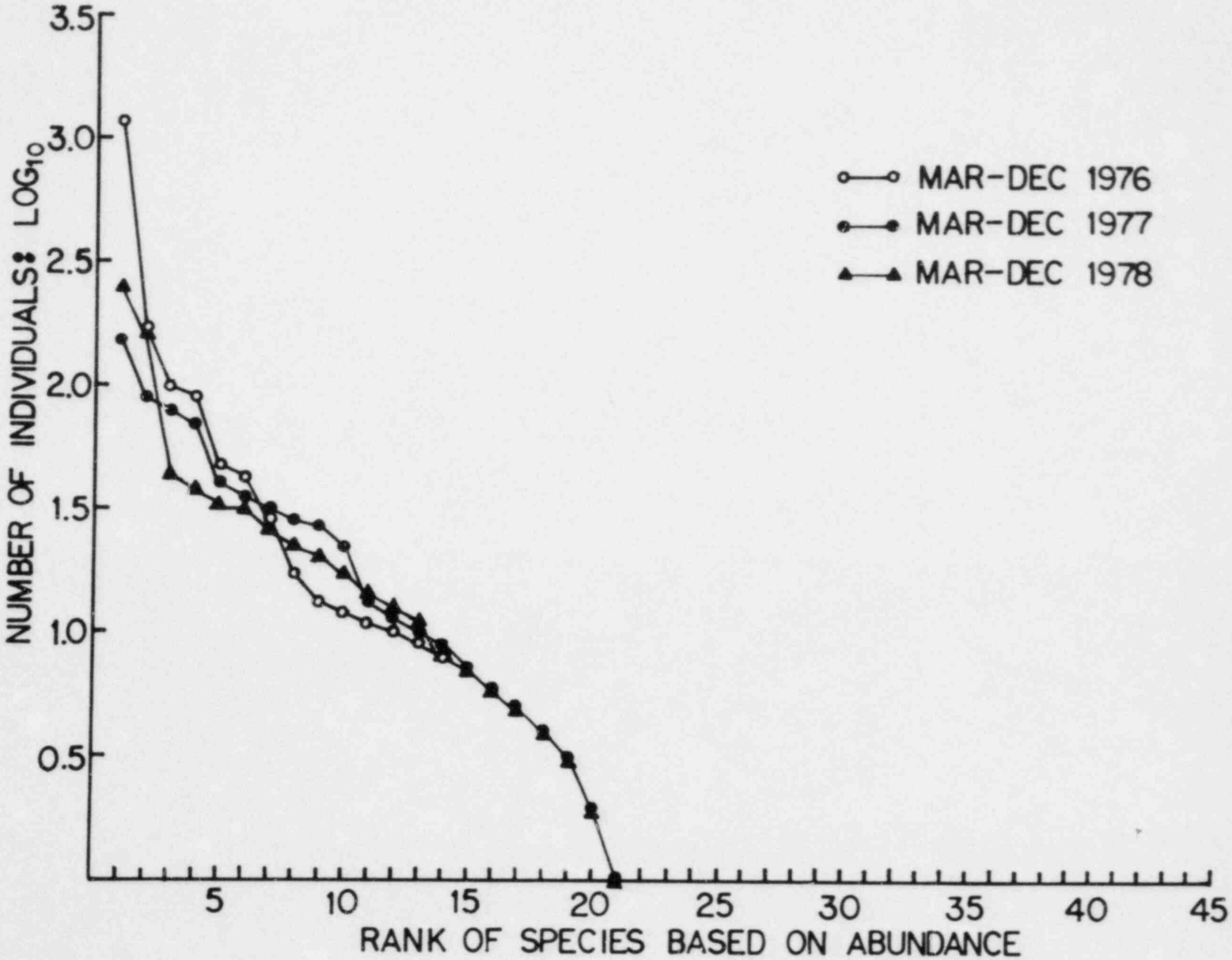
FIGURE 2.2A-6



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

DOMINANCE-DIVERSITY CURVES FOR TRAWL COLLECTIONS AT STATION 1

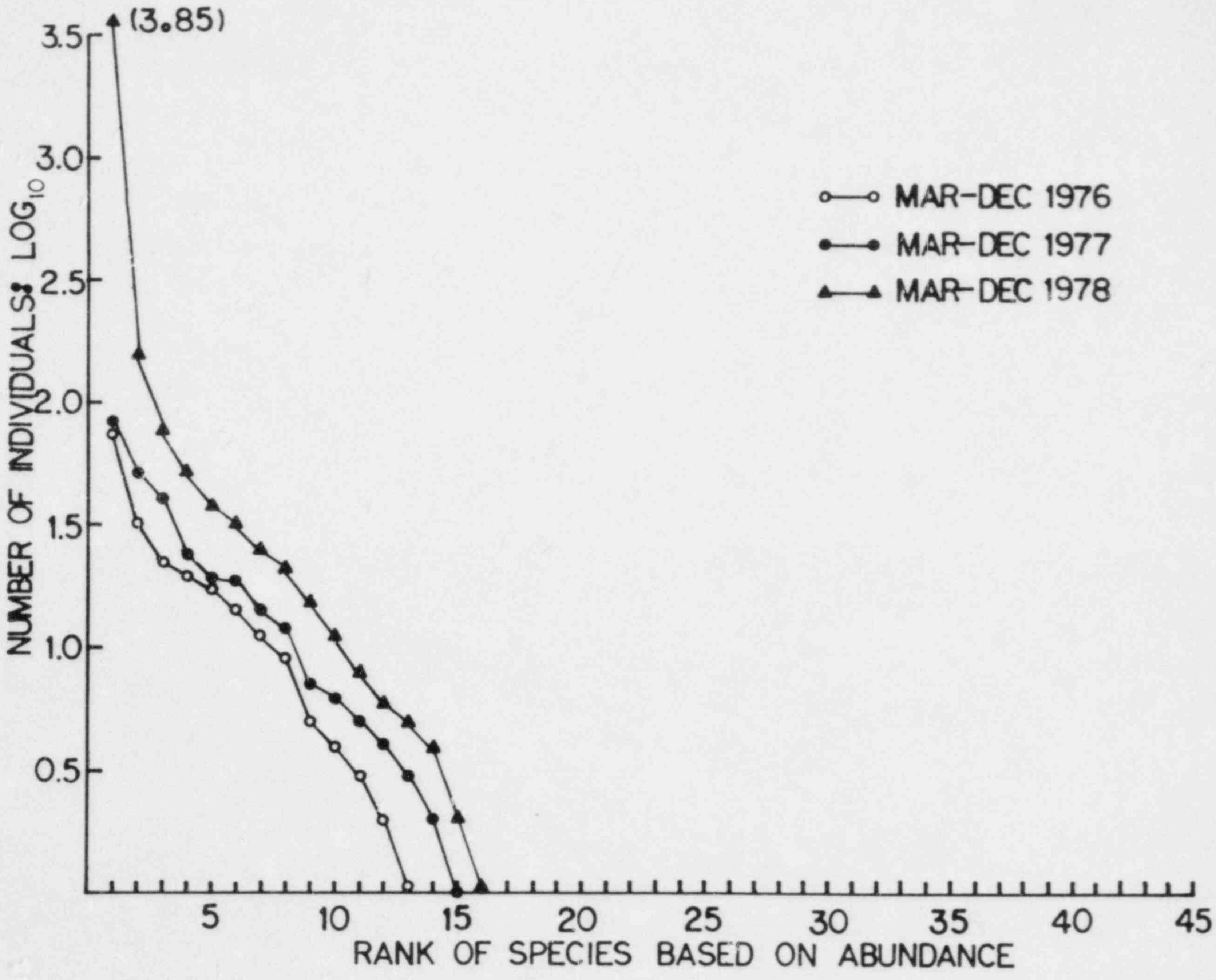
FIGURE 2.2A-7



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

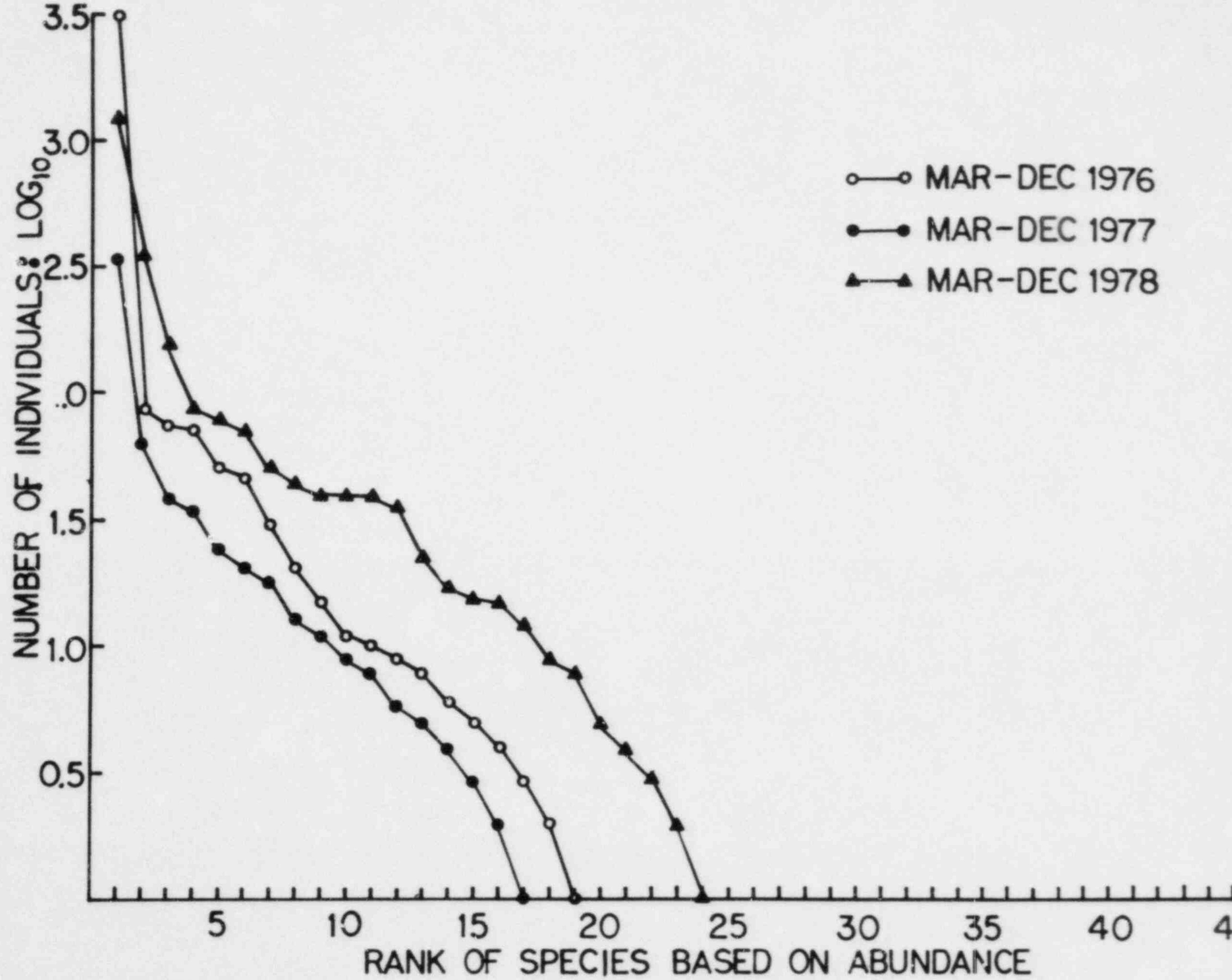
DOMINANCE-DIVERSITY CURVES FOR TRAWL COLLECTIONS AT STATION 2

FIGURE 2.2A-8



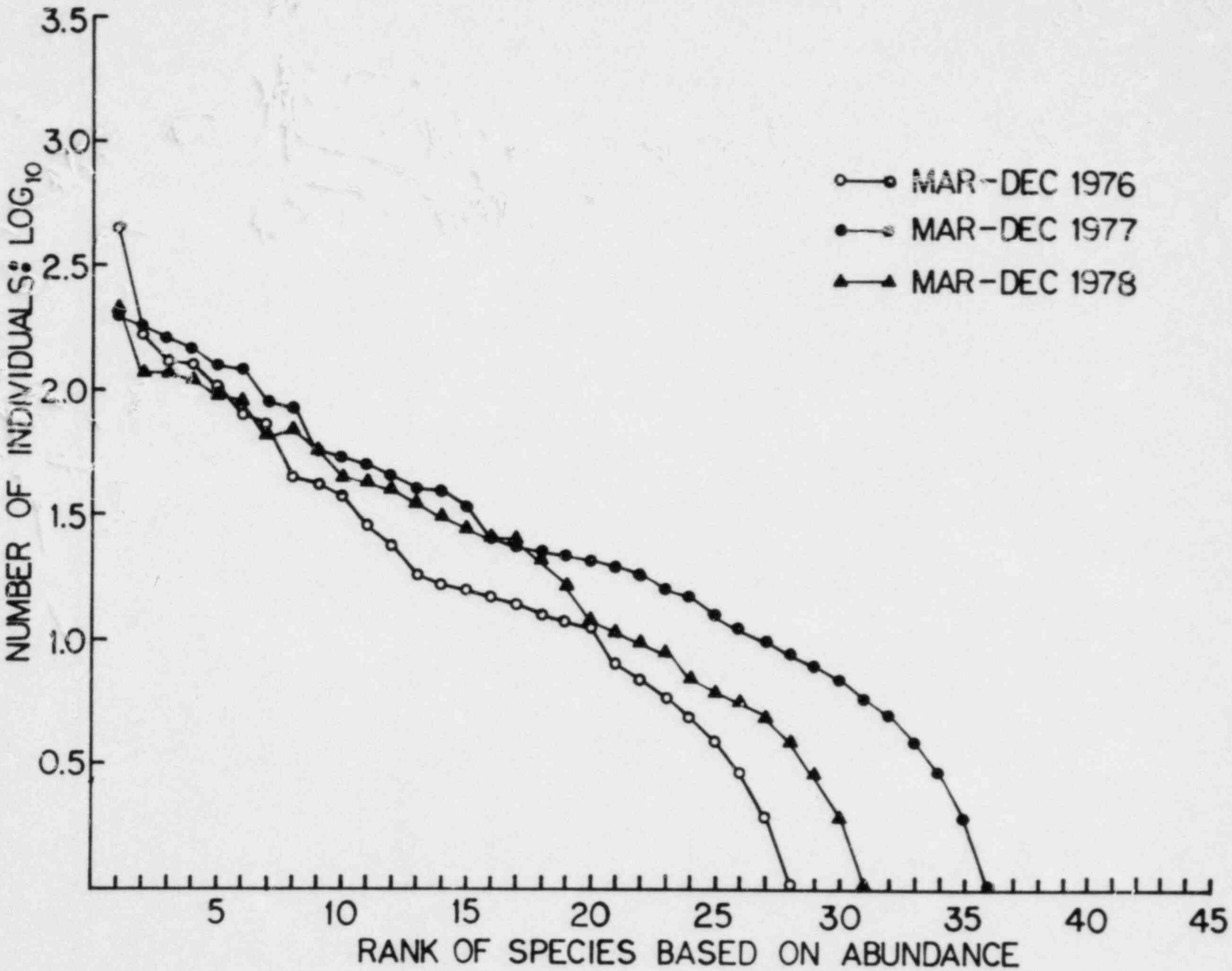
FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

DOMINANCE-DIVERSITY CURVES FOR TRAWL COLLECTIONS AT STATION 3
FIGURE 2.2A-9



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

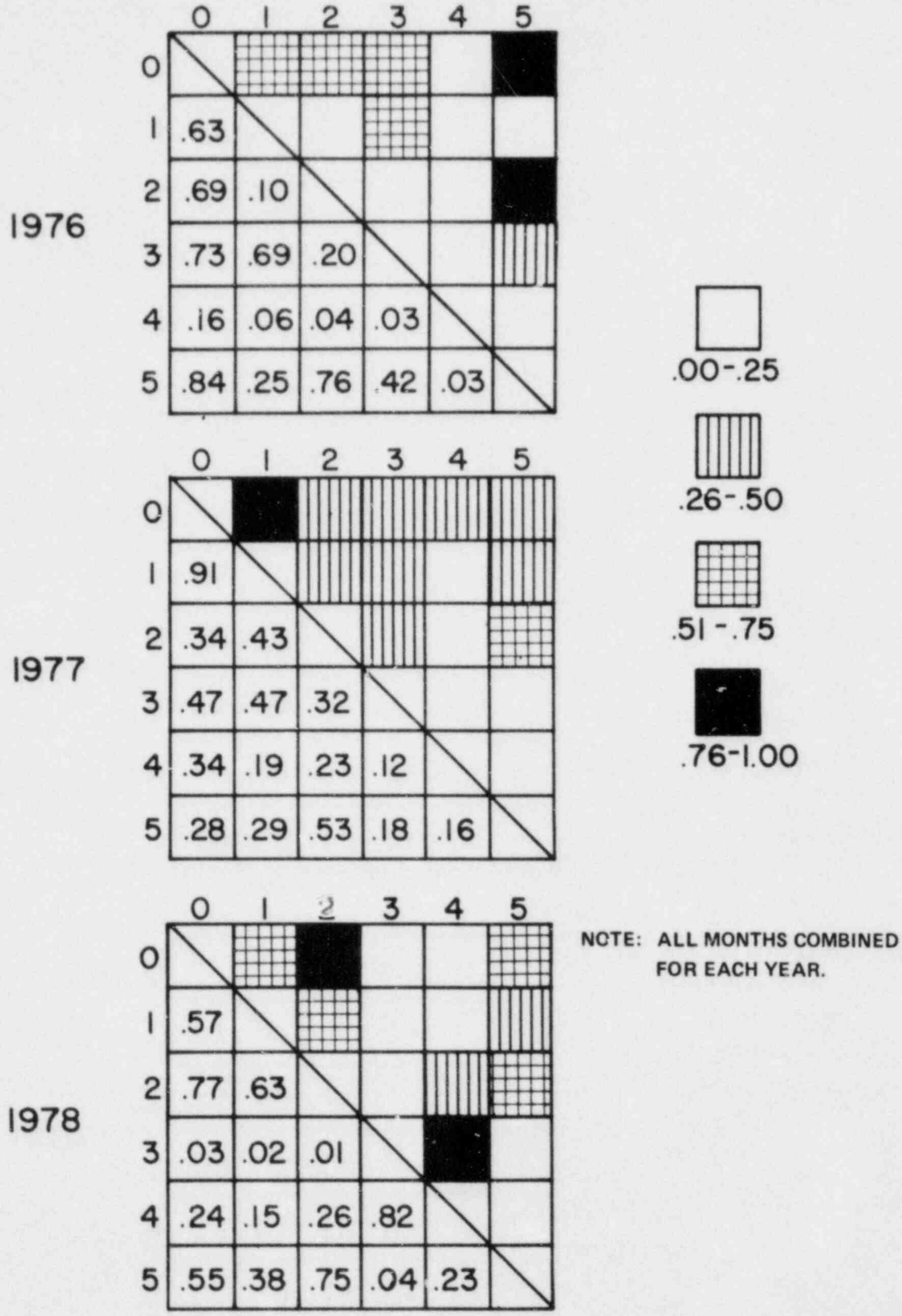
DOMINANCE-DIVERSITY CURVES FOR TRAWL COLLECTIONS AT STATION 4
FIGURE 2.2A-10



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

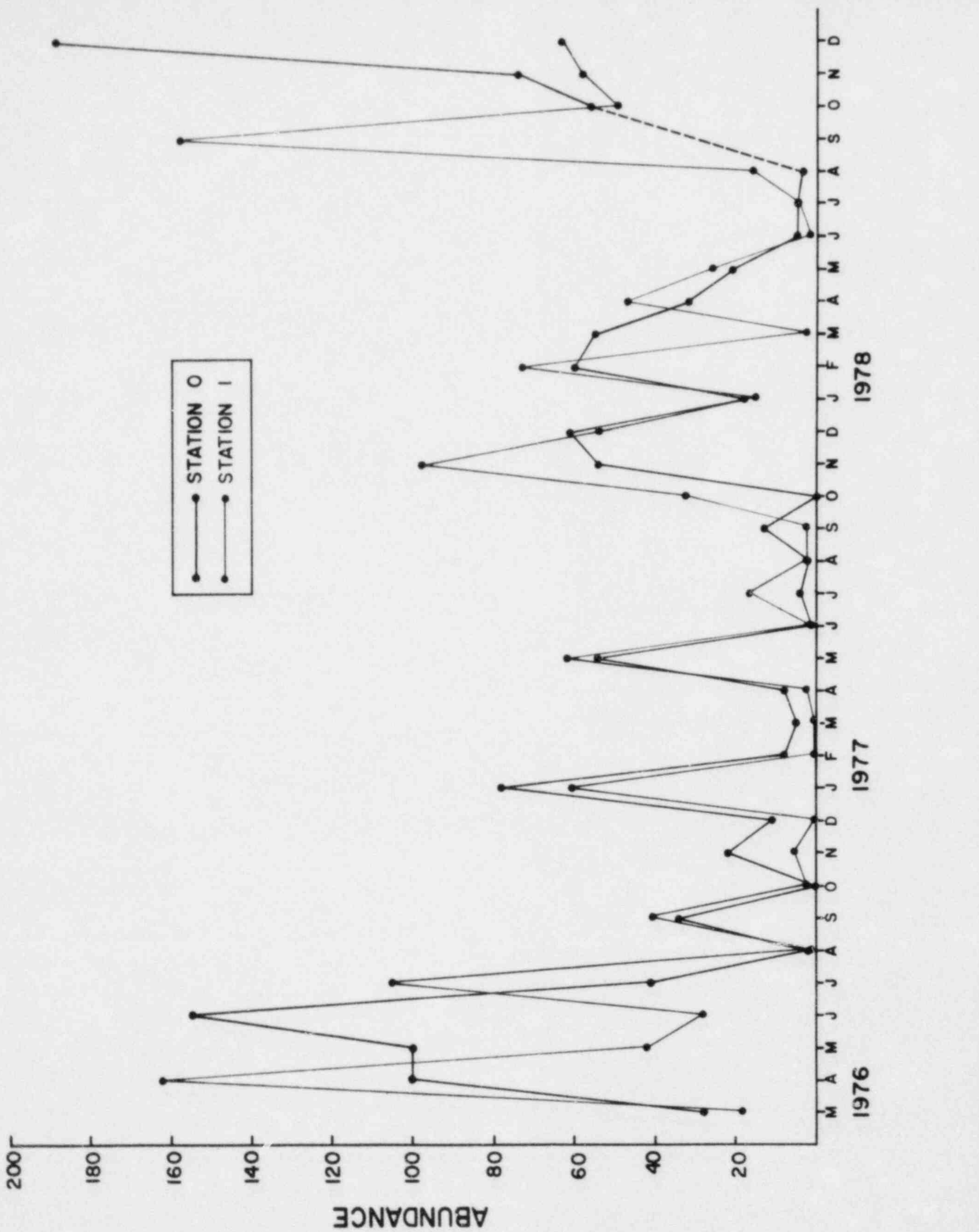
DOMINANCE-DIVERSITY CURVES FOR TRAWL COLLECTIONS AT STATION 5

FIGURE 2.2A-11



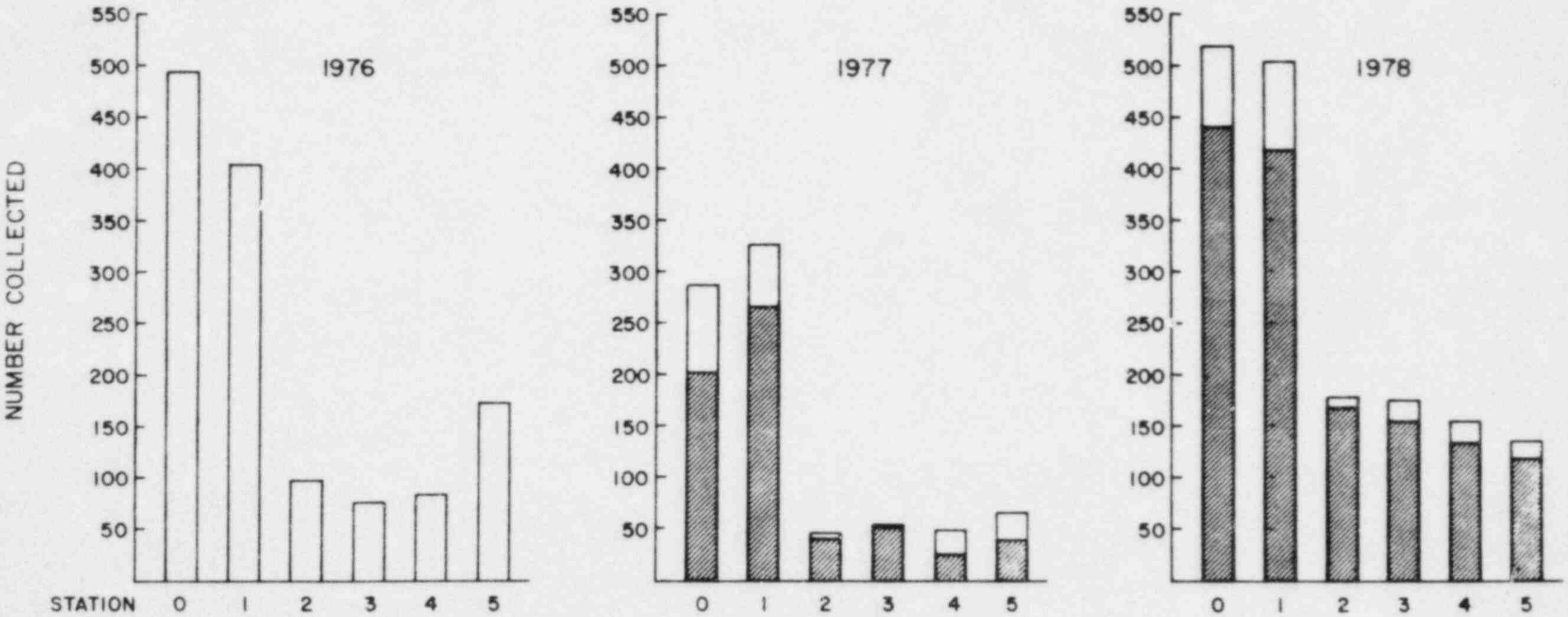
FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

MORISITA INDICES OF SIMILARITY BETWEEN OFFSHORE STATIONS BASED ON TRAWL DATA
FIGURE 2.2A-12



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

MO. ABUND. OF TRACHYPENAEUS CONSTRICTUS IN TRAWL COLLECTIONS AT STATIONS 0 & 1
FIGURE 2.2A–13

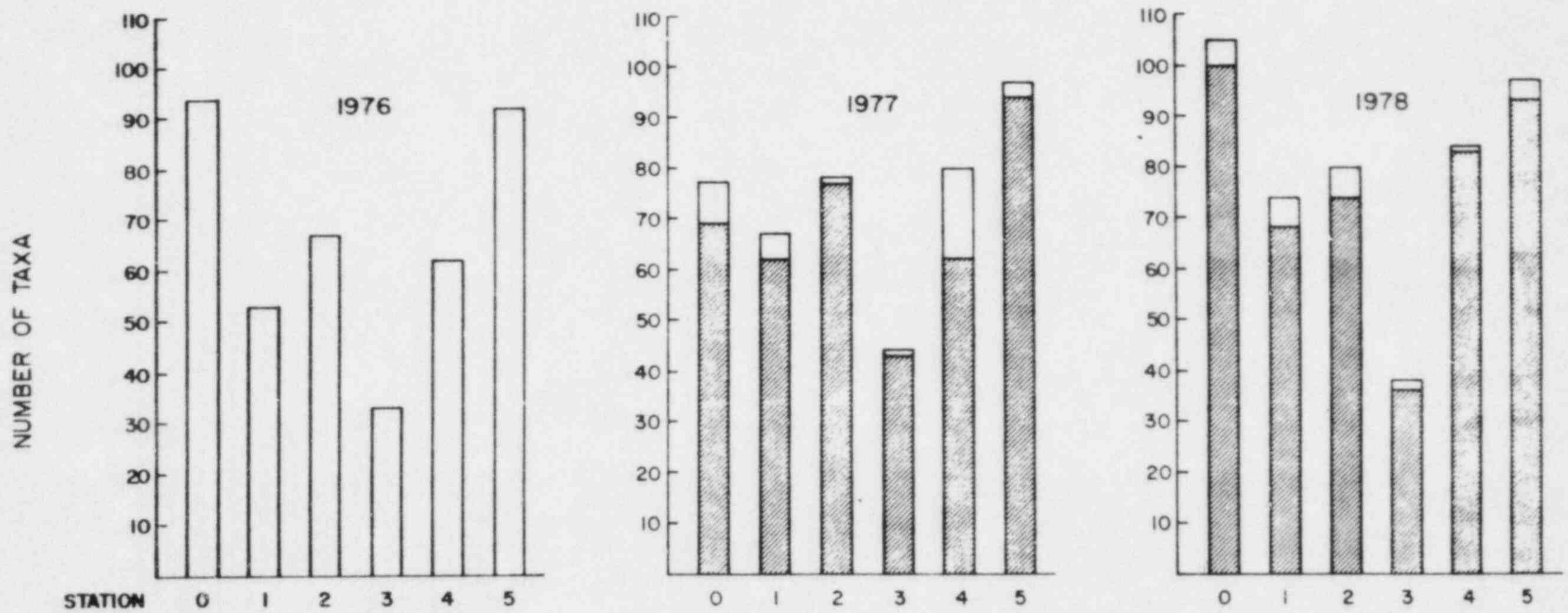


NOTE: 1. 1976: MARCH THROUGH DECEMBER
2. 1977 & 1978: ALL MONTHS (MARCH THROUGH DECEMBER ARE SHADED FOR COMPARISON WITH 1976)

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

ABUNDANCE OF TRACHYPENAEUS CONSTRICTUS IN TRAWL COLLECTIONS OF ALL MONTHS COMBINED

FIGURE 2.2A-14



NOTE: SEE NOTES IN FIGURE 2.2A-14

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

TOT. NC. OF MACROINVERTEBRATE TAXA COLLECTED BY OTTER TRAWL AT EACH OFFSHORE STATION

FIGURE 2.2A-15

TWO DIGIT TABLE OF CONTENTS

TWO DIGIT TABLE OF CONTENTS (Cont'd)

TWO DIGIT TABLE OF CONTENTS (Cont'd)

2.3 METEOROLOGY

2.3.1 REGIONAL CLIMATOLOGY

2.3.1.1 General Climate

The subtropical marine type climate of the St Lucie site is dominated by the presence of the Azores-Bermuda high pressure system[1]. Characteristic features are long, warm summers with abundant rainfall followed by mild, relatively dry winters. The high frequency of onshore winds and the proximity of the warm waters of the Gulf Stream result in warm, humid conditions during most of the year. The average annual relative humidity is approximately 73 percent. Temperatures in excess of 90°F typically occur on about 45 days a year, but summer heat is tempered by sea breezes along the coast and by frequent afternoon or early evening thundershowers. During the winter, the area is occasionally subjected to an outbreak of cold, continental air. This air mass is usually rapidly moderated with the result that subfreezing temperatures rarely occur in the area.

The annual average precipitation along the lower east coastal division of Florida, following the NOAA grouping scheme[2], exceeds 59 inches and is unevenly distributed throughout the year. Generally, the highest rainfall amounts occur between June and October in association with thunderstorms or the passage of hurricanes; a distinct dry period occurs from November through March. The maximum 24 hour precipitation recorded in the area was 15.23 inches during a storm on April 17, 1942[3]. Measurable snow or frozen precipitation during the wintertime is unusual for Florida[4], however, a trace was noted in January 1977[3]. Although rainfall amounts are relatively large, the site area is not immune to droughts. Between July 1970 and June 1971, the Lower East Coast Division of Florida experienced a record low 12 month rainfall of 34.59 inches with the result that the worst drought in that region in over 40 years occurred in 1971. The level of Lake Okeechobee dropped to 10.3 feet, only 0.2 feet above the record minimum of 10.1 feet[5].

Wind speeds along coastal areas are fairly high, and generally average over nine mph[3]. Prevailing directions are ill defined resulting from mesoscale influences such as land and sea breezes along shore and by convectional forces inland; in general, northerly component winds dominate in winter and southerly component winds dominate in summer[4].

Severe weather in the St Lucie site area is not uncommon. Table 2.3-1 summarizes the average monthly and annual thunderstorm days recorded at West Palm Beach during the period 1943-1974. Thunderstorms occur on an average of 79 days a year[3] and are most frequent during the months of July and August.

Severe thunderstorms are occasionally accompanied by locally high winds and hail. Between 1955 and 1967, 116 cases of surface hailstorms (hail 3/4-inch diameter or larger) were reported; 32 of these had hail with diameters greater than 1-1/2 inches[6]. The one degree latitude-longitude square in which the site is located experienced a total of three hailstorms during the same period[6]. The average monthly and annual distributions of hailstorms for the state are given in Table 2.3-1.

Tornadoes, funnel clouds and waterspouts have occurred during all seasons in southeastern Florida, but are most frequent during spring and summer. In the one degree latitude-longitude square in which the site is located a total of 36 tornadoes were reported over the period 1955-1967 which indicates a mean annual tornado frequency of 2.8 in the one degree square[6]. The mean seasonal and annual number of tornadoes which have occurred in the state of Florida during that period are as follows[6]:

Season	Frequency (Tornadoes/Yr)
Spring	9.0
Summer	15.1
Autumn	6.3
Winter	4.5
Annual	34.9

Table 2.3-2 presents the monthly distribution of waterspouts which have occurred within 25 miles offshore and along a 200 mile zone centered at St Lucie during the period 1952-1973. Of the 178 waterspouts identified in this table, only 11 were reported to migrate inland[7]. Their worst reported damage was in the "weak tornado" category (estimated wind speeds of 72-112 mph), as defined by Fujita[8].

Florida, because of its location between the subtropical Atlantic and the Gulf of Mexico, is often exposed to storms of tropical origin. Known as tropical cyclones, these storms are classified according to their stages of development as follows[9]:

Classification	Highest Sustained Wind Speed Range (mph)
Tropical depression	39
Tropical storm	39-73
Hurricane	73

During the period 1900-1963, the Florida Peninsula has been affected by 65 tropical cyclones. Of these, 25 were classified as hurricanes, 33 as tropical storms and seven as tropical depressions[10]. The monthly and annual distribution of tropical cyclones affecting the Florida Peninsula is presented in Table 2.3-3. Roughly half the storms in each category passed close enough to the St Lucie site to affect it with strong winds and/or heavy rainfall. Hurricane occurrence is most frequent during September and October in the site area with paths generally toward the west-northwest. The worst hurricane in recent times in the site region occurred in August 1949. Winds at West Palm Beach reached 110 mph with gusts to 125 mph before the anemometer was blown away. The highest one-minute wind speed was estimated at 120 mph with gusts to 130 mph[5].

Meteorological conditions conducive to high air pollution potential are infrequent in southeastern Florida. The warm waters of the adjacent Gulf Stream current, located a few miles offshore, inhibit the formation of strong persistent low-level inversions while instability during the day is aided by strong insolation. Along the immediate coastline and areas such as Hutchinson Island, well developed sea breeze conditions result in persistent, slightly stable onshore flow.

Between August 1, 1960, and April 3, 1970, there were no high air pollution potential days according to data given in the State of Florida Air Implementation Plan[11]. Air pollution potential criteria for meteorological conditions that have potential to develop into an episode[12,13] were followed in the above assessment.

Tables 2.3-4 and 2.3-5 present the Florida and National Ambient Air Quality Standards and existing air quality conditions in Fort Pierce, Florida; these levels were based on available data between 1975 and 1977. Existing levels of SO_2 and NO_2 are well below state and federal standards; total suspended particulate concentrations, however, indicated three excursions of the standards during this period. The maximum 24 hour concentration (248 mg/m^3) at the N7th St. location in 1977 was believed to be caused by the operation of a hospital incinerator nearby[14].

2.3.2 LOCAL METEOROLOGY

The site characteristics described in this section are based on long term National Weather Service records[3] from West Palm Beach, Florida, and short term onsite data collected from the St Lucie meteorological tower between September 1, 1976 and August 31, 1978.

2.3.2.1 Winds

Table 2.3-6 summarizes long term monthly and annual average wind data for West Palm Beach. In general, average wind speeds are in excess of seven mph and the prevailing wind regime exhibits northerly component winds during the winter months shifting to more southerly directions during the summer. The mean annual wind speed is 9.4 mph and the prevailing direction is from the east-southeast. Local winds of higher speed and short duration occur on occasion in connection with thunderstorms or the passage of cold fronts. The peak "fastest-mile" wind speed recorded between 1959 and 1977 was 86 mph in August 1964.

Table 2.3-7 presents a summary of the lower level (ten meter) onsite winds recorded at the St Lucie meteorological tower. The average annual wind speed is 6.9 mph and the prevailing direction is from the southeast. The maximum hour averaged wind speed recorded during the two year period was 30.0 mph. Diurnally, offshore winds generally prevail during the night and early morning while onshore winds are prevalent during the remainder of the day. The mean wind conditions predominant at the St Lucie site are summarized by Pasquill stability in Tables 2.3-8 through 2.3-11 for speed and direction, the two sensor heights, and the two years of data. The joint frequency tables from which the summaries were compiled are found under separate cover[16].

2.3.2.2 Temperature and Atmospheric Water Vapor

Table 2.3-12 provides a summary of long term average temperatures and relative humidity and extreme temperatures at West Palm Beach. The mean daily maximum temperature during the warmest month, August, is 90.2°F;

January, the coldest month has a mean daily minimum temperature of 55.9°F. The mean annual temperature is 74.5°F. The mean diurnal range, the difference between the mean daily maximum temperature (83.0°F) and the mean daily minimum temperature (66.0°F) is 17.0°F. The highest temperature on record between 1937 and 1977 is 101.0°F in July 1942; the coldest is 27.0°F in January 1977. The average annual relative humidity is 73.3 percent[3].

At the St Lucie site the average temperature during the two year period was 72.5°F and the diurnal range was 9.8°F. The mean daily maximum and minimum temperatures during the warmest (July) and coldest months (January) were 85.5°F and 51.3°F, respectively. The highest temperature recorded on-site was 99.8°F; the lowest was 28.4°F. Average monthly relative humidities exceeded 60 percent throughout the year. The average annual relative humidity was 71.6 percent; the mean annual dewpoint was 62.6°F. Table 2.3-13 presents a summary of the on-site data; a compilation of the diurnal statistics, means, and extremes is available elsewhere[10].

2.3.2.3 Precipitation

West Palm Beach has a mean annual precipitation of 62.06 inches[3]. A major portion of the rainfall occurs between June and October in association with "local" showers and thunderstorms. Precipitation equal to or greater than 0.01 inches occurs on an average of 131 days a year and most frequently during the rainy season. The greatest 24 hour precipitation on record between 1938 and 1977 was 15.23 inches in April 1942. Snow rarely occurs in this region, although a trace was noted in January 1977. Monthly and annual precipitation totals and greatest 24 hour rainfall totals are summarized for West Palm Beach in Table 2.3-14.

Table 2.3-15 presents a summary of onsite precipitation data. The site averaged 31.58 inches of precipitation annually with maximum monthly amounts in excess of four inches occurring during August and September. A compilation of rainfall frequency and duration and precipitation wind roses are presented elsewhere[16].

2.3.2.4 Fog and Smog

Table 2.3-16 presents heavy fog data for West Palm Beach. On average, there are eight days a year when heavy fog occurs and these are mainly confined to the months between October and April.

Although no onsite fog or smog data are available, West Palm Beach data are representative for the site.

2.3.2.5 Stability

Studies by Holzworth indicate that for the eastern coast of Florida, unstable conditions (Pasquill stability Classes A, B, C) occur on the order of 16-25 percent of the time, neutral conditions (D) and stable conditions (E, F, G) both occur of the order of 36-45 percent of the time[15].

Tables 2.3-17 and 18 summarize onsite stability frequencies on a monthly and annual basis for the two year period; these frequencies are based on a joint occurrence with valid wind parameters for the referenced height. Between September 1976 and August 1978 the distribution of atmospheric stability categories was as follows: unstable, 20 percent; neutral, 30 percent; and stable, 50 percent. This indicates that the site is prone towards stable conditions. Tables 2.3-19 to 2.3-21 present onsite persistence of inversion conditions and indicate that there were three cases during the period when stable conditions existed for more than 15 consecutive hours. Table 2.3-22 summarizes mean monthly morning and afternoon mixing heights at Miami, Florida.

2.3.2.6 Potential Influence of the Plant and Its Facilities on Local Meteorology

The site area and the surrounding five mile radius terrain is essentially flat with elevations not exceeding 25 feet. The highest elevation within a 50 mile radius is 75 feet and is located to the west-northwest of the site. The only major geographic feature between the north-northwest and south-southeast sectors is the Atlantic Ocean. Topographic maps of the area within a radius of five and 50 miles are provided as Figures 2.3-1 and 2.3-2, respectively. The relatively flat terrain makes topographic cross-sections of little importance, thus they are not provided.

The presence and operation of the plant is not expected to exert a modifying influence on the normal and extreme meteorological conditions in the area.

SECTION 2.3: REFERENCES

1. U.S. Dept. of Commerce, 1976. Climatography of the U.S. No. 20 - Climate of Fort Pierce, Florida, NOAA, Environmental Data Service.

2. U.S. Dept. of Commerce, 1977. Climatological Data - Annual Summary Florida, NOAA, Environmental Data Service.

3. U.S. Dept. of Commerce, 1977. Local Climatological Data - Annual Summary with Comparative Data, West Palm Beach, Florida, NOAA, Environmental Data Service.

4. U.S. Dept. of Commerce, 1977. Climatography of the United States No. 60-8, Climate of Florida, NOAA, Environmental Data Service.

5. U.S. Dept. of Commerce, 1959. Climatography of the United States No. 60-8, Climate of the States - Florida, NOAA, Environmental Data Service.

6. Pautz, M.E., 1969. Severe Local Storm Occurrences, 1955-1967, Weather Bureau Office of Meteorological Operations, Weather Analysis and Prediction Division.

7. U.S. Dept. of Commerce, 1952-1973. Storm Data, NOAA, Environmental Data Service.

8. Fujita, T.T., 1971. Characterization of Hurricanes & Tornadoes by Area and Intensity, SMRP No. 92.

9. Alaka, M.A., 1968. Climatology of Atlantic Tropical Storms and Hurricanes, U.S. Dept. of Commerce, ESSA Technical Report WB-6.

10. Cry, G.W., 1965. Tropical Cyclones of the North Atlantic, U.S. Dept. of Commerce, Weather Bureau Technical Paper No. 55.

11. Florida Dept. of Pollution Control, 1972. State of Florida Air Implementation Plan, Tallahassee, Florida.

12. Stackpole, J.D., 1967. The Air Pollution Potential-Forecast Programs U.S. Dept. of Commerce, Weather Bureau, Technical Memorandum, WBTM-NMC 43.

13. Gross, E., 1970. The National Air Pollution Potential Forecast Program, U.S. Dept. of Commerce, ESSA, Technical Memorandum, WBTM NMC 47.

14. Hodges, M. 1978. Florida Dept. of Environmental Regulations, Personal Communication.

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15. Doty, S.R., Holzworth, G.C., Wallace, B.L., 1976. A Climatological Analysis of Pasquill Stability Categories Based 'STAR' Summaries, U.S. Environmental Protection Agency, ESRL, Research Triangle Park, N.C.

16. Florida Power & Light Co., 1978. Meteorological Data Summaries - St Lucie Meteorological Tower 1976-1978.

TABLE 2.3-1

AVERAGE MONTHLY AND ANNUAL THUNDERSTORM STATISTICS

Month	West Palm Beach, Florida Average Number of Thunderstorm Days[(a)] (1943-1974)[1]	State of Florida Average Number of Surface Hail Occurrences[(b) 2] (1955-1967)
January	1	0.0
February	1	0.1
March	2	1.2
April	3	1.5
May	8	2.5
June	13	1.8
July	16	1.2
August	16	0.2
September	11	0.3
October	5	0.2
November	1	0.1
December	1	0.0
Annual	79	8.9

(a) Defined as day on which thunder is heard at station.
(b) 3/4-inch diameter and larger.

Reference: (1) U.S. Dept. of Commerce, 1977, Local Climatological Data - Annual Summary with Comparative Data: West Palm Beach, Florida, NOAA Environmental Data Service.

(2) Pautz, 1969, Severe Local Storm Occurrences, 1955-1967, Weather Bureau, Office of Meteorological Operations, Weather Analysis & Prediction Division, WBTM FCST 12.

TABLE 2.3-2

MONTHLY DISTRIBUTION OF WATERSPOUTS
WITHIN 25 MILES OFFSHORE

Month	Total
January	6
February	5
March	8
April	4
May	14
June	16
July	51
August	19
September	30
October	17
November	7
December	1
TOTAL	178

Reference: U.S. Dept of Commerce, 1952-1973, Storm Data, NOAA, Environmental Data Service.

TABLE 2.3-3

MONTHLY DISTRIBUTION OF TROPICAL CYCLONES
AFFECTING THE FLORIDA PENINSULA
(1900-1963)

Month	Hurricanes	Tropical Storms	Tropical Depressions	Total
January	0	0	0	0
February	0	1	0	1
March	0	0	0	0
April	0	0	0	0
May	0	1	0	1
June	2	2	2	6
July	2	3	1	6
August	3	9	2	14
September	10	5	1	16
October	7	9	1	17
November	1	2	0	3
December	0	1	0	1
Annual	25	33	7	65

Reference: Cry, G.W., 1965, Tropical Cyclones of the North Atlantic Ocean, U.S. Dept. of Commerce, Weather Bureau Technical Paper No. 55.

TABLE 2.3-4

STATE OF FLORIDA AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Standard
Particulate Matter	
Annual Geometric Mean	60 $\mu g/m^3$
Maximum 24-Hour Concentration*	150 $\mu g/m^3$
Sulfur Oxides	
Annual Arithmetic Mean	60 $\mu g/m^3$
Maximum 24-Hour Concentration*	260 $\mu g/m^3$
Maximum 3-Hour Concentration*	1300 $\mu g/m^3$
Carbon Monoxide	
Maximum 8-Hour Concentration*	10 mg/m^3
Maximum 1-Hour Concentration*	40 mg/m^3
Photochemical Oxidants	
Maximum 1-Hour Concentration*	160 $\mu g/m^3$
Hydrocarbons	
Maximum 3-Hour (6-9 am) Concentration*	160 $\mu g/m^3$
Nitrogen Oxides	
Annual Arithmetic Mean	100 $\mu g/m^3$

*Not to be exceeded more than once a year

Reference: Bureau of National Affairs, 1977, Environmental Reporter - State Air Laws, 346:0513

TABLE 2.3-5

AVAILABLE AIR QUALITY MONITORING DATA
AT FORT PIERCE, FLORIDA

Nitrogen Dioxide ($\mu g/m^3$)

Standards: Annual Arithmetic Mean 100 $\mu g/m^3$

Location	1975 Ann. Ave.	1976 Ann. Ave.	1977 Ann. Ave.
Fort Pierce			
S 6th St.	15	24	26

Sulfur Dioxide ($\mu g/m^3$)

Standards: Maximum 3-Hour 1300 $\mu g/m^3$
Maximum 24-Hour 260 $\mu g/m^3$
Annual Arithmetic Mean 60 $\mu g/m^3$

Location	1976 Max. 24-hr.	1976 Ann. Ave.	1977 Max. 24-hr.	1977 Ann. Ave.
Fort Pierce				
S 6th St.	63	8	18	6
Boston Ave.	3	3	6	3
N 7th St.	7	3	14	3
Seaway Drive Cau	37	4	3	3

Total Suspended Particulates ($\mu g/m^3$)

Standards: Maximum 24-Hour 150 $\mu g/m^3$
Annual Geometric Mean 60 $\mu g/m^3$

Location	1975 Max. 24-hr.	1975 Ann. Ave.	1976 Max. 24-hr.	1976 Ann. Ave.	1977 Max. 24-hr.	1977 Ann. Ave.
Fort Pierce						
N 4th St.	113	55	106	56	136	67
S 6th St.	71	38	66	36	81	38
City M	109	42	78	36	88	43
City W	100	53	110	52	159	58
City F	118	55	145	59	121	49
Boston Ave.	-	-	51	34	92	40
N 7th St.	-	-	59	38	248	42
Seaway Drive Cau	-	-	48	29	78	31

Reference: Florida Department of Environmental Regulation

TABLE 2.3-6

LONG TERM AVERAGE WIND SPEED AND PREVAILING DIRECTION AT WEST PALM BEACH, FLORIDA

Month	Average Speed (mph)[a]	Prevailing Direction[b]
January	9.8	NW
February	10.3	SE
March	10.7	SE
April	10.9	E
May	9.6	ESE
June	8.0	ESE
July	7.5	ESE
August	7.6	ESE
September	8.6	ENE
October	10.0	ENE
November	10.0	ENE
December	9.9	NNW
Annual	9.4	ESE

a) period of record: 1942-1977
b) period of record: 1963-1977

Reference: U.S. Dept. of Commerce, 1977, Local Climatological Data - Annual Summary with Comparative Data: West Palm Beach, Florida, NOAA, Environmental Data Service

TABLE 2.3-7

AVERAGE WIND SPEED AND PREVAILING DIRECTION
AT THE ST LUCIE SITE

Month	Average Speed (mph)	Prevailing Direction
January	8.1	NW
February	7.6	NW
March	7.2	SE
April	7.8	ESE
May	6.7	ESE
June	6.3	SSE
July	5.8	SSE
August	6.5	ESE
September	5.1	SE
October	7.4	NE
November	6.9	N
December	7.8	WNW
Annual	6.9	SE

period of record: September 1976 - August 1978

ST LUCIE UNIT 2

MEAN WIND SPEED (MPS)
10.00 METERS

TIME PERIOD	PASQUILL STABILITY CLASS							
	A	B	C	D	E	F	G	ALL
9/76	2.98	2.72	2.80	2.43	1.66	1.21	-	2.03
10/76	3.72	3.84	3.75	3.67	3.37	1.81	1.16	3.41
11/76	4.95	4.69	4.42	3.85	3.07	1.71	1.42	3.17
12/76	3.90	4.60	4.10	4.07	3.75	2.43	2.10	3.72
1/77	4.30	3.94	4.47	4.27	3.41	1.97	1.54	3.65
2/77	3.87	3.85	3.54	3.67	2.76	1.17	-	3.28
3/77	3.89	3.47	3.08	3.46	2.76	1.51	-	3.25
4/77	4.48	5.02	4.65	4.33	3.53	1.72	.96	3.99
5/77	3.81	3.30	3.57	3.40	2.90	2.10	-	3.11
6/77	4.15	3.82	3.63	3.38	2.34	1.45	-	2.72
7/77	3.53	3.48	3.44	2.80	2.23	1.49	-	2.63
8/77	4.31	3.69	4.03	3.23	2.93	2.19	-	3.19
9/77	3.42	2.92	2.99	2.90	2.33	1.10	-	2.52
10/77	3.42	3.42	3.20	3.38	3.12	1.89	1.27	3.13
11/77	3.75	3.14	3.18	3.40	2.91	1.38	1.28	3.03
12/77	4.06	3.85	3.56	3.71	3.26	2.06	1.73	3.31
1/78	4.38	3.75	3.53	3.94	3.56	2.40	1.44	3.59
2/78	3.95	4.37	3.97	3.87	3.26	2.17	1.82	3.43
3/78	3.71	3.68	3.14	3.45	2.84	1.72	.97	3.15
4/78	3.61	3.08	3.11	3.59	2.66	1.97	2.35	3.08
5/78	3.55	3.07	3.03	3.31	2.47	1.35	-	2.96
6/78	4.03	3.47	2.77	3.35	1.97	2.07	-	2.97
7/78	3.48	2.91	2.85	2.96	1.96	2.15	-	2.62
8/78	3.18	3.00	2.83	2.71	2.01	1.33	-	2.56
9/01/76 - 8/31/77	3.98	3.80	3.83	3.49	2.88	1.77	1.58	2.18
9/01/77 - 8/31/78	3.69	3.34	3.12	3.34	2.74	1.89	1.58	3.04
8/01-76 - 9/31/78	3.81	3.51	3.46	3.41	2.81	1.84	1.58	3.11

TABLE 2.3-9

ST LUCIE UNIT 2

MEAN WIND SPEED (MPS) 57.91 METERS

TIME PERIOD	PASQUILL STABILITY CLASS							
	A	B	C	D	E	F	G	ALL
9/76	5.28	5 [illegible]1	4.57	4.21	3.72	3.87	-	4.03
10/76	6.23	6.73	7.38	6.71	3.82	3.82	1.95	6.51
11/76	7.15	8.17	8.56	7.09	6.22	4.34	3.27	6.28
12/76	8.07	8.37	7.89	7.72	7.37	4.74	4.72	7.04
1/77	6.44	5.94	6.73	6.87	6.23	4.05	2.55	6.14
2/77	6.00	6.22	5.89	5.90	5.59	3.40	-	5.70
3/77	6.88	5.48	5.52	6.20	5.84	3.06	-	6.13
4/77	7.27	8.28	7.15	6.88	6.42	2.99	2.78	6.76
5/77	6.27	5.24	5.72	5.74	5.16	3.46	-	5.37
6/77	5.67	5.18	4.97	4.23	3.05	1.09	1.80	3.47
7/77	5.14	4.80	4.81	4.18	3.14	1.34	-	3.81
8/77	6.79	5.64	6.71	5.41	5.55	4.67	-	5.61
9/77	4.88	3.86	4.85	4.67	4.42	3.19	-	4.49
10/77	5.19	5.33	5.21	5.56	5.85	3.67	3.24	5.44
11/77	6.28	5.23	5.46	6.03	5.75	3.17	2.14	5.64
12/77	6.56	6.77	6.62	6.42	6.24	4.54	3.56	6.09
1/78	7.10	6.71	6.53	7.01	7.26	5.79	3.13	6.88
2/78	6.14	7.53	6.70	6.79	6.23	4.91	4.08	6.24
3/78	6.49	6.71	5.82	6.21	5.97	4.76	2.23	6.08
4/78	5.97	5.38	5.54	5.95	5.74	4.78	7.57	5.76
5/78	6.14	5.44	5.72	5.79	5.38	3.79	-	5.63
6/78	5.90	4.99	4.24	5.23	3.66	3.02	-	4.73
7/78	4.64	3.89	3.99	4.16	3.34	3.54	-	3.86
8/78	4.37	4.18	3.84	4.33	3.80	2.58	-	4.08
9/01/76 - 8/31/77	6.49	6.01	6.35	5.81	5.37	3.93	3.55	5.59
9/01/77 - 8/31/78	5.86	5.35	5.13	5.53	5.39	4.29	3.48	5.40

TABLE 2.3-10

ST LUCIE UNIT 2

PREDOMINANT DIRECTION
10.00 METERS

TIME PERIOD	PASQUILL STABILITY CLASS							
	A	B	C	D	E	F	G	ALL
9/76	E	ESE	E	E*	SSE	NNE*	-	E
10/76	ESE	NE*	ESE	NNW	SE	SW	NW	ESE
11/76	NNE	N	N	N	NNW	NNW	NNW	NNW
12/76	SSE	N	NNW	NNW	NNW	SSW	NW	NNW
1/77	N	N	N	NNW	NW	NW	NW	NW
2/77	N	N	N	N	NW	WNW	-	N
3/77	SSE	SSW*	NE	SW	ESE	WSW*	-	SSE
4/77	SSE	ESE	ENE*	ESE	ESE	WNW	SSE	ESE
5/77	NE	ENE	ESE*	E	SE	WNW	-	ESE
6/77	SE	ESE	SE	SSW	WSW	ESE	-	SW
7/77	ENE	ENE	SSE	SSE	SE	NNE*	-	SE
8/77	SSE	ESE	E*	ESE	ESE	SSE	-	ESE
9/77	NE	NE	ESE	SE	SE	NNW	-	SE
10/77	NE	NE	ENE	ENE	ENE	NW	WNW	ENE
11/77	NNW	ENE	NE	S	SE	WNW	WNW	SE
12/77	N	N	NNW	SSW	SSW	NW	NW	NNW
1/78	NW	NNW*	NW	NW	NW	NW	WNW	NW
2/78	N	N	N	NNW	NW	SSW	WNW	NW
3/78	N	NNE	ESE	S	SE	SSE	W	SE
4/78	ESE	SE	ESE	SSW	SSE	NNE	NE	SSE
5/78	NE	ENE	SSE	ENE	SSE	WSW	-	ENE
6/78	NE	SE	E	SSE	SSE	ESE	-	SSE
7/78	SE	ESE	ESE	SSW	SW	SW	-	SSW
8/78	ENE*	ESE	E	ESE	ESE	ESE	-	ESE
9/01/76 - 8/31/77	SSE	ESE	N	ESE	ESE	SSW	NNW	ESE
9/01/77 - 8/31/78	NNE	SE	ESE	SSW	SE	NW	NW	SE
9/01/76 - 8/31/78	NE	N	E	SSW	SE	NW	NW	SE

* denotes other sectors with comparable frequencies

TABLE 2.3-11

ST LUCIE UNIT 2

PREDOMINANT DIRECTION
57.91 METERS

TIME PERIOD	PASQUILL STABILITY CLASS							
	A	B	C	D	E	F	G	ALL
9/76	ESE	SE	ESE*	SE	SE	WSW	-	SE
10/76	E	E*	ENE*	NW	E	SW	NW	E
11/76	SE	N	N	N	NW	SSW	N	N
12/76	SSE	N	NNW	N	NNW	NNW*	NNW	NNW
1/77	N	NNW	N	NNW	NW	NW	SW	NW
2/77	N	N	N	NW	NW	WNW	-	NW
3/77	SSE	SW	N	S	ESE	SSW*	-	SSE
4/77	SSE	ESE	E	S	ESE	WSW	ESE	ESE
5/77	E	E	E	ESE*	E	WSW*	-	E
6/77	SE*	E	SE	SSW	WSW	SSW	W*	SSW
7/77	E	ENE	E	SE	SE	SSE	-	SE
8/77	SSE	ESE	ESE	ESE	ESE	SSE	-	ESE
9/77	NNE	NE	ESE	SE	ESE	NW*	-	SE
10/77	NNE	NNE*	E	E	E	NNW	WSW	E
11/77	N	E	E*	NNW	SE	SSW*	W	SE
12/77	N	N	NNW	SSW	NNW	SSW	NNE	NNW
1/78	NW	NNW	NW	NNW	NNW	N	N	NW
2/78	N	N	NW	NNW	NW	SSW	SSW	NW
3/78	N	ENE*	ESE	S	NNW	SE	WSW	SE
4/78	SSE	SSE	E	SSW	ESE	ENE*	ENE	ESE
5/78	NE	ENE*	SSE	ESE	E	SE	-	E
6/78	NNE	E	ESE	NE	SSE	S	-	SSE
7/78	SE	E	E	SSW	SW	SSW	-	ESE*
8/78	NE	ESE	E	ESE	ESE	SSE	-	ESE
9/01/76 - 8/31/77	SSE	E	SE	ESE	ESE	SSW	WSW	ESE
9/01/77 - 8/31/78	NNE	SE	E	ESE	ESE	N	WSW	ESE
9/01/76 - 8/31/78	SSE	E	ESE	ESE	ESE	SSW	WSW	ESE

* denotes other sectors with comparable frequencies

TABLE 2.3-12

LONG-TERM AVERAGE AND EXTREME TEMPERATURES AND AVERAGE RELATIVE HUMIDITY AT WEST PALM BEACH, FLORIDA

Month	Averages (°F)[a] Daily Max	Daily Min	Mean	Extreme (°F)[b] Highest	Lowest	Average Relative Humidity %
January	75.0	55.9	65.5	89	27	73.5
February	76.0	56.2	66.1	90	34	71.0
March	79.3	60.2	69.8	94	31	69.5
April	82.9	64.9	73.9	99	45	66.5
May	86.1	68.9	77.5	96	53	70.0
June	88.3	72.7	80.5	98	62	77.3
July	89.6	74.1	81.9	101	66	77.0
August	90.2	74.4	82.3	98	65	76.8
September	88.3	74.7	81.5	97	66	78.5
October	84.3	70.1	77.5	93	46	74.5
November	79.5	62.5	71.0	91	36	72.3
December	76.1	57.4	66.8	90	30	71.8
Annual	83.0	66.0	74.5	101	27	73.3

a) period of record: 1941-1970
b) period of record: 1937-1977

Reference: U.S. Dept. of Commerce, 1977, Local Climatological Data - Annual Summary with Comparative Data: West Palm Beach, Florida, NOAA, Environmental Data Service.

TABLE 2.3-13

AVERAGE AND EXTREME TEMPERATURES AND AVERAGE RELATIVE HUMIDITY AT THE ST. LUCIE SITE

Month	Average (°F) Daily Max	Daily Min	Mean	Extreme (°F) Highest	Lowest	Average Relative Humidity %
January	65.1	51.3	58.1	80.1	28.4	65.1
February	66.9	53.4	60.3	82.0	37.6	69.6
March	74.3	64.2	69.3	88.9	47.8	72.2
April	76.6	67.8	72.3	90.5	57.7	67.4
May	80.2	72.7	76.5	86.0	61.5	73.2
June	84.2	76.3	80.2	90.7	71.8	77.6
July	85.5	77.4	81.3	89.8	71.4	78.2
August	84.9	77.7	81.3	90.0	72.5	75.2
September	84.2	75.9	80.1	89.6	70.5	74.8
October	79.7	70.5	75.2	88.2	57.0	67.5
November	75.4	65.3	70.3	99.8	50.0	70.7
December	71.4	59.2	65.3	82.8	41.9	68.3
Annual	77.4	67.6	72.5	99.8	28.4	71.6

period of record: September 1976 - August 1978

TABLE 2.3-14

PRECIPITATION DATA AT WEST PALM BEACH, FLORIDA

Month	Mean Total[a] (inches)	Greatest 24-Hour[b] (inches)
January	2.60	6.36
February	2.60	4.70
March	3.32	4.88
April	3.51	15.23
May	5.17	7.04
June	8.14	9.21
July	6.52	5.83
August	5.91	5.89
September	9.85	8.71
October	8.75	9.58
November	2.48	5.52
December	2.21	5.26
Annual	62.06	15.23

a) period of record: 1941-1970
b) period of record: 1939-1977

Reference: U.S. Dept. of Commerce, 1977, Local Climatological Data - Annual Summary with Comparative Data: West Palm Beach, Florida, NOAA, Environmental Data Service.

TABLE 2.3-15

PRECIPITATION DATA AT THE ST. LUCIE SITE

Month	Mean Total (inches)
January	2.65
February	1.00
March	1.74
April	2.77
May	2.07
June	1.37
July	3.27
August	4.19
September	4.11
October	2.78
November	2.78
December	2.93
Annual	31.58

period of record: September 1976 - August 1978

TABLE 2.3-16

MEAN NUMBER OF DAYS WITH HEAVY FOG AND VISIBILITY LESS THAN ¼ MILE AT WEST PALM BEACH, FLORIDA

Month	Mean No. of Days
January	2
February	1
March	1
April	1
May	*
June	*
July	*
August	*
September	*
October	*
November	1
December	1
Annual	8

Note: * = less than ½

period of record: 1943-1977

Reference: U.S. Dept. of Commerce, 1977, Local Climatological Data - Annual Summary with Comparative Data: West Palm Beach, Florida, NOAA, Environmental Data Service

TABLE 2.3-17

ST LUCIE UNIT 2

PERCENT TOTAL OCCURRENCES OF EACH STABILITY CLASS
10 METERS

TIME PERIOD	PASQUILL STABILITY CLASS							
	A	B	C	D	E	F	G	ALL
9/76	8.20	1.96	1.96	29.59	55.08	3.21	0	100.00
10/76	6.50	2.51	5.02	26.00	54.65	4.14	1.18	100.00
11/76	.30	1.21	3.17	25.83	58.16	7.40	3.93	100.00
12/76	.56	.74	2.22	32.96	52.96	6.30	4.26	100.00
1/77	11.50	5.01	5.68	25.71	41.54	6.50	4.06	100.00
2/77	27.77	3.95	6.22	22.46	34.29	5.31	0	100.00
3/77	26.92	3.95	3.42	24.93	38.46	2.28	0	100.00
4/77	25.28	3.40	3.08	23.01	42.95	1.46	.81	100.00
5/77	4.75	3.86	4.45	27.00	58.61	1.34	0	100.00
6/77	.57	.85	2.55	32.53	61.67	1.56	0	100.00
7/77	6.56	2.79	3.91	42.54	43.10	1.12	0	100.00
8/77	6.58	4.63	5.23	34.53	45.74	3.29	0	100.00
9/77	2.32	2.68	2.14	26.61	65.18	1.07	0	100.00
10/77	12.62	4.94	4.53	27.71	41.43	7.13	1.65	100.00
11/77	8.77	4.24	3.54	28.71	47.67	5.37	1.70	100.00
12/77	7.80	4.30	2.42	26.75	45.97	8.87	3.90	100.00
1/78	12.06	4.07	2.52	22.44	48.53	6.17	4.21	100.00
2/78	13.23	3.31	3.61	26.17	42.41	6.62	4.66	100.00
3/78	17.76	3.50	3.50	31.05	38.04	5.31	.84	100.00
4/78	22.56	4.04	4.60	23.40	38.30	6.55	.56	100.00
5/78	21.22	5.99	3.40	27.89	39.05	2.45	0	100.00
6/78	14.10	5.58	4.85	42.44	31.86	1.17	0	100.00
7/78	8.34	6.46	7.13	40.38	36.20	1.48	0	100.00
8/78	17.77	6.06	5.11	37.28	30.69	3.10	0	100.00
9/01/76 - 8/31/77	10.54	2.97	3.98	28.95	48.76	3.62	1.19	100.00
9/01/77 - 8/31/78	13.42	4.65	3.99	30.14	41.67	4.67	1.47	100.00
9/01/76 - 8/31/78	12.02	3.83	3.98	29.57	45.10	4.16	1.33	100.00

TABLE 2.3-18

ST LUCIE UNIT 2

PERCENT TOTAL OCCURRENCES OF EACH STABILITY CLASS
57.91 METERS

TIME PERIOD	PASQUILL STABILITY CLASS							
	A	B	C	D	E	F	G	ALL
9/76	7.64	1.95	1.95	29.66	55.60	3.20	0	100.00
10/76	5.82	2.49	5.12	27.01	54.57	3.88	1.11	100.00
11/76	.57	1.00	2.87	25.64	58.60	7.59	3.72	100.00
12/76	.44	.58	1.75	29.84	50.36	9.90	7.13	100.00
1/77	11.66	5.08	5.76	25.93	40.88	6.58	4.12	100.00
2/77	27.65	4.02	6.91	21.06	35.21	5.14	0	100.00
3/77	27.10	3.99	3.44	26.00	37.28	2.20	0	100.00
4/77	25.99	3.21	3.21	24.77	40.67	1.38	.76	100.00
5/77	4.57	3.71	4.29	27.14	59.00	1.29	0	100.00
6/77	.44	.73	2.48	31.97	62.48	1.61	.29	100.00
7/77	6.59	2.82	3.76	43.15	42.61	1.08	0	100.00
8/77	6.17	4.78	5.40	35.03	45.06	3.55	0	100.00
9/77	1.95	2.79	3.06	31.48	59.33	1.39	0	100.00
10/77	12.61	4.96	4.25	27.76	41.78	6.94	1.70	100.00
11/77	8.77	4.24	3.54	28.71	47.67	5.37	1.70	100.00
12/77	7.80	4.30	2.42	26.75	45.97	8.87	3.90	100.00
1/78	12.24	4.13	2.61	22.70	48.01	6.19	4.13	100.00
2/78	14.01	3.28	3.58	25.93	42.03	6.56	4.62	100.00
3/78	18.30	3.07	3.21	31.70	38.41	4.47	.84	100.00
4/78	22.53	4.03	4.59	23.50	38.25	6.54	.56	100.00
5/78	21.62	6.12	3.27	27.31	39.26	2.42	0	100.00
6/78	13.84	5.80	5.06	42.26	31.85	1.19	0	100.00
7/78	8.34	6.46	7.13	40.38	36.20	1.48	0	100.00
8/78	17.77	6.06	5.11	37.28	30.69	3.10	0	100.00
9/01/76 - 8/31/77	10.27	2.87	3.92	29.03	48.49	3.95	1.47	100.00
9/01/77 - 8/31/78	13.28	4.61	3.99	30.48	41.64	4.55	1.45	100.00
9/01/76 - 8/31/78	11.81	3.76	3.96	29.77	44.98	4.26	1.46	100.00

TABLE 2.3-19

PERSISTENCE OF INVERSION CONDITIONS (ALL STABLE CASES)

FLORIDA POWER AND LIGHT CO.
ST. LUCIE UNIT 2

DATA PERIOD (YR - JULIAN DAY) - 76245 TO 77243
THRESHOLD OF ANEMOMETER (MPH) - .58

WIND DIRECTION PERSISTENCE - PASQUILL #S#
1 SECTOR PERSISTENCE

CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	11	7	2	2	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	11	11	4	5	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	16	7	4	6	4	1	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	28	11	6	4	4	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	45	20	11	5	4	3	5	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
SE	34	24	17	2	7	4	2	4	0	0	1	0	1	0	0	2	0	0	0	0	0	0	0	0
SSE	32	21	11	7	3	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S	30	8	8	3	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSW	36	13	4	3	1	2	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
SW	47	13	7	2	5	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WSW	36	15	4	5	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
W	26	6	6	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	38	7	9	5	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	38	16	8	5	5	3	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	39	10	7	6	8	1	1	0	1	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0
N	20	11	4	4	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AVERAGE WIND SPEED (M/SEC)

CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	2.50	2.81	2.68	3.04	4.92	0.	3.35	4.22	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NE	2.48	3.62	4.86	2.81	0.	4.63	0.	0.	0.	4.96	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ENE	3.05	2.96	5.67	4.36	3.17	3.26	3.52	0.	0.	5.42	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
E	3.35	4.16	4.17	3.06	2.94	1.72	0.	0.	0.	4.92	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ESE	2.83	3.11	2.71	3.88	3.65	3.72	3.46	4.27	4.43	4.51	3.17	3.06	3.93	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SE	2.47	2.74	2.52	2.68	2.91	3.54	3.74	3.72	0.	0.	3.72	0.	2.97	0.	0.	2.70	0.	0.	0.	0.	0.	0.	0.	0.
SSE	2.33	2.47	2.56	3.03	2.26	0.	3.52	3.28	2.41	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
S	2.47	2.38	2.73	3.45	2.09	0.	3.13	2.48	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SSW	3.26	3.23	3.19	2.71	2.68	3.61	99.99	0.	0.	0.	3.09	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SW	2.63	2.51	3.82	5.59	3.29	3.07	0.	3.53	4.78	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
WSW	2.11	2.35	2.65	1.54	0.	0.	0.	0.	2.46	0.	2.31	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
W	1.56	2.31	2.27	0.	2.20	1.40	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
WNW	1.78	1.55	2.12	1.66	2.72	2.87	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NW	2.46	2.27	2.79	2.06	3.32	3.66	2.23	0.	0.	0.	3.02	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NNW	2.58	2.38	3.17	2.46	3.22	2.94	2.12	0.	3.31	3.33	0.	0.	2.94	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
N	3.09	2.84	3.58	4.49	4.51	0.	2.91	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL NO. OF OBSERVATIONS = 8760

TABLE 2.3-20

PERSISTENCE OF INVERSION CONDITIONS (ALL STABLE CASES)

FLORIDA POWER AND LIGHT CO.
ST. LUCIE UNIT 2

DATA PERIOD (YR - JULIAN DAY) - 77244 TO 78243
THRESHOLD OF ANEMOMETER (MPH) - .58

WIND DIRECTION PERSISTENCE - PASQUILL #5#
1 SECTOR PERSISTENCE

CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	16	1	4	5	2	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
NE	10	7	4	1	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	26	13	1	2	2	4	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	15	14	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	23	17	11	9	5	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	33	16	13	3	5	3	3	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
SSE	40	25	13	3	2	2	1	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S	17	11	4	7	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSW	24	9	9	4	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW	37	10	10	3	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WSW	31	14	2	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W	21	6	4	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	37	9	3	1	1	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	32	17	8	4	3	4	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	25	16	13	4	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N	15	7	3	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AVERAGE WIND SPEED (M/SEC)

CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	2.89	2.53	2.74	2.43	2.38	0.	3.91	0.	5.99	0.	0.	5.43	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NE	2.84	2.75	2.71	5.19	0.	3.32	1.68	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ENE	3.15	2.93	3.02	2.99	4.10	5.43	3.86	3.38	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
E	3.34	2.92	3.58	2.32	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ESE	2.44	2.56	2.42	2.92	2.55	2.04	3.80	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SE	2.13	2.33	2.42	2.92	2.65	3.64	2.51	4.12	0.	3.45	0.	0.	0.	0.	0.	0.	0.	0.	3.29	0.	0.	0.	0.	0.
SSE	2.23	2.25	2.55	2.98	2.61	2.30	2.29	1.94	3.31	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
S	3.51	2.90	3.66	3.40	0.	3.98	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SSW	3.23	2.96	3.51	2.86	4.30	0.	0.	2.88	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SW	2.30	1.95	2.13	2.32	3.99	0.	4.64	4.27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
WSW	2.06	2.39	1.40	1.88	0.	0.	3.52	0.	.22	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
W	2.23	1.76	2.99	2.81	3.05	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
WNW	2.35	1.77	3.35	1.79	5.36	1.40	2.29	2.23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NW	2.50	2.79	2.47	2.64	2.96	2.49	2.40	2.63	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NNW	2.58	2.83	3.39	2.86	2.79	4.09	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
N	2.28	2.34	3.72	3.04	5.14	1.53	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL NO. OF OBSERVATIONS = 8760

TABLE 2.3-21

PERSISTENCE OF INVERSION CONDITIONS (ALL STABLE CASES)

FLORIDA POWER AND LIGHT CO.
ST. LUCIE UNIT 2

DATA PERIOD (YR - JULIAN DAY) - 76245 TO 78243
THRESHOLD OF ANEMOMETER (MPH) - .58

WIND DIRECTION PERSISTENCE - PASQUILL #S#
1 SECTOR PERSISTENCE

CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	27	8	6	7	4	0	2	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
NE	21	18	8	6	0	5	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	42	20	5	8	6	5	2	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	43	25	11	7	4	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	67	37	22	14	9	5	6	1	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
SE	67	40	30	5	12	7	5	5	0	1	1	0	1	0	0	2	0	0	1	0	0	0	0	0
SSE	72	46	24	10	5	2	3	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S	47	19	12	10	1	4	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSW	60	22	13	7	5	2	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
SW	84	23	17	5	7	1	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WSW	67	29	6	6	0	0	1	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
W	47	12	10	5	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	75	16	12	6	3	4	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	70	33	16	9	8	7	6	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	64	26	20	10	12	2	1	0	1	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0
N	35	18	7	6	4	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AVERAGE WIND SPEED (M/SEC)

CONSECUTIVE HOURS

SECTOR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
NNE	2.73	2.78	2.72	2.61	3.65	0.	3.63	4.22	5.99	0.	0.	5.43	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NE	2.65	3.26	3.79	3.20	0.	3.84	1.68	0.	0.	4.96	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ENE	3.11	2.94	5.14	3.97	3.48	4.99	3.69	3.38	0.	5.42	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
E	3.35	3.46	3.90	2.75	2.94	1.72	0.	0.	0.	4.92	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ESE	2.65	2.86	2.57	3.26	3.04	3.05	3.32	4.27	4.74	4.51	3.17	3.06	3.93	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SE	2.30	2.57	2.48	2.83	2.80	3.59	3.01	3.82	0.	3.45	3.72	0.	2.97	0.	0.	2.70	0.	0.	3.29	0.	0.	0.	0.	0.
SSE	2.27	2.34	2.56	3.01	2.40	2.30	3.11	2.27	2.86	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
S	2.86	2.68	3.07	3.41	2.09	3.98	3.13	2.48	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SSW	3.25	3.11	3.42	2.80	3.98	3.61	99.99	2.88	0.	0.	3.09	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SW	2.48	2.27	2.77	3.63	3.49	3.07	4.64	3.90	4.78	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
WSW	2.08	2.37	2.23	1.61	0.	0.	3.52	0.	1.34	0.	2.31	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
W	1.87	2.04	2.56	2.81	2.48	1.40	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
WNW	2.08	1.68	2.46	1.68	3.60	1.77	2.29	2.23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NW	2.48	2.54	2.62	2.31	3.18	2.99	2.34	2.63	0.	0.	3.02	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NNW	2.58	2.67	3.32	2.62	3.05	3.51	2.12	0.	3.31	3.33	0.	0.	2.94	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
N	2.73	2.65	3.64	4.01	4.82	1.53	2.91	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL NO. OF OBSERVATIONS = 17520

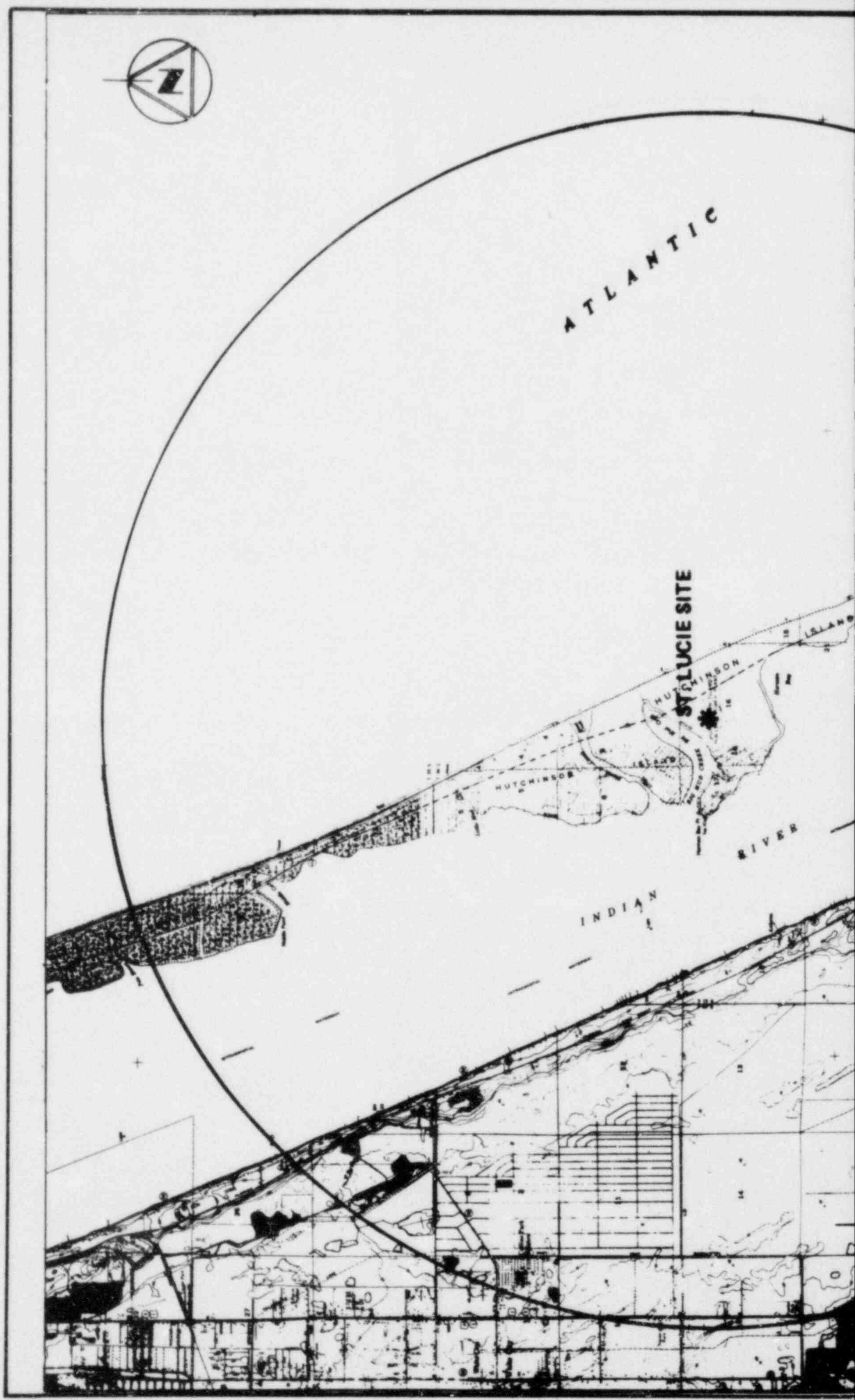
TABLE 2.3-22

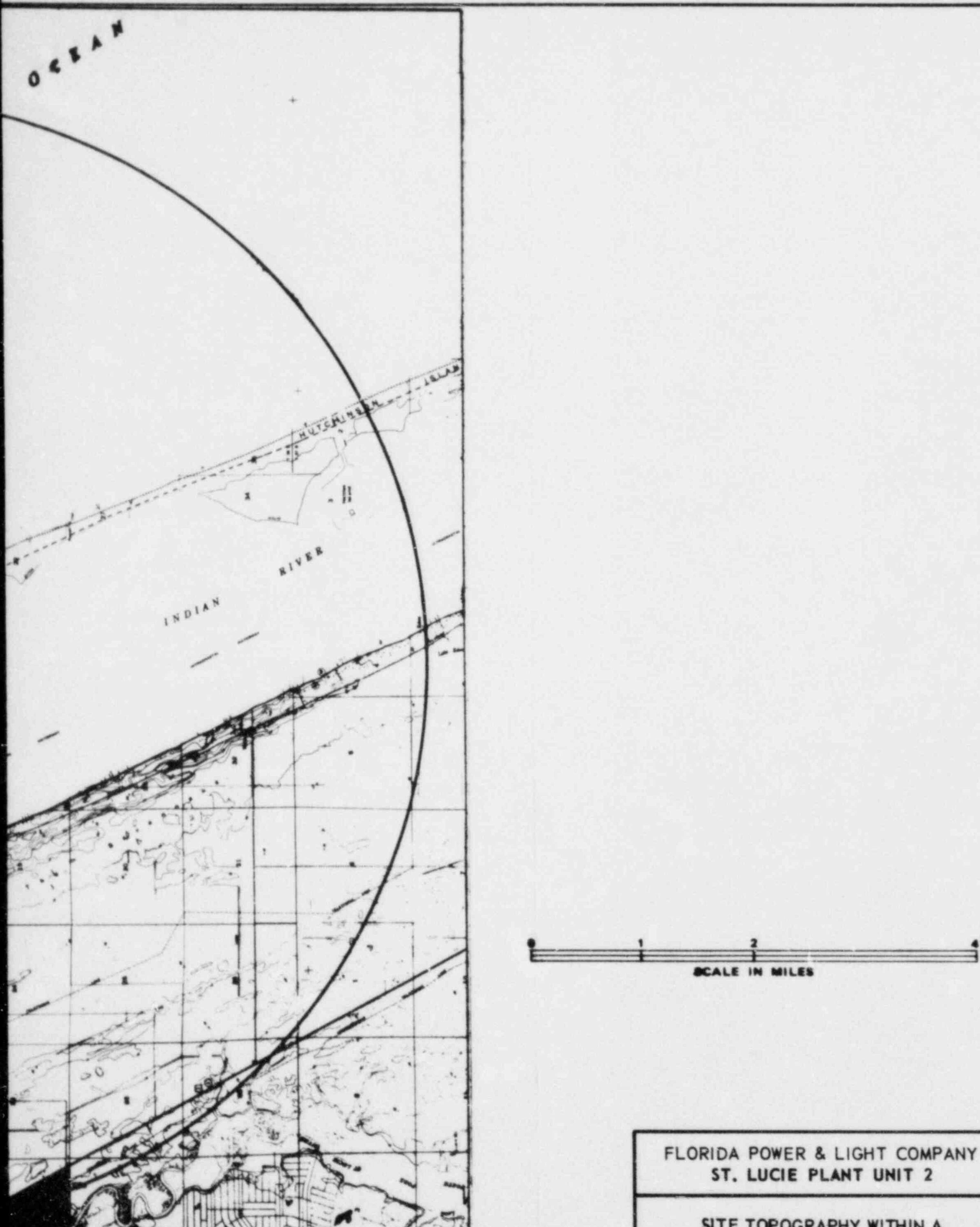
MEAN MORNING AND AFTERNOON MIXING HEIGHTS AT MIAMI, FLORIDA

Month	Mixing Height (m)	
	Morning	Afternoon
January	702	1106
February	728	1201
March	904	1398
April	1038	1411
May	921	1394
June	982	1168
July	1072	1337
August	1007	1308
September	959	1204
October	862	1298
November	873	1243
December	638	1207

period of record: 1960-1964

Reference: NOAA data tape

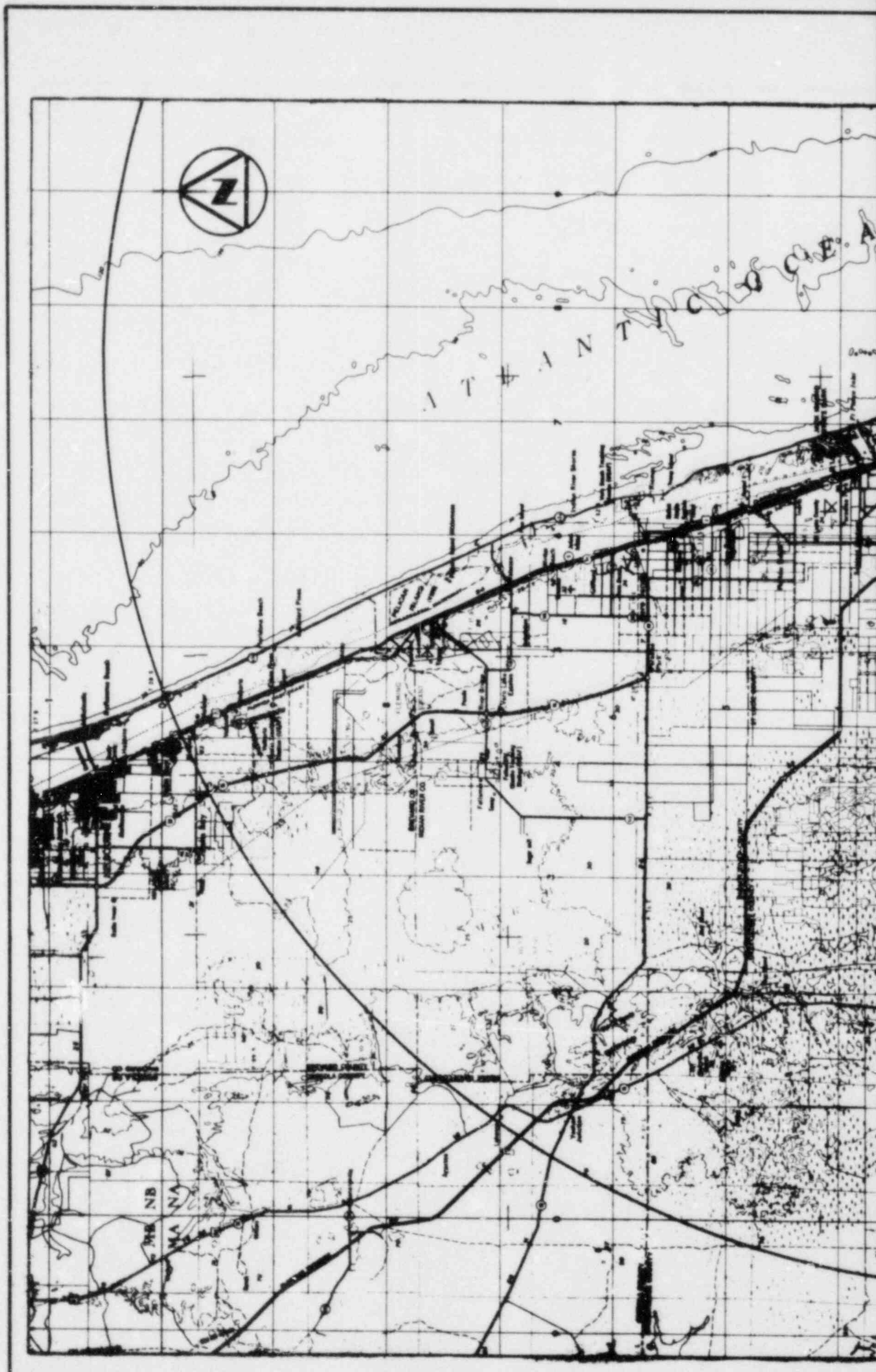

ATLANTIC
ST. LUCIE SITE
HUTCHINSON
HUTCHINSON
INDIAN
RIVER

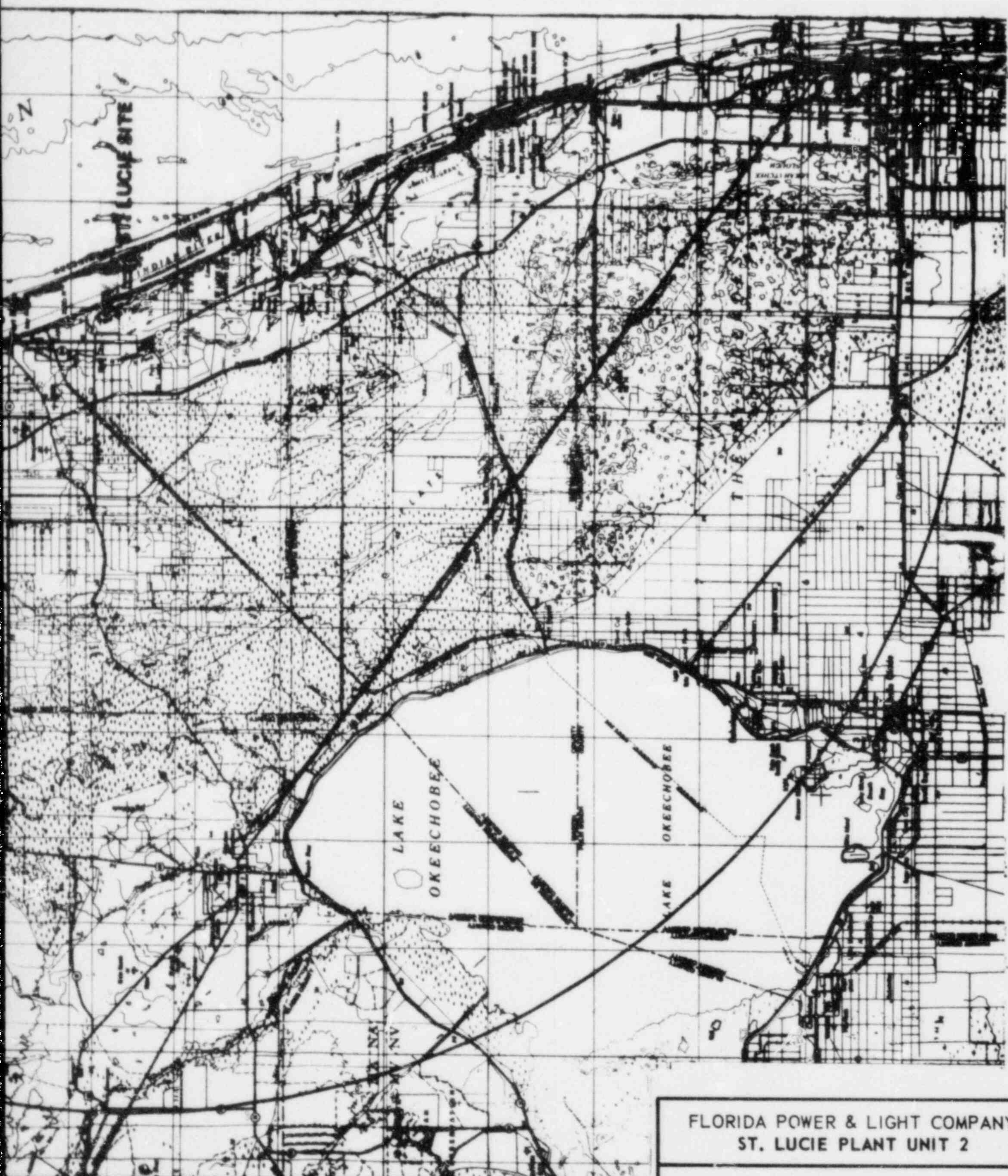


FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

SITE TOPOGRAPHY WITHIN A 5 MILE RADIUS

FIGURE 2.3-1


A T L A N T I C O C E A



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

SITE TOPOGRAPHY WITHIN A
50 MILE RADIUS
FIGURE 2.3-2

2.4 HYDROLOGY

2.4.1 INTRODUCTION

The Atlantic Ocean, to the east of the site (Figure 2.1-1), will provide most of the water required for plant operation. In addition, the St Lucie plant dissipates waste heat and discharges liquid wastes, after treatment, to that body of water (see Sections 3.4, 3.5, 3.6 and 3.7). This section describes surface water hydrology, ground water hydrology and surface water quality characteristics.

2.4.2 SURFACE WATER HYDROLOGY

2.4.2.1 Bathymetry

As shown in Figure 2.1-1, the Hutchinson Island shoreline and nearshore bathymetry to -30 ft Mean Low Water (MLW) are oriented along a NNW-SSE (340^{o} - 160^{o}) line. The nearshore ocean bottom slopes at a one on 80 gradient to about -35 ft MLW for approximately 0.5 miles before rising to Pierce Shoal (-21 ft MLW).

A slight trough with depths of nearly -50 ft MLW separates Pierce Shoal from the northward extension of St Lucie Shoal, which is five miles seaward of the coastline. Across the coastal shelf to the -120 MLW contour, the overall slope is gentle, approximately one on 600. At about 12 miles offshore, the sea floor slope increases to one to 100, reaching the -600 ft MLW contour approximately 18 miles east of Hutchinson Island. Bathymetric profiles across the coastal shelf off Hutchinson Island are shown in Figure 2.4-1.

2.4.2.2 Ocean Tides

Tidal analyses by the National Ocean Survey for several locations near the St Lucie plant are referenced to the nearest primary control station which is Miami, Florida. Published datums[1] are referred to local Mean Low Water (MLW), although all datums can be reduced to the National Geodetic Vertical Datum which is accepted as Mean Sea Level (MSL). A time series of semi-diurnal high and low tides is shown in Figure 2.4-2.

At Miami Beach, the mean range between high and low tides is 2.5 feet, and the spring range (average semi-monthly new and full moon tide) is 3.0 feet. Tide ranges increase northward to 2.8 and 3.3 feet, respectively, at Palm Beach and 3.5 and 4.1 feet at Cape Canavarel[1].

For tides monitored at Vero Beach (the temporary subordinate station nearest the St Lucie site), mean tidal range is 3.4 feet. A short interval record for October, 1972, indicates that the mean range is 3.0 feet at Seminole Shores, about 11 miles south of the plant site (unpublished records of the National Ocean Survey). The largest astronomical tide range should be approximately 5.0 feet based on maximum-mean ratio of solar and lunar tractive forces of 13 to nine[2].

A tide monitoring program was undertaken at the site by Florida Power & Light Company from May 1976 to May 1977. For the full year of measurements, a mean tidal range of 3.28 feet was determined. A comparison of these site specific measurements to corresponding predicted tides resulted in a standard deviation between 0.3 and 0.4 feet. This difference in tidal range reflects meteorological factors.

2.4.2.3 Surface Currents

Surface water circulation in the nearshore region of the St Lucie site is of the combined wind driven and rotary tidal current type. The Florida Current, a branch of the Gulf Stream System, is found offshore, beyond the 300 foot contour[3]. The rotary tidal current continuously changes direction through 360 degrees during a 12.4 hour cycle. However, near a shoreline boundary the rotary characteristic is deformed into an elliptical pattern with an ebb and flood flow alongshore.

Wind driven currents are directly related to wind direction and intensity, although near the shoreline the surface current is deflected into a longshore direction depending on the angle of the wind to the shoreline. Because of the variability of local winds at the site, current patterns will change frequently with changes in weather patterns.

To describe currents at the St Lucie site, a monitoring program was conducted from September, 1973 to May 1975 (See Section 6.1.1). Current speed and direction were measured in 32 feet of water about 2000 feet from shore in the area of the discharge location. Current data were analyzed for the frequency distribution of current speed and direction[4].

Directional frequency distribution of the nearshore current shows a bimodal annual distribution with a prevailing flow oriented 335 degrees and a secondary flow toward 165 degrees. These directions are nearly parallel to the coastline. As shown in Tables 2.4-1 and 2.4-2, respectively, the prevailing direction is within the 300-360 degree sector about 49 percent of the time at the surface and 32 percent near the bottom. In the secondary 120-180 degree sector, the respective occurrence frequencies are nearly 23 and 24 percent. Onshore flow within the 210-270 degree sector occurs less than eight percent of the time. Seasonal differences in the bimodal distribution of current direction are represented by the July and October profiles shown as Figure 2.4-3.

Average current speed is 0.74 fps near the surface and decreases to 0.54 fps close to the bottom. About 33 percent of bottom currents are less than 0.4 fps, which is the upper limit for tidal currents in open waters off Florida (Tables 2.4-3 and 2.4-4). The 50th percentile speed near the bottom is 0.4 fps, which suggests that at least half of all nearshore flows are caused by wind driven currents. Current speed ranged from near zero to more than 1.6 fps. Approximately ten percent of all current speeds measured exceeded 1.0 fps at the surface and less than three percent exceeded 1.6 fps.

Summertime flow appears to be weaker than during other seasons as indicated by the modal frequency of lower current speed during July, in comparison to October (Figure 2.4-4). When wind speed is light, the wind driven current becomes negligible, and the semidiurnal tidal current becomes more apparent.

Additional current data acquired at the St Lucie site in March - April, 1977, confirmed the prevailing longshore flow that was recognized in the earlier monitoring program. However, lower current speeds for onshore flow indicate that the earlier measurements may include a wave motion component. The current rose in Figure 2.4-5 shows current direction and speed distribution monitored for ten days in 1977.

2.4.3 GROUNDWATER

The groundwater regime of the St Lucie site and surrounding region has been described in Section 2.5 of the St Lucie Unit 2 Environmental Report - Construction Permit. The Final Environmental Statement Related to Construction of St Lucie Plant Unit 2 discusses groundwater at the site.

2.4.4 SURFACE WATER QUALITY

Worth and Hollinger[5], and Applied Biology Inc,[6,7,8] have reported surface water quality data from the St Lucie site. The majority of the data presented are from Atlantic Ocean coastal waters off Hutchinson Island, near the St Lucie site. Details of the water quality sampling programs are noted in Section 6.1.4. Figure 2.4-6 shows the locations of water quality sampling Stations 0 through 5.

A number of physical and chemical parameters are reported, including temperature, salinity, dissolved oxygen, and dissolved inorganic nutrients (nitrogen, phosphorus, and silicon). The physical and chemical data obtained in these studies from the six offshore stations sampled by Applied Biology[6,7,8], are summarized in Table 2.4-5. The ranges of concentrations of several water quality parameters investigated for the Indian River in the summer of 1974 are presented in Table 2.4-6.

2.4.4.1 Temperature

Sea water temperatures reported in these studies range from about 15 to 32°C. The mean temperature for all stations and depths reported is about 25°C. Figure 2.4-7 illustrates the seasonal variation in temperature from September, 1971 through 1978, at Station 2 which is representative of the offshore stations. Additional daily monitoring of temperature at a location near Station 1 has been performed by FP&L, and is reported by Worth and Hollinger[5], and Applied Biology[6,7,8].

2.4.4.2 Salinity

The average salinity of the Atlantic Ocean off Hutchinson Island is about 35.5 parts per thousand(ppt). A range from 33.0 to 38.5 ppt has been reported[5]; however, most values fall between 34.0 and 36.0 ppt. In general, salinity is low during fall and winter, and increases to a seasonal maximum during the summer. Data reported by the US Coast and Geodetic Survey for the Atlantic Ocean at Canova Beach, Florida, 50 miles north of the plant site, indicated that mean salinity values are highest in May at 36.6 ppt, and lowest in November at 35.4 ppt. The wider range in values observed at the plant site are probably due to the effects of the Fort Pierce and St Lucie Inlets, intrusions of Gulf Stream water, and current effects created by the Gulf Stream[5].

2.4.4.3 Dissolved Oxygen

Typical dissolved oxygen levels in the area range between five and eight mg/l. Almost all observations fall in the range of four to eight mg/l, although extremes of 3.2 and 10.3 mg/l have been observed. Table 2.4-7 illustrates the distribution of dissolved oxygen values for the six offshore stations. About 50 percent of the values observed range between six and seven mg/l. Of all values reported, 5.9 percent were below five mg/l, and 1.7 percent were above eight mg/l. The mean seasonal distribution of dissolved oxygen for all stations is presented in Figure 2.4-8. The monthly means vary from 5.9 mg/l in August, to 6.9 mg/l in February. All months, with the exception of August, have mean dissolved oxygen levels in excess of six mg/l.

The very low dissolved oxygen concentrations (less than four mg/l) observed in July, August and September 1972 coincided with decreased water temperature, increased phosphate levels and low phytoplankton density. These phenomena are characteristic of an upwelling of deep waters, which are typically relatively cool, nutrient rich, and oxygen depleted (see Section 2.7 of the St Lucie Unit 2 Environmental Report - Construction Permit).

2.4.4.4 Nutrients

Nutrient levels are generally low. Total dissolved inorganic nitrogen (the sum of nitrate, nitrite, and ammonia) averages from about 0.03 to 0.1 mg/l as N. Dissolved silica averages 0.2 to 0.3 mg/l as Si. The values reported for dissolved phosphate show considerable disparity. Values reported by Worth and Hollinger[5] for the period 1971-1973, average about 0.15 mg/l as P. However, in the more recent data[6,7,8] for 1976, 1977 and 1978, phosphate levels rarely exceed 0.01 mg/l as P (Table 2.4-5).

Nutrient concentrations measured at the St Lucie site show no clear seasonal patterns. Nitrate and nitrite tend to peak in spring and fall. Ammonia peaks occur in summer or fall. Silica levels tend to peak in summer. No seasonal trends in phosphate levels are apparent. In general, no statistically significant variation between stations was observed for the chemical parameters measured, indicating that the coastal area investigated is well mixed.

Significant temporal variation was observed. Worth and Hollinger[5] attribute this variation to the tidal exchange between the estuarine, nutrient rich water of the Indian River and the generally low nutrient coastal water. Intrusion of Gulf Stream water was also observed during summer months.

2.4.4.5 Conclusions

The water quality of the nearshore coastal environment at the plant site reflects the interrelation of physical, chemical, and biological effects. Water circulation patterns, including tidal effects, rainfall, flows from the St Lucie and Fort Pierce inlets, upwellings, and possible Gulf Stream intrusions, appear to have a dominant effect on water quality at the St Lucie site.

Nutrient concentrations in coastal environments show considerable variation from site to site. Table 2.4-8 illustrates the range in nutrient values for coastal waters in surveys reported by Riley and Skirrow[9], Sverdrup, et al[10] and Raymont[11]. With the exception of the high phosphorus levels (~0.15 mg P/l) reported by Worth and Hollinger[5] for the period 1971-73, the nutrient values typically observed at the site are generally low and are well within the ranges reported for coastal oceans (see Table 2.4-5). Atypically high nutrient values were observed in isolated instances.

SECTION 2.4: REFERENCES

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TABLE 2.4-1

FREQUENCY DISTRIBUTION OF SURFACE CURRENT DIRECTION
MONTHLY AND ANNUAL AVERAGES WITHIN 30 DEGREE SECTORS
(PERCENT)

Month - 1974	000-030	030-060	060-090	090-120	120-150	150-180	180-210	210-240	240-270	270-300	300-330	330-360
Jan	12.6	6.2	3.4	4.2	0.9	3.0	4.5	2.2	4.0	5.7	18.5	32.7
Feb	1.7	1.3	1.2	2.6	6.0	11.1	4.7	1.9	1.7	6.1	27.8	33.8
Mar	3.9	1.6	1.5	4.0	10.6	16.8	9.6	2.2	0.9	3.4	12.4	33.1
Apr	3.7	1.0	1.3	2.2	9.0	15.0	5.5	1.8	2.1	7.4	24.7	26.4
May	4.7	1.5	1.4	1.1	5.1	7.4	1.9	1.9	1.9	7.5	27.8	37.9
Jun						- Data Missing -						
Jul	4.1	0.6	0.9	3.9	8.3	13.2	4.4	0.8	1.1	5.3	17.8	39.5
Aug	5.4	2.0	1.5	5.8	16.9	14.0	5.1	2.1	2.1	4.0	19.0	21.7
Sep	5.7	2.6	2.0	4.2	12.8	20.8	5.8	3.6	3.0	4.8	12.3	22.6
Oct*	4.3	3.4	3.1	6.6	16.7	22.8	10.5	6.4	6.0	5.4	8.1	6.5
Nov	4.2	3.3	1.8	2.7	11.4	18.1	7.9	3.4	2.4	3.3	14.3	27.4
Dec	4.3	2.3	1.5	2.2	8.8	19.2	15.2	3.4	0.6	4.3	11.5	26.6
Annual Average	5.0	2.2	1.9	3.3	9.0	13.9	6.5	2.3	2.0	5.2	18.6	30.2

Annual average based on ten months data. *1973 measurements not included in annual average.

TABLE 2.4-2

FREQUENCY DISTRIBUTION OF BOTTOM CURRENT DIRECTION
MONTHLY AND ANNUAL AVERAGES WITHIN 30 DEGREE SECTORS
(PERCENT)

Month - 1974	000-030	030-060	060-090	090-120	120-150	150-180	180-210	210-240	240-270	270-300	300-330	330-360
Jan	4.8	1.7	2.4	5.0	2.6	2.6	6.4	2.6	7.2	16.9	30.1	17.8
Feb*	1.0	3.2	1.2	1.3	2.2	18.7	33.1	1.7	1.3	2.2	4.3	29.9
Mar	3.0	6.0	1.6	7.2	8.3	9.0	6.6	4.0	4.9	10.2	18.2	21.0
Apr	5.3	2.8	1.6	4.7	7.4	14.8	11.0	3.0	1.4	7.9	16.5	23.5
May	3.8	2.0	2.9	8.2	14.0	11.1	7.1	5.5	6.1	16.8	17.0	5.5
Jun						- Data	Missing -					
Jul	5.9	3.0	2.8	3.4	5.4	6.7	8.1	2.5	4.9	16.9	19.6	20.9
Aug	2.9	5.6	7.3	10.8	11.4	11.2	10.0	6.3	6.6	8.9	8.9	10.2
Sep	2.5	3.6	2.8	6.0	9.8	18.3	9.8	5.8	6.8	7.4	15.1	12.1
Oct	2.3	1.7	2.4	5.3	15.6	21.2	10.8	3.0	3.1	7.6	16.5	10.4
Nov	3.1	2.0	3.0	5.2	15.4	21.2	5.2	2.9	1.5	4.1	14.3	22.1
Dec	10.9	3.3	3.6	6.3	9.2	20.5	18.2	1.1	1.0	3.0	7.0	16.1
Annual Average	4.5	3.8	3.0	6.2	9.9	13.7	9.3	3.7	4.4	10.0	16.3	16.0

Annual average based on ten months data. *1975 measurements not included in annual average.

TABLE 2.4-3

FREQUENCY DISTRIBUTION OF SURFACE CURRENT SPEED
MONTHLY AND ANNUAL AVERAGES WITHIN 0.1 FPS INCREMENTS
(PERCENT)

Month 1974	0.0-0.1	0.1-0.2	0.2-0.3	0.3-0.4	0.4-0.5	0.5-0.6	0.6-0.7	0.7-0.8	0.8-0.9	0.9-1.0	1.0-1.1	1.1-1.2	1.2-1.3	1.3-1.4	1.4-1.5	1.5-1.6	1.6
Jan	0.1	0.7	2.8	4.4	13.8	9.9	15.7	16.6	14.3	6.9	7.7	4.0	0.7	1.0	0.4	0.2	0.9
Feb	0.4	1.4	1.7	3.3	12.3	6.9	13.5	16.3	12.9	11.0	10.4	5.3	1.5	1.2	0.4	0.15	1.4
Mar	0.4	1.1	0.8	3.3	11.0	8.8	14.7	12.1	13.3	7.3	10.7	6.7	3.3	2.3	0.8	0.7	2.5
Apr	0.2	2.5	2.1	1.3	8.0	7.3	11.7	12.5	13.6	11.8	9.2	7.4	3.0	3.1	1.4	0.6	4.3
May	0.6	1.4	2.3	2.3	4.8	7.5	7.2	9.5	21.0	12.3	8.3	8.0	4.9	2.5	1.8	0.5	4.7
Jun	- Data Missing -																
Jul	1.7	1.3	5.1	4.0	11.3	8.4	11.4	14.2	14.9	8.8	7.4	5.5	2.8	0.9	0.8	0.5	1.3
Aug	1.7	1.4	3.7	4.5	9.7	13.0	14.1	13.5	10.8	9.4	6.7	4.8	2.8	1.7	1.5	0.6	1.3
Sep	0.2	1.6	3.0	3.3	4.5	13.7	11.4	17.3	13.6	10.7	8.4	5.1	3.4	0.8	1.1	0.4	1.4
Oct	- Data Missing -																
Nov	1.1	3.4	4.2	3.6	11.8	9.8	11.1	6.2	18.6	7.6	8.3	6.0	3.6	1.7	0.7	1.0	1.1
Dec	0.0	1.5	1.8	3.1	13.2	7.7	14.7	10.7	23.3	5.1	9.0	3.5	1.4	1.8	0.7	0.5	2.0
Annual Average	0.64	1.63	2.87	3.31	10.04	9.3	12.55	12.89	15.63	9.09	8.63	5.63	2.74	1.7	0.97	0.52	2.3

TABLE 2.4-4

FREQUENCY DISTRIBUTION OF BOTTOM CURRENT SPEED
MONTHLY AND ANNUAL AVERAGES WITHIN 0.1 FPS INCREMENTS
(PERCENT)

Month 1974	0.1-0.1	0.1-0.2	0.2-0.3	0.3-0.4	0.4-0.5	0.5-0.6	0.6-0.7	0.7-0.8	0.8-0.9	0.9-1.0	1.0-1.1	1.1-1.2	1.2-1.3	1.3-1.4	1.4-1.5	1.5-1.6	1.6
Jan	2.7	3.2	10.1	9.9	26.4	19.5	15.4	9.4	2.5	0.7	0.4						
Feb							- Data Missing -										
Mar	0.9	5.0	4.1	10.5	20.7	9.0	19.5	11.5	9.7	4.1	3.9	1.1					0.1
Apr	3.7	12.3	12.0	7.7	19.4	16.1	13.9	7.7	3.3	1.9	0.4	0.3	0.5				0.6
May	0.5	14.8	15.7	4.2	4.6	25.0	6.5	18.1	6.9	3.7							
Jun							- Data Missing -										
Jul	9.3	14.1	21.0	13.4	16.7	10.7	6.2	4.6	2.8	0.8	0.6						
Aug	3.8	3.3	24.6	13.6	22.2	18.0	7.7	3.6	1.4	1.0	0.4	0.3	0.08	0.08			
Sep	0.2	7.3	26.4	11.9	27.8	13.4	6.5	5.2	0.9	0.7							
Oct	0.7	4.0	11.4	8.4	19.0	12.9	12.8	7.6	12.2	4.6	2.6	3.1	0.6	0.3	0.1		0.4
Nov	0.1	1.3	11.4	9.2	25.7	11.6	13.9	5.0	13.6	4.6	2.1	1.2		0.1			
Dec	0.1	0.4	5.6	8.9	34.6	12.4	18.7	10.5	6.0	1.7	0.7	0.5					
Annual Average	2.2	6.6	14.2	9.8	21.7	14.8	12.1	13.3	5.9	2.5	1.1	0.7	0.1	0.05			0.5

TABLE 2.4-5

ST. LUCIE PLANT SITE - WATER QUALITY MONITORING DATA

Parameter	Worth and Hollinger[5] 1971 - 1974 Surface N	Surface Mean	Bottom N	Bottom Mean	Range Reported	Applied Biology Inc[6,7,8]# 1976 - 1978 Surface N	Surface Mean	Mid-Depth N	Mid-Depth Mean	Bottom N	Bottom Mean	Range Reported
Temperature, °C	199	25.5	199	24.9	19-32	204	24.3	144	23.7	204	23.8	14.6-30.8
Salinity, ppt	193	35.6	193	35.8	33.0-38.5	199	35.6	135	35.8	198	35.8	33.0-36.6
Dissolved Oxygen, mg/l	184	6.4	182	6.2	3.2-10.3	198	6.5	144	6.6	198	6.4	4.4-8.6
NO_3-N, mg/l as N	96*	0.018*	97*	0.013*	<.01-.651	126	0.013	126	0.013	126	0.014	<0.001-0.28
NH_3-N, mg/l as N	91*	0.013*	91*	0.013*	<.01-.121	204	0.064	203	0.067	204	0.067	<0.01-0.57
NO_2-N, mg/l as N	96*	0.002*	97*	0.008*	<.001-.060	204	0.001	203	0.001	204	0.001	<0.001-0.007
PO_4-P, mg/l as P	156	0.117	158	0.111	<.01-.186	174	<0.01	174	<0.01	174	0.01	<0.01-0.17
SiO_2-Si, mg/l as Si	156	0.203	159	0.204	<.05-0.91	174	0.19	174	0.19	174	0.21	<0.02-0.99
Total Particulate, mg/l	176	6.65	176	10.17	0.2-69.0	-	-	-	-	-	-	-
Total Organic Carbon, mg/l	-	-	-	-	-	204	6.5	204	5.8	204	6.7	0.6-35.5
Turbidity, FTU	-	-	-	-	-	144	-	144	-	144	-	0.0-26.8

* September, 1971 to August, 1973 only

During the course of the monitoring program conducted by Applied Biology, Inc, methods of analysis for NO_3, PO_4, and SiO_2 were modified. Data reported here include only data obtained using the more sensitive and accurate methods incorporated for NO_3 in April, 1977, and for PO_4 and SiO_2 in August, 1976.

TABLE 2.4-6

INDIAN RIVER WATER QUALITY DATA-SUMMER, 1974[5]

A. Nutrients, Range of Values Reported

	St. Lucie Inlet	Link Port to Jensen Beach
NH_3-N, mg/l as N	ND* - 0.221	ND - 0.046
NO_3-N, mg/l as N	ND - 0.154	0.001 - 0.270
PO_4-P, mg/l as P	0.046 - 0.329	0.050 - 0.198
SiO_2-Si, mg/l as Si	0.003 - 7.28	0.255 - 6.78

B. Salinity, Range in 0/00

	Ebb Tide		Flood Tide	
	Surface	2m Depth	Surface	2m Depth
Indian R. - North	20-32	20-35	15-33	22-35
Indian R. - South	24-35	27-35	24-35	24-35
Taylor Creek	3-12	24-33	7-14	26-31
Fort Pierce Inlet	22-36	25-36	24-36	26-36

* ND = not detectable

TABLE 2.4-7

DISTRIBUTION OF MEASURED DISSOLVED OXYGEN DATA(5,6,7,8)

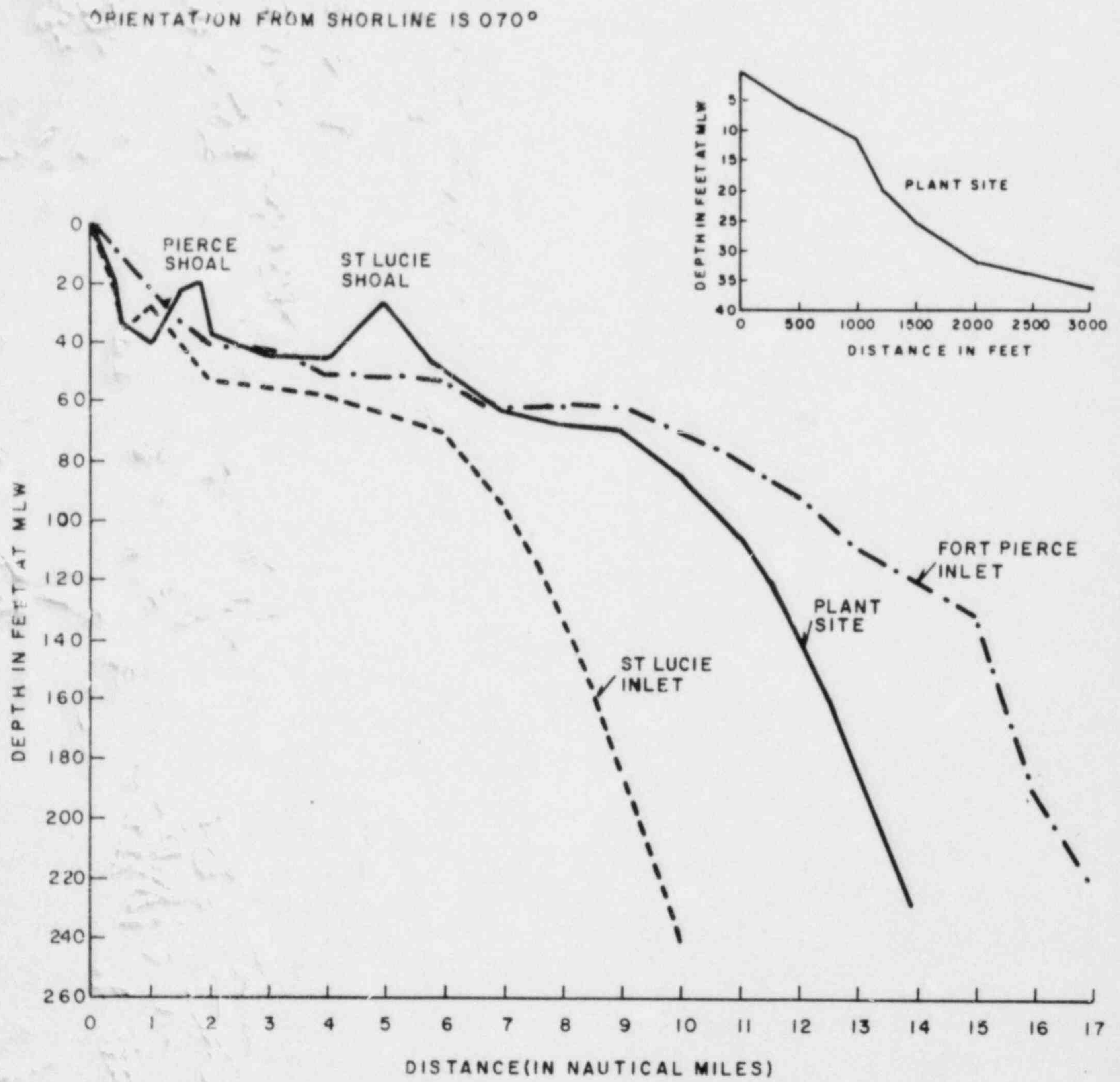
Station	No. Values Reported	Dissolved Oxygen, mg/l				
		< 5	5-6	6-7	7-8	> 8
0	87	3.4%	24.1%	46.0%	26.4%	-
1	181	4.4%	29.3%	45.3%	20.4%	0.5%
2	182	3.3%	25.8%	49.4%	20.9%	0.5%
3	177	4.0%	19.2%	53.6%	21.5%	1.7%
4*	130	6.1%	20.0%	44.6%	25.4%	3.8%
5*	127	6.3%	20.5%	43.3%	27.6%	2.4%
Total	884	4.5%	23.4%	47.5%	23.1%	1.5%

* No values reported for these stations September, 1973 to August, 1974.

TABLE 2.4-8

REPORTED RANGES OF NUTRIENT IN COASTAL OCEAN AREAS

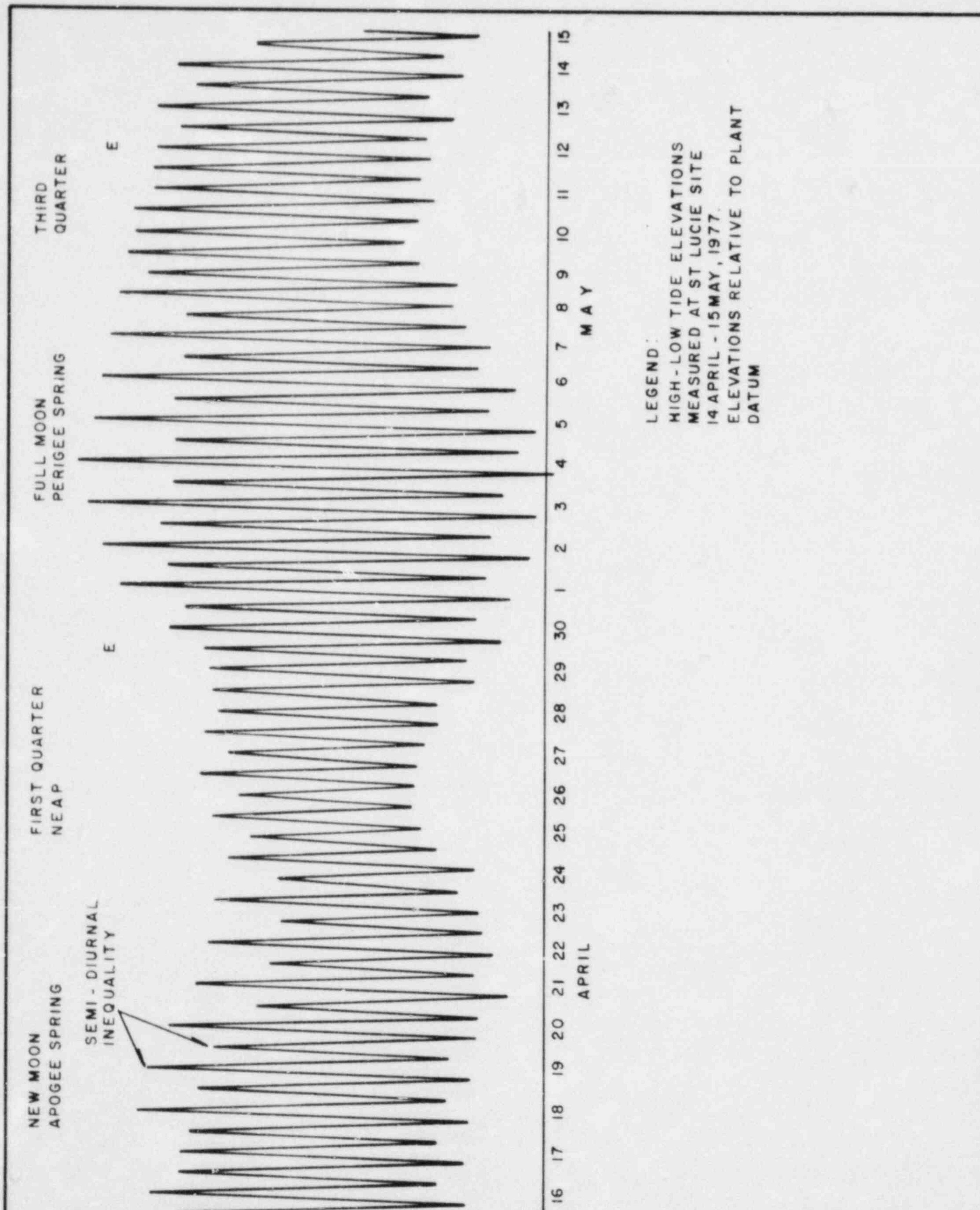
	Riley and Skirrow, 1965 (9)	Sverdrup, et al., 1942 (10)	Raymont, 1963 (11)
PO_4-P, mg/l as P	0-0.035	0.0015-0.062	0-0.060
NO_3-N, mg/l as N	0.070-0.350	0.007-0.378	<0.005-0.300
NH_3-N, mg/l as N	0-0.055	~0-0.031	0.007-0.200
NO_2-N, mg/l as N	-	~0-0.011	0-0.015
SiO_2-Si, mg/l as Si	0.010-1.63	0.014-1.68	0.010-1.50



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

BATHYMETRIC PROFILES OFFSHORE
HUTCHINSON ISLAND

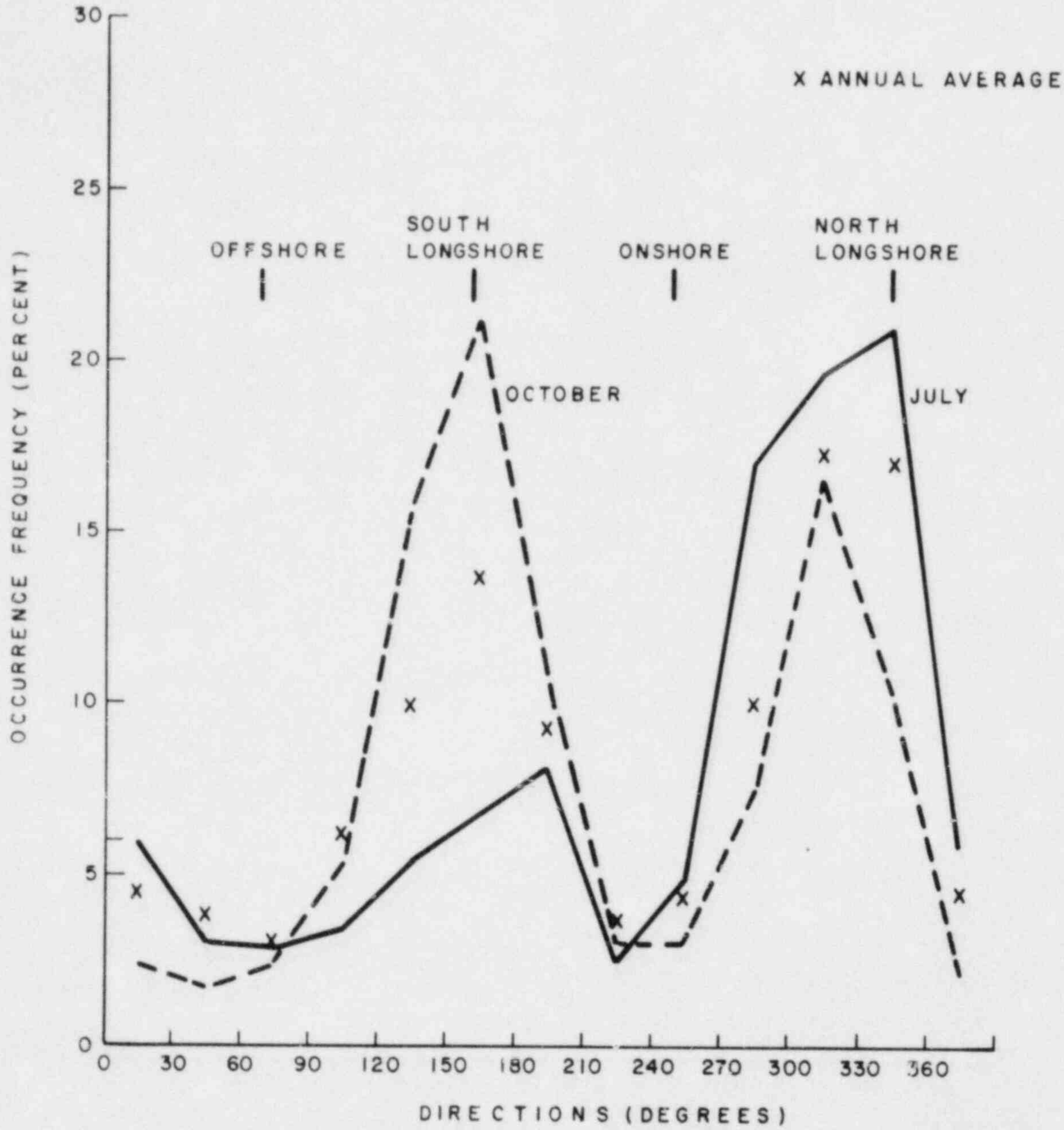
FIGURE 2.4-1



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

HIGH- AND LOW-TIDE ELEVATIONS AT ST LUCIE SITE

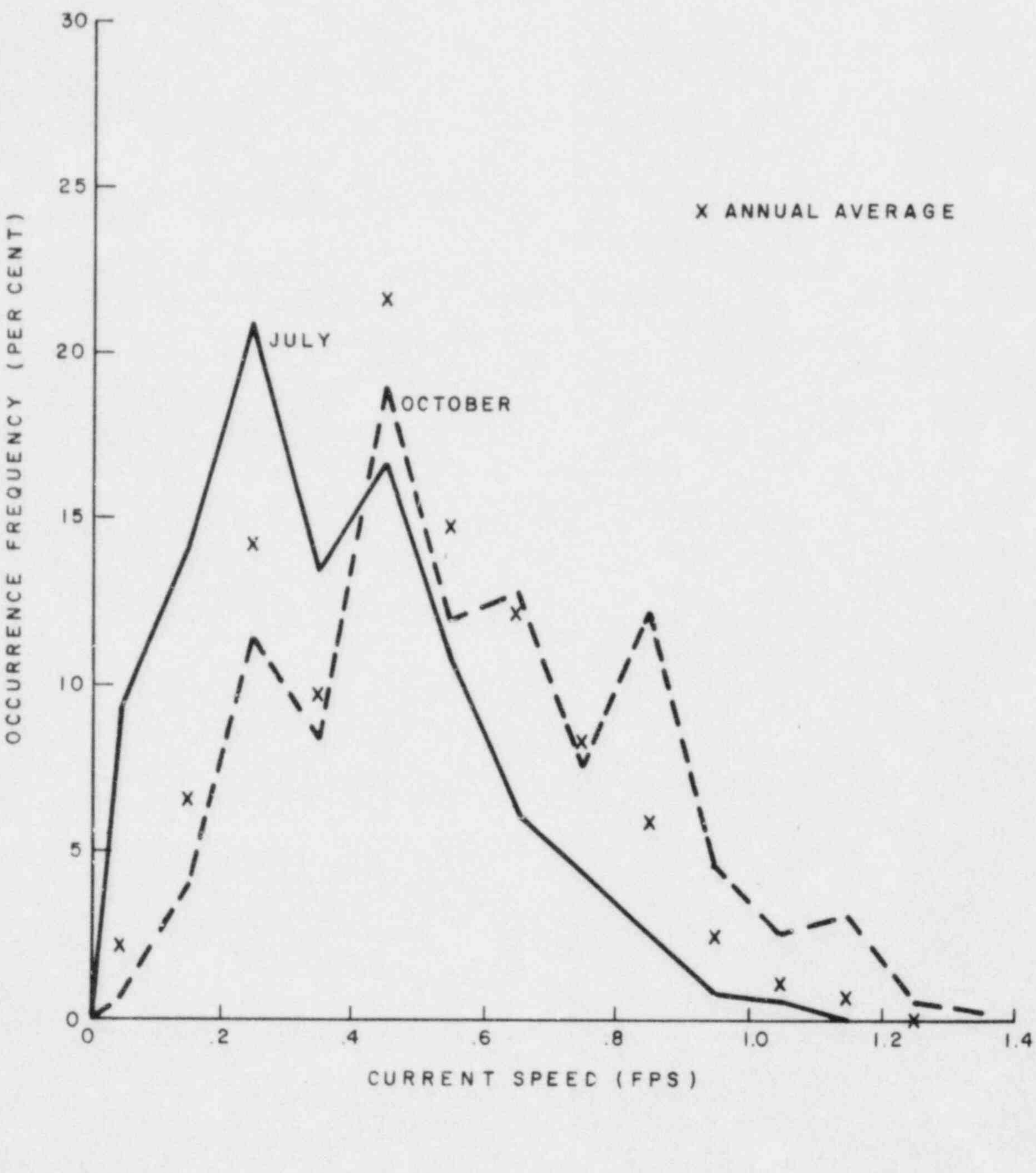
FIGURE 2.4-2



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

FREQUENCY OCCURRENCE OF NEARSHORE CURRENT DIRECTION

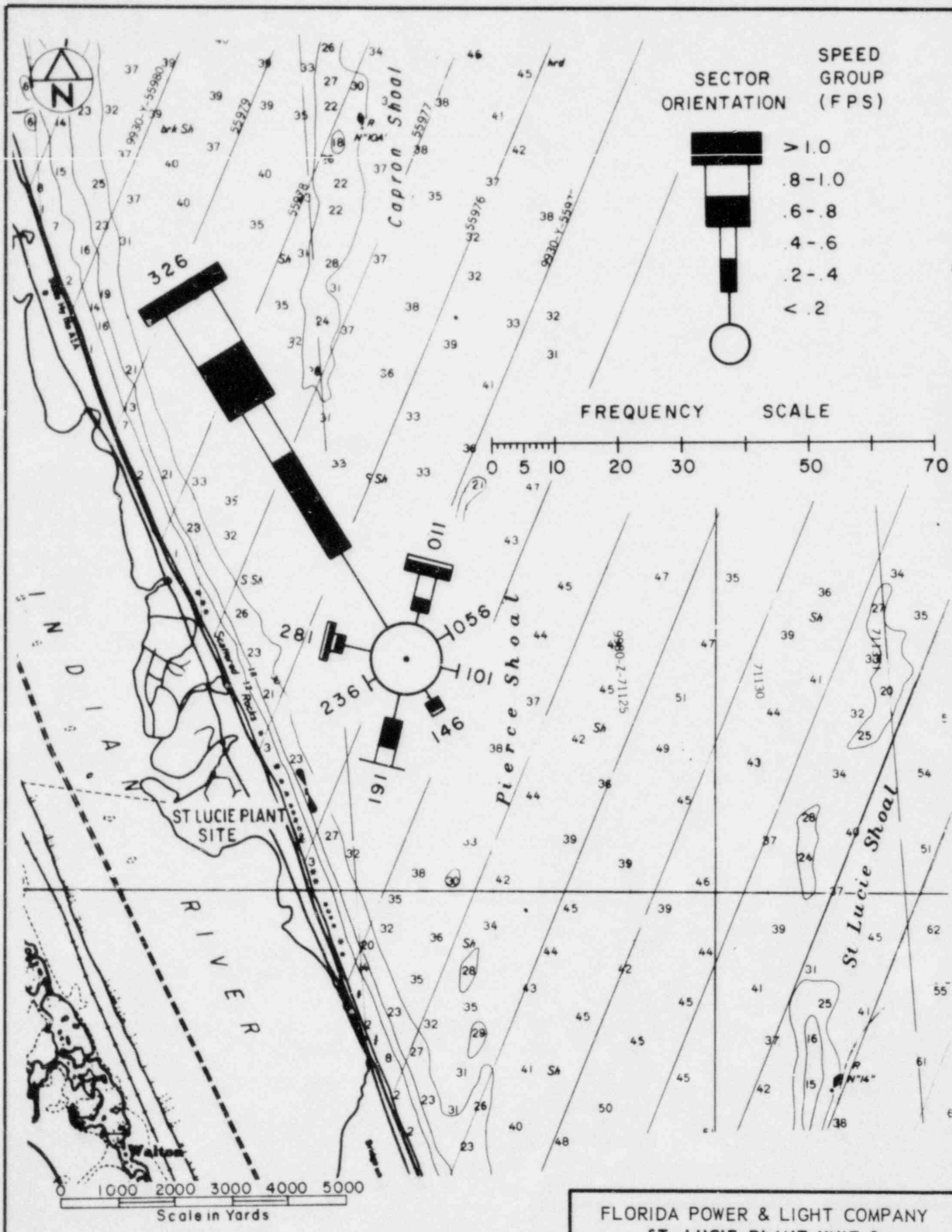
FIGURE 2.4-3



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

FREQUENCY OCCURRENCE OF NEARSHORE CURRENT SPEED

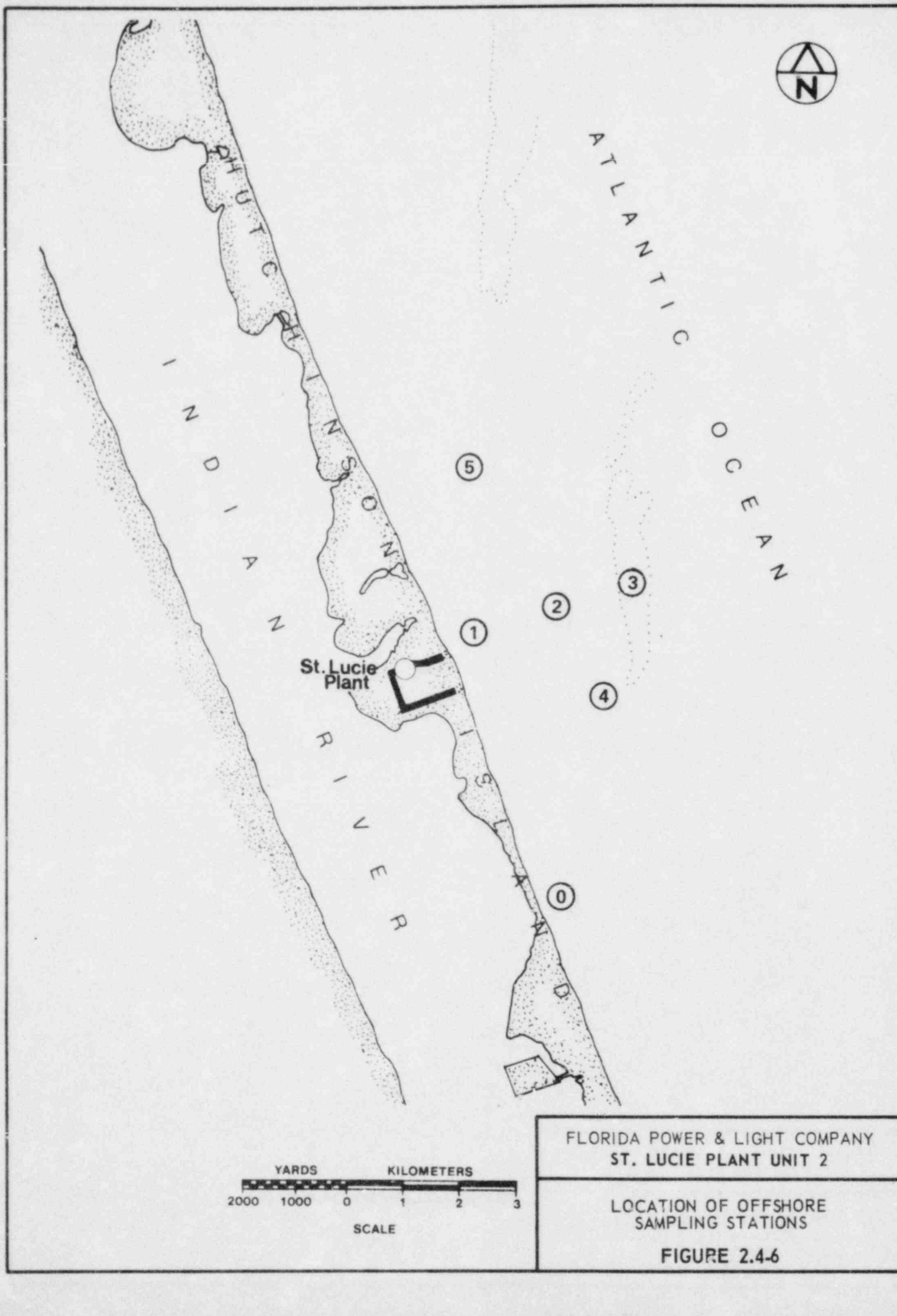
FIGURE 2.4-4



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

CURRENT ROSE – ALL MEASUREMENTS
MARCH 25 – APRIL 4, 1977

FIGURE 2.4-5



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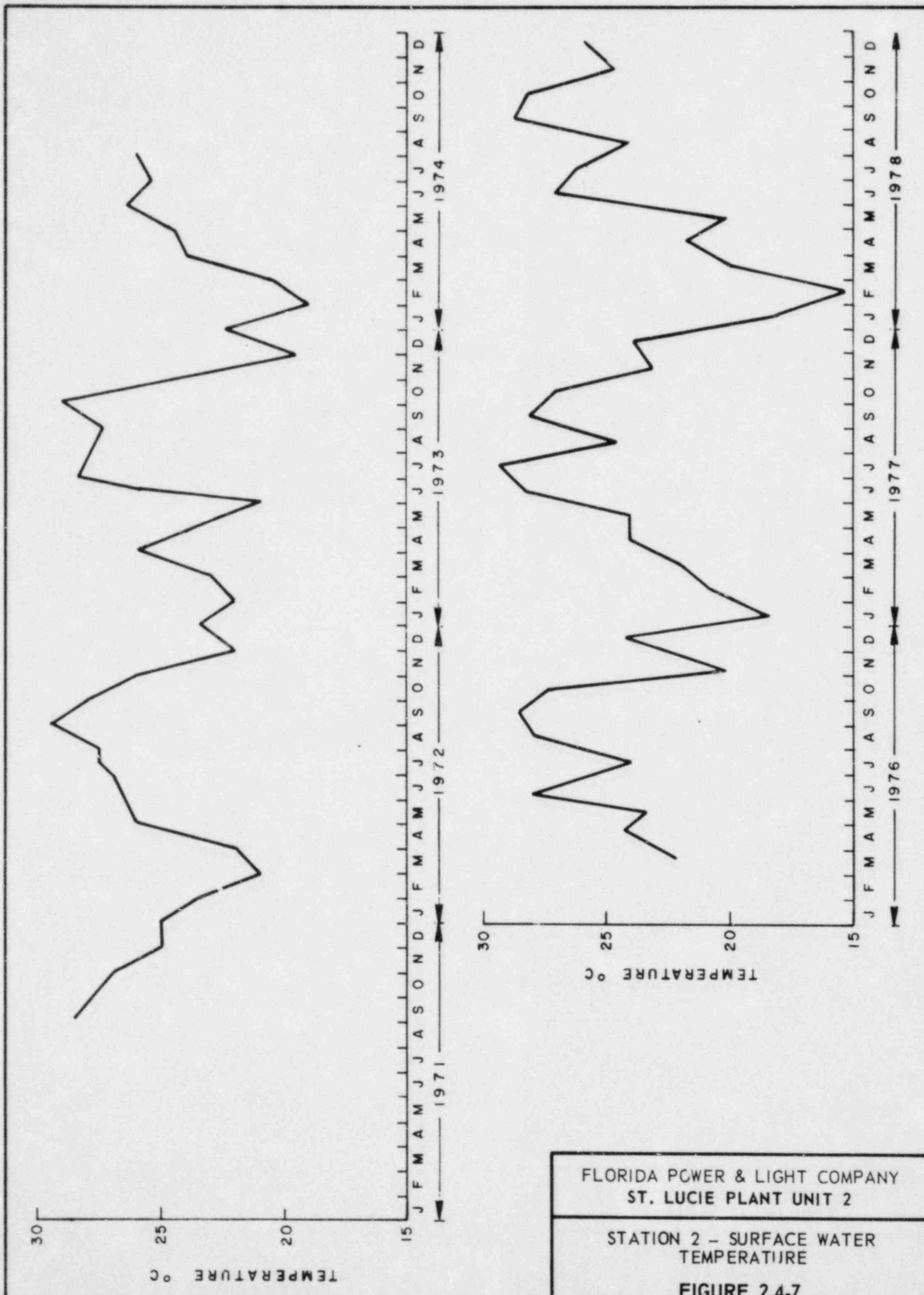
LOCATION OF OFFSHORE SAMPLING STATIONS

FIGURE 2.4-6



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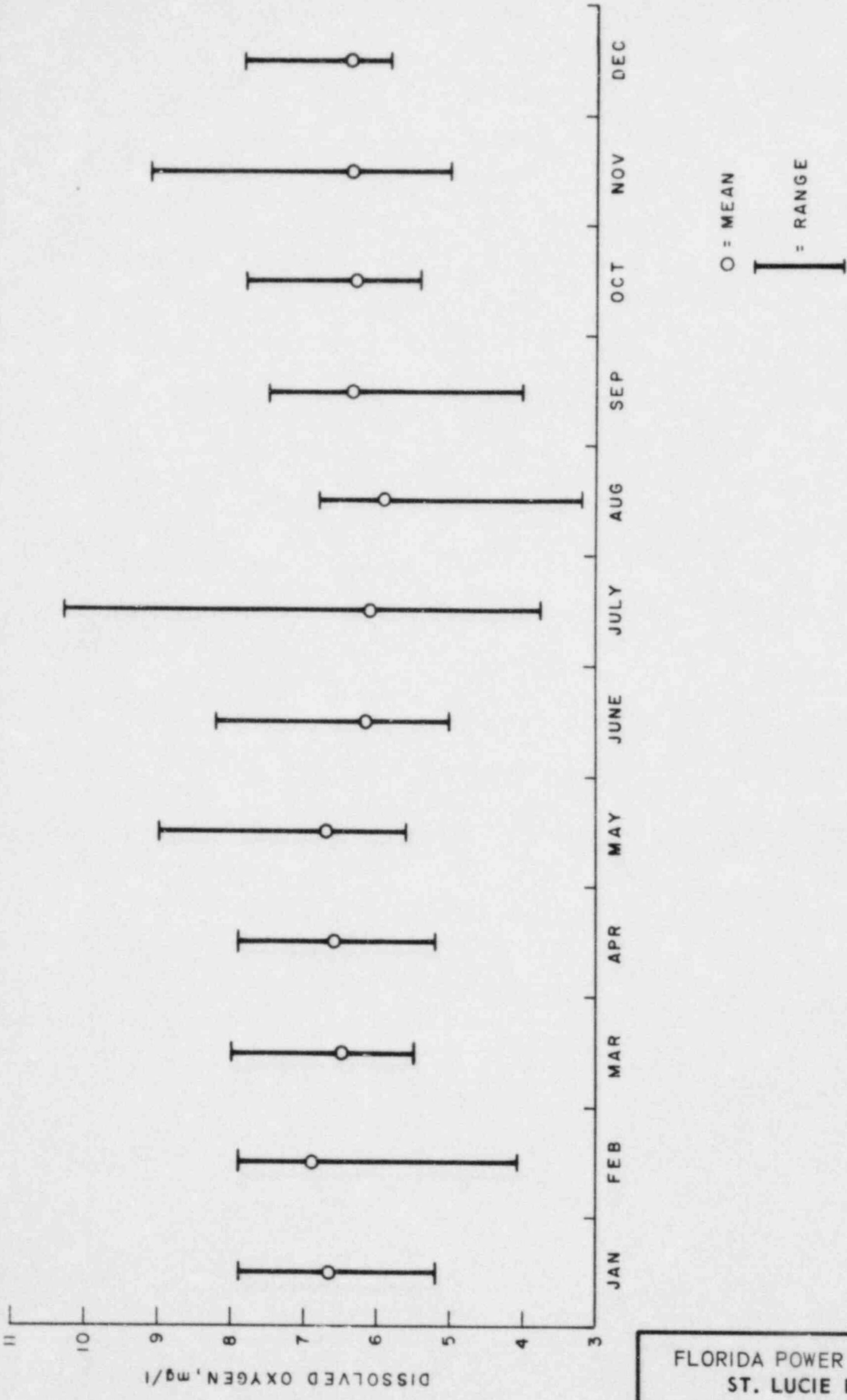
STATION 2 – SURFACE WATER TEMPERATURE

FIGURE 2.4-7



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DISSOLVED OXYGEN VALUES BY MONTH
STATIONS 1 THROUGH 5, POOLED

FIGURE 2.4-8

2.5 GEOLOGY

A description of the major geological aspects of the St Lucie site and surrounding environs has been presented the St Lucie Unit 2 Environmental Report - Construction Permit and the St Lucie Unit 2 Final Environmental Statement.

2.6 REGIONAL HISTORIC, ARCHEOLOGICAL, ARCHITECTURAL, SCENIC, CULTURAL, AND NATURAL FEATURES

2.6.1 HISTORIC, ARCHEOLOGICAL AND ARCHITECTURAL FEATURES

The National Register of Historic Places (1969, and as amended in Federal Register, Volume 44, No. 26, dated Tuesday, February 6, 1979) does not list any historic places within five miles of the plant site. The two nearest historic places were added to the Register on February 6, 1979[1]. They are: 1) House of Refuge, 11 miles south southeast of the St Lucie site; and 2) the site of Fort Pierce, approximately eight miles northwest of the plant site (see Figure 2.6-1). The House of Refuge, originally a haven for shipwrecked sailors, is now a two story frame museum with a lookout tower above its roof. The site of Fort Pierce is identified by a brass marker, since nothing of the original fort remains today. The next nearest places referenced in the National Register of Historic Places are about 40 miles north and west of the plant, and have been noted in the St Lucie Unit 2 Environmental Report - Construction Permit, Section 2.3.

The impact of St Lucie Unit 2 construction on existing archeological sites is discussed by the Florida State Board of Archives and History in Section 2.3 of the St Lucie Unit 2 Environmental Report - Construction Permit. In addition, it is not expected that new historic or archeological sites will be found in the plant vicinity. According to the Final Environmental Statement for St Lucie Unit 2, dated May, 1974: "As the site has previously been surveyed for Unit 1, and essentially all of the land clearing for both units was accomplished during the construction of Unit 1, there is virtually no potential for discovery of objects of historical, archeological, architectural, or natural significance during construction of Unit 2".

2.6.2 SCENIC, NATURAL AND MAN-MADE FEATURES

The area surrounding St Lucie Unit 2 contains many natural features. These include the Atlantic Ocean and its beaches, the Indian River and Intracoastal Waterway, the native and introduced vegetation, Hutchinson Island, and many smaller water bodies in the area. Several man-made features also exist in the surrounding area, and are visible from various locations.

To assess the visual impact of St Lucie Unit 2 on this environment, a professional landscape architect surveyed the area during March 7-9, 1979. Manmade and/or maintained scenic areas, such as parks and recreation areas, as well as natural untouched areas were visited. Representative locations were checked for the extent of view of the St Lucie Unit 1 containment building, the partially completed St Lucie Unit 2 containment building, and the ancilliary power plant structures which could be seen by observers at these points. Photographs were taken of typical views of the power plant complex (Figure 2.6-1). This survey provides the basis for the following discussion:

2.6.3 EFFECTS ON NEARBY RESIDENTS AND MOTORISTS

Residents are accustomed to the visual impact of St Lucie Unit 1, and its ancilliary structures. The construction of St Lucie Unit 2 will not greatly alter the existing landscape, and therefore, it is expected to contribute only a limited additional visual impact on the existing landscape. A discussion of the visual impact on specific residential complexes follows.

The nearest residences will be the condominium units called Sand Dollar Villas, 1.4 miles south of St Lucie Units 1 and 2. Persons living on the upper floors of the most northerly of the five units of this complex will be able to obtain a clear aerial view of the total plant site. Views of the plant from the other four units will be blocked by this most northerly unit. Since these condominium units will not be available for occupancy until mid-1980, persons moving into the most northerly unit will be fully aware of the presence of the plant.

The next closest residential development parallels State Route (SR) 707, from the Jensen Beach Bridge, north to the City of Fort Pierce. This linear development is about 1.8 miles west of the plant site. Views available to residences along SR 707 are intermittent and are obstructed by natural vegetation on the eastern side of SR 707.

The plant is most visible to motorists on SR A1A, since it is located approximately 1000 feet west of the road. Assuming a driving speed of 55 miles per hour along SR A1A, northbound motorists will have a view of a total elapsed time of approximately one minute. Persons southbound on Route A1A will observe the plant for about the same period of time. (See Figure 2.6-2 for locations of observation points on SR A1A and Table 2.6-1 for viewing stations, distances, and extent of viewing possible at each station). Photographs, taken by a professional landscape architect, illustrating the views of the plant from SR A1A, are shown in Figures 2.6-3 and 2.6-4. Figure 2.6-5 is a photograph of the plant switchyard and transmission lines, taken from SR A1A and looking across Big Mud Creek to the Indian River.

Motorists may also view the power plant from SR 707, roughly 1.8 miles west of the plant. Figure 2.6-6 is a photograph of the St Lucie Plant taken from this highway. The views obtained from SR 707 will be intermittent because of intervening vegetation along the eastern side of the SR 707 roadway, and because SR 707 is a narrow and meandering road which requires close attention on the part of the driver. It should also be pointed out that the distance between SR 707 and the plant is such to reduce the visual impact of the plant. Several of the multistory apartment condominum buildings on Hutchinson Island are more prominent than is the power plant complex.

The plant is also visible to boaters on the Intracoastal Waterway (Indian River). Figures 2.6-7 and 2.6-9, taken from SR 707, are representative of views which could be observed by Indian River boaters and fishermen. From observations made along SR 707, some of the high-rise apartments and condominium buildings on Hutchinson Island are more prominent to persons on the Indian River than the buildings of the power plant complex.

2.6.4 EFFECTS ON VIEWS FROM OCEAN BEACHES

Several of the ocean beaches closest to the plant were visited, and no part of the existing plant complex could be observed from them. It is conceivable that glimpses of the highest element (reactor containment building) of St Lucie Unit 2 could be obtained from some beach areas, but such areas were not discovered during field reconnaissance. Any glimpses of the plant by persons on ocean beaches would be of the tops of the reactor containment building only, because of intervening vegetation and the difference in elevation between the plant site and the ocean beach.

2.6.5 EFFECTS ON VIEWS FROM BRIDGES

Views from area bridges are considered to be important in the visual analysis because they are elevated and heavily used. Therefore, motorists and fishermen on the bridges obtain a clear and unobstructed view of the Indian River and its environs, and these views are of great beauty. All of the bridges have one or more parks abutting them. These parks contain active and passive recreational facilities. A discussion of views from the bridges and the parks abutting them follows.

Both Jensen Beach Bridge and Stuart Bridge (also known as Ocean Boulevard) are too far from the plant to afford a clear view of it. This is also true for the parks abutting them. Figure 2.6-7 shows St Lucie Units 1 and 2 as observed from the park on the west side of the east draw bridge of the Jensen Beach Bridge. It can be seen that there is very little impact from the plant upon observers in the park. This bridge and its parks are six miles from the St Lucie plant site.

The picnic area and Jaycee Park which are located adjacent to the Stuart Bridge were also visually checked for impact. The St Lucie site is barely visible to the naked eye from the bridge and its parks. The Stuart Bridge is ten miles from the plant site.

Views from the two bridges north of the St Lucie site were also checked. South Bridge, 8.6 miles from the plant site, does afford a view of St Lucie Units 1 and 2. The plant's permanent elements, however, are dwarfed by condominiums and apartment buildings in the visual plane of the plant and its visual effects are thereby reduced. Of even greater visual importance are objects in the foreground of the viewer from the span, such as transmission line towers, the sewage disposal treatment plant for the city of Fort Pierce, and the bulk of buildings and stacks of the city power plant.

South Bridge is abutted on its north side by a park containing the St Lucie County Historical Museum, a public boat ramp, a US Coast Guard Installation, and a Fort Pierce Fire Department Beach substation. There is no view of St Lucie Unit 2 from this park, because of intervening, view-obstructing vegetation, buildings, and the bridge supports and understructure.

The next bridge north of South Bridge, the "North Bridge" or Banty Saunders Bridge, is ten miles from the plant. There is virtually no view of the plant from this bridge. It can be only dimly perceived, and it is viewed between the supports of the South Bridge, which is the taller of the two bridges.

2.6.6 EFFECTS ON VIEWS FROM OTHER AREAS

The plant is barely discernable from the Indian River Drive Memorial Park, which is a large and heavily used municipal park in the city of Fort Pierce, on the banks of the Indian River (Figure 2.6-8 is a photograph of the St Lucie plant from the nearest point of the park). Within this park are a recreation center for senior citizens, an art gallery, amphitheater, boat ramp, and a municipal yacht basin.

Other scenic areas, including the South Jetty Fishing Pier and the Jaycee Park on SR AlA, have no view of the plant because of intervening vegetation and structures.

Figure 2.6-10 is a photograph of the plant from the "backyards" of residential trailers located in a trailer park (named Venture 3) off SR AlA. This trailer park is about 5.5 miles south of the St Lucie site. This photograph may also be taken as representative of the view of the plant as seen by residents of Nettles Island, to which access could not be gained on the field reconnaissance survey. Nettles Island is approximately four miles from the plant and extends farther into the Indian River than does the area from which the photo was taken. However, its view of the plant is screened by existing vegetation on Hutchinson Island, except at its most westerly tip. (See Figure 2.6-1).

The Savannas Recreation Area is a wilderness recreation area located almost totally within the City of Fort Pierce. It is west of SR 707 on Midway Road, and covers approximately 550 acres. This area is still under development and will eventually include picnic areas, botanical gardens, a boat ramp, and camp sites for tents and trailers. St Lucie Units 1 and 2 cannot be seen from this area because of its distance from the Indian River and the intervening vegetation.

2.6.7 SUMMARY OF EFFECTS

In summary, it may be stated that the only full and unobstructed views of St Lucie Unit 2 are those gained by persons travelling along SR AlA within a limited distance in both north and south directions of the plant. The only views of the plant which can be considered to be of significant effect are obtained at intervals in cleared areas along SR 707, and these views are usually mitigated by vegetation, piers, boats, etc. Occupants of vehicles will not be very aware of the plant's presence across the Indian River because of more distracting elements closer at hand; pedestrians and residents in homes along the west side of SR 707 will probably be more aware of the plant and the transmission line supports traversing the waters of the Indian River. All other areas of scenic value were found to be very mildly affected by virtue of distance and/or screening elements such as structures or vegetation and/or elevational differentials.

SECTION 2.6: REFERENCES

1. National Register of Historic Places, Annual Listing of Historic Properties. Federal Register, Wednesday, February 6, 1979, Part II. US Department of Interior; Heritage, Conservation and Recreation Service.

TABLE 2.6-1

SR A1A - POINTS FROM WHICH ST LUCIE PLANT (2 UNITS) CAN BE OBSERVED

NORTHBOUND ON A1A

Station #	Location (in feet/miles)	Degree to which partial/full view of plant complex is obtained
0	.2 mile (1050') south of intake canal	Partial & intermittent
1	.2 mile (1050') north of sta. 0- at intake canal	Almost full view
2	.5 mile (2640') north of sta. 1 - directly opposite discharge canal	Full view
3	.2 mile (1050') north of sta. 2	At this station, plant is no longer in view.

Max. period of full view ± 3168' or ± .6 mile (stations 1–2)

Total miles elapsed = .9 (4752' ±)
Total time (@ 55 mph) = 1 minute ± (59 seconds)

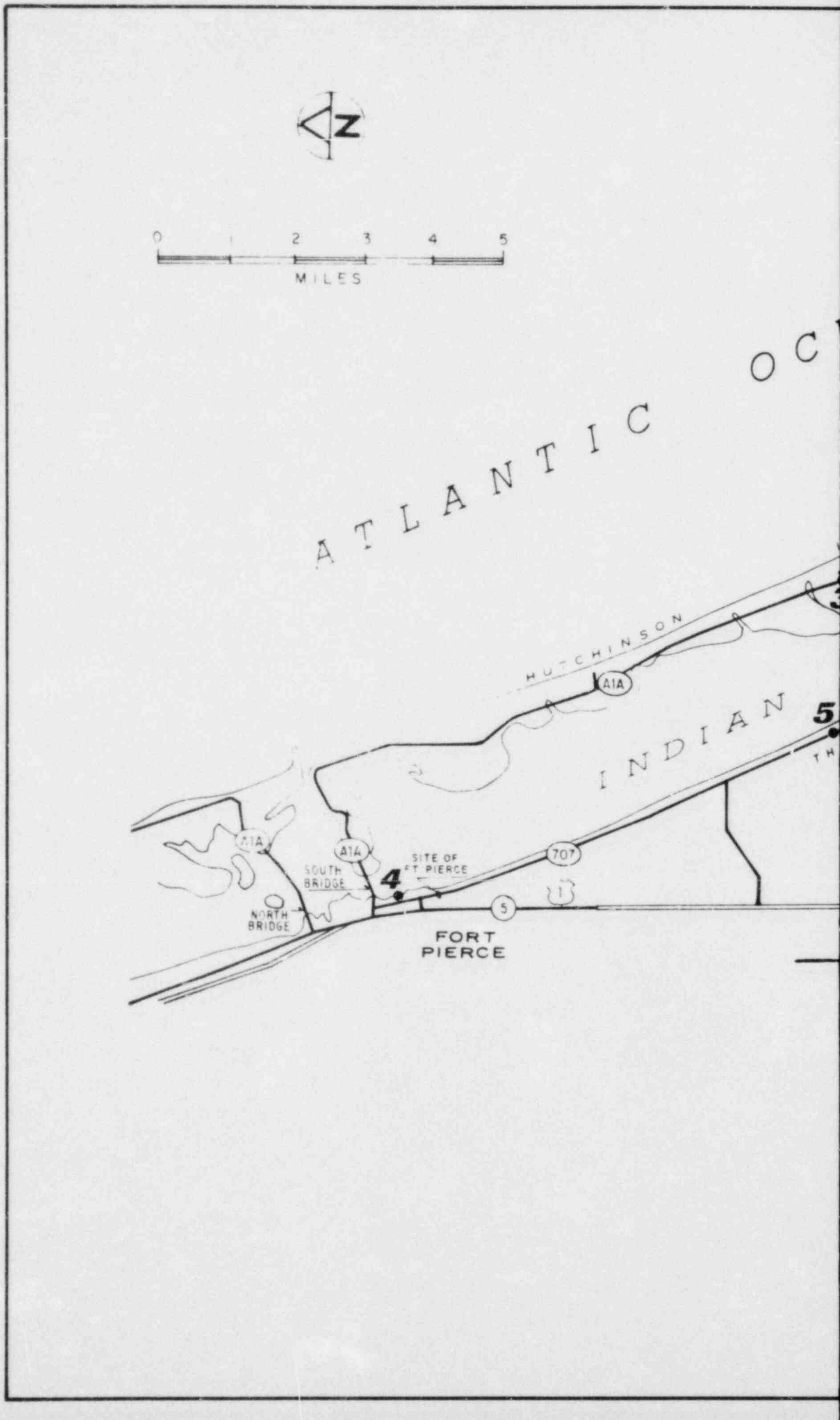
SOUTHBOUND ON A1A

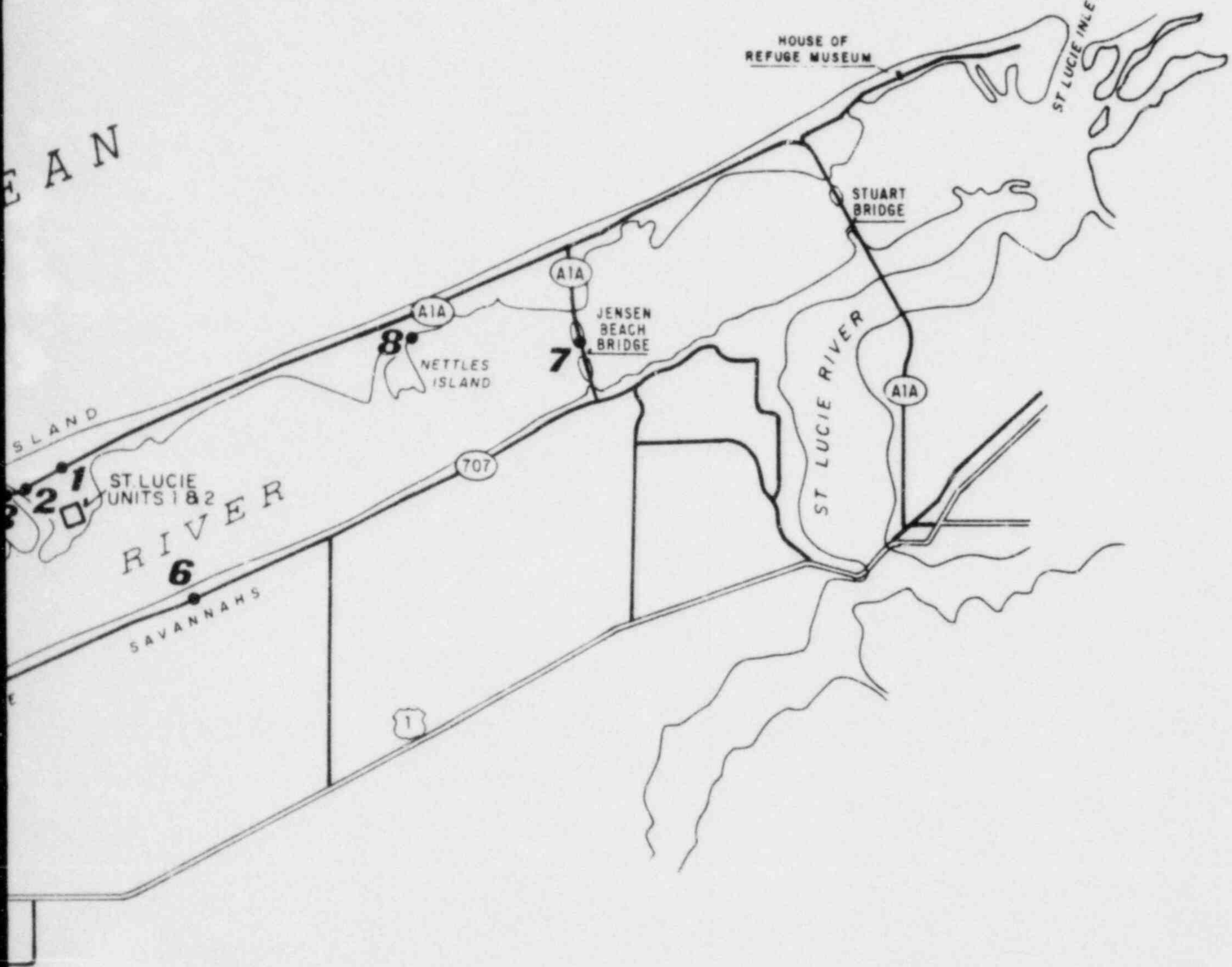
Station #	Location (in feet/miles)	Degree to which partial/full view of plant complex is obtained
0	.6 mile (3168') north of discharge canal	Intermittent views of highest elements only
1	.15 mile (792') south of sta. 0	Full view
2	.45 mile (2376') south of sta. 1 - directly opposite discharge canal	Full view
3	.4 mile (2112') south of sta. 2	Plant (and site) no longer visible

Max. period of full view ± 4488' or ± .9 mile (stations 1–2)

Total miles elapsed = 1.0 (5280')
Total time (@ 55 mph) = 1 minute, 5 seconds ±

Note: See Figure 2.6-2 for graphic locations of viewing points.


N
0 1 2 3 4 5
MILES
ATLANTIC OC
HUTCHINSON
A1A
INDIAN
5
4
SITE OF FT PIERCE
SOUTH BRIDGE
NORTH BRIDGE
707
5
1
FORT PIERCE



FOR PHOTOGRAPH LOCATION NUMBER	SEE FIGURE NUMBER
1	2.6-3
2	2.6-4
3	2.6-5
4	2.6-8
5	2.6-6
6	2.6-9
7	2.6-7
8	2.6-10

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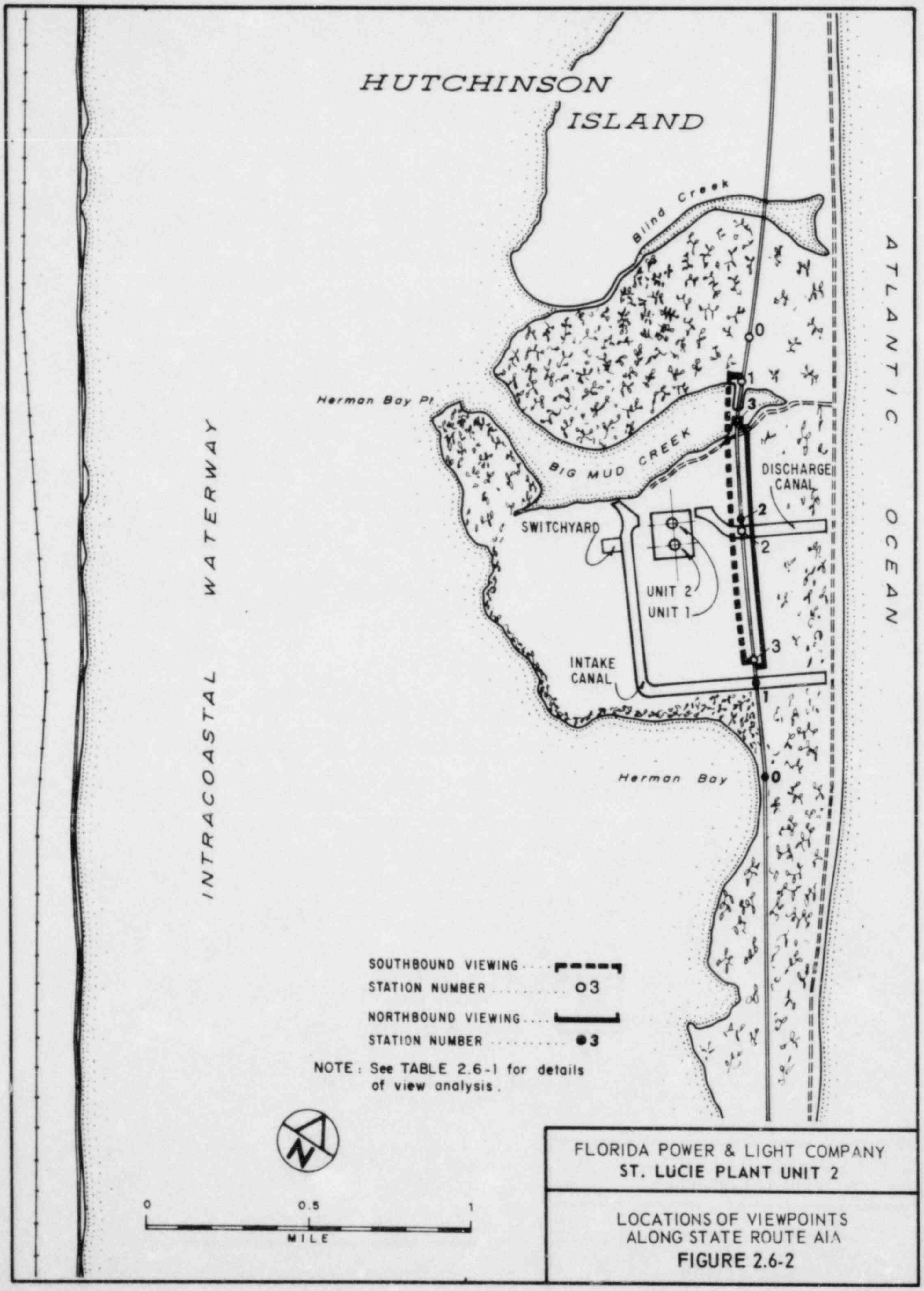
LOCATION OF HISTORIC SITES & INDEX OF PLANT PHOTOGRAPHS
FIGURE 2.6-1



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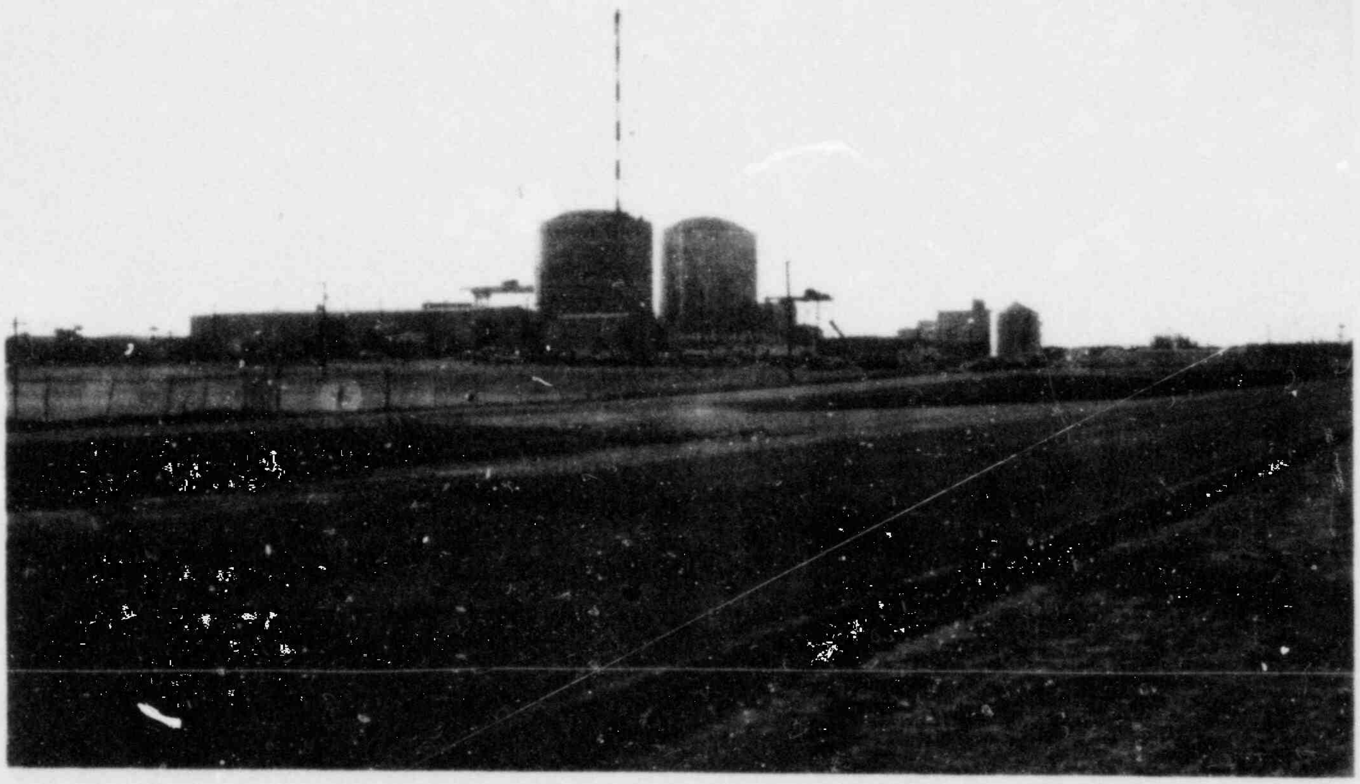
ST. LUCIE PLANT UNIT 2

LOCATIONS OF VIEWPOINTS ALONG STATE ROUTE A1A
FIGURE 2.6-2



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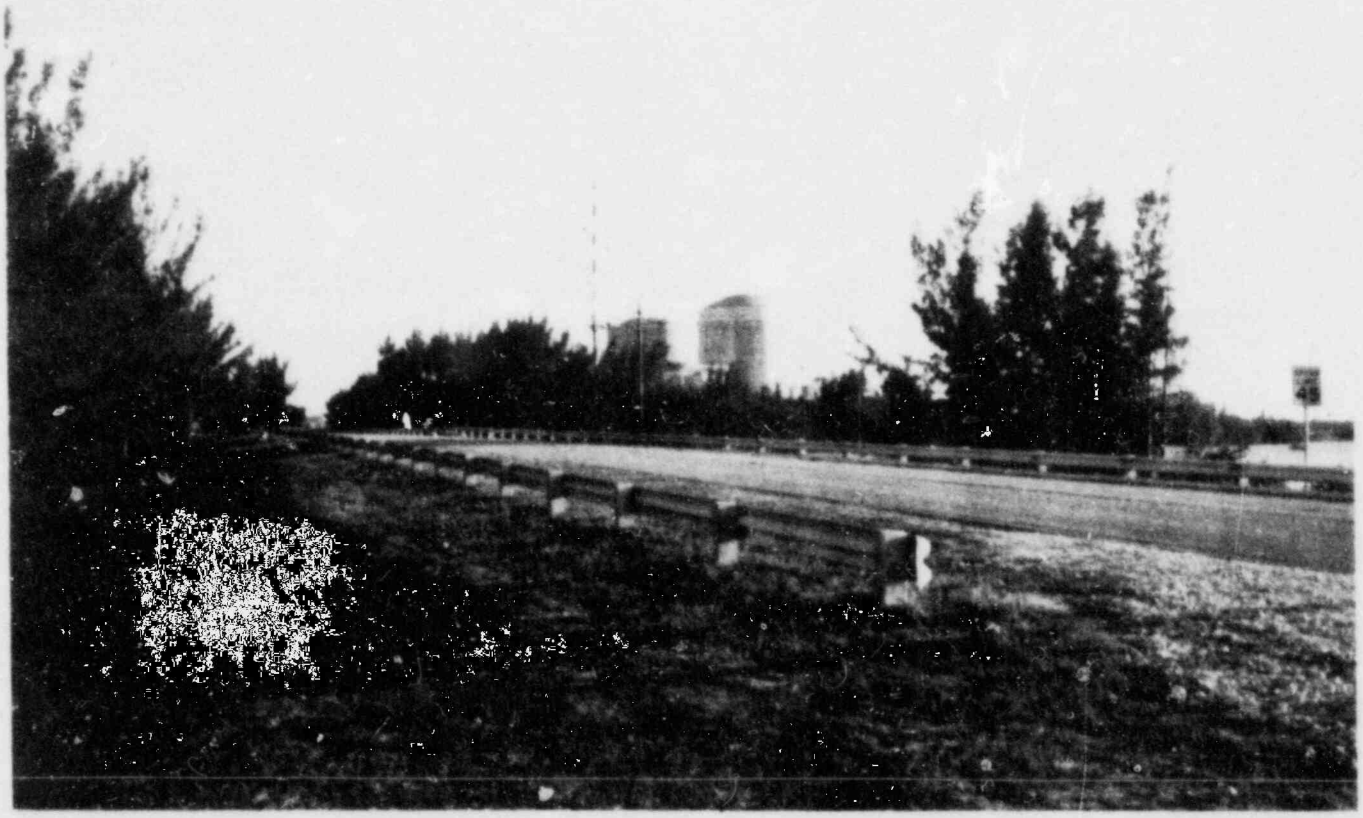
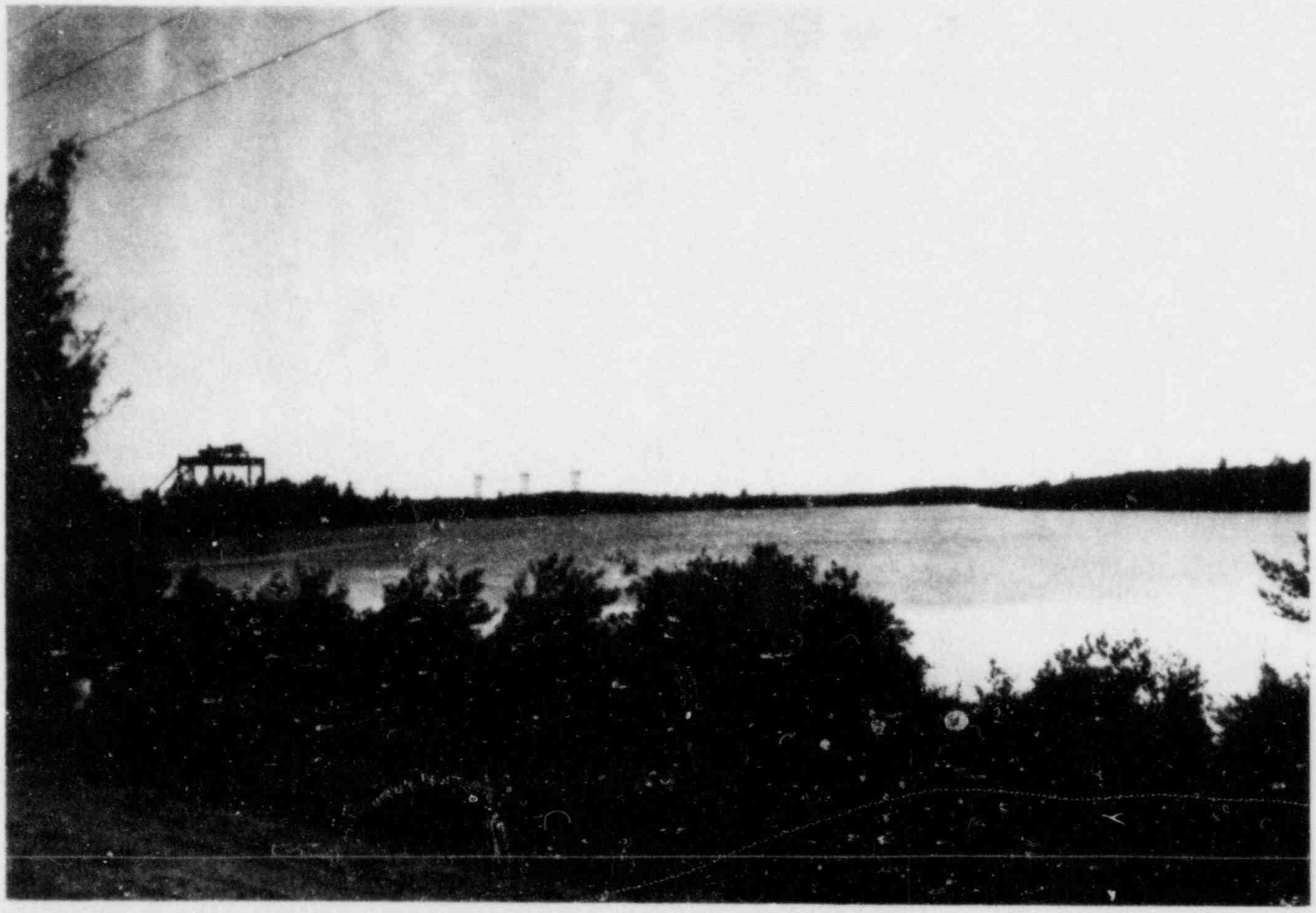
ST. LUCIE PLANT UNIT 2

VIEW OF POWER PLANT COMPLEX ABOUT 1000 FEET SOUTH ON ROUTE A1A
FIGURE 2.6-3



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

VIEW OF POWER PLANT ON ROUTE A1A, ABOUT 2000 FEET NORTH OF PLANT
FIGURE 2.6–4



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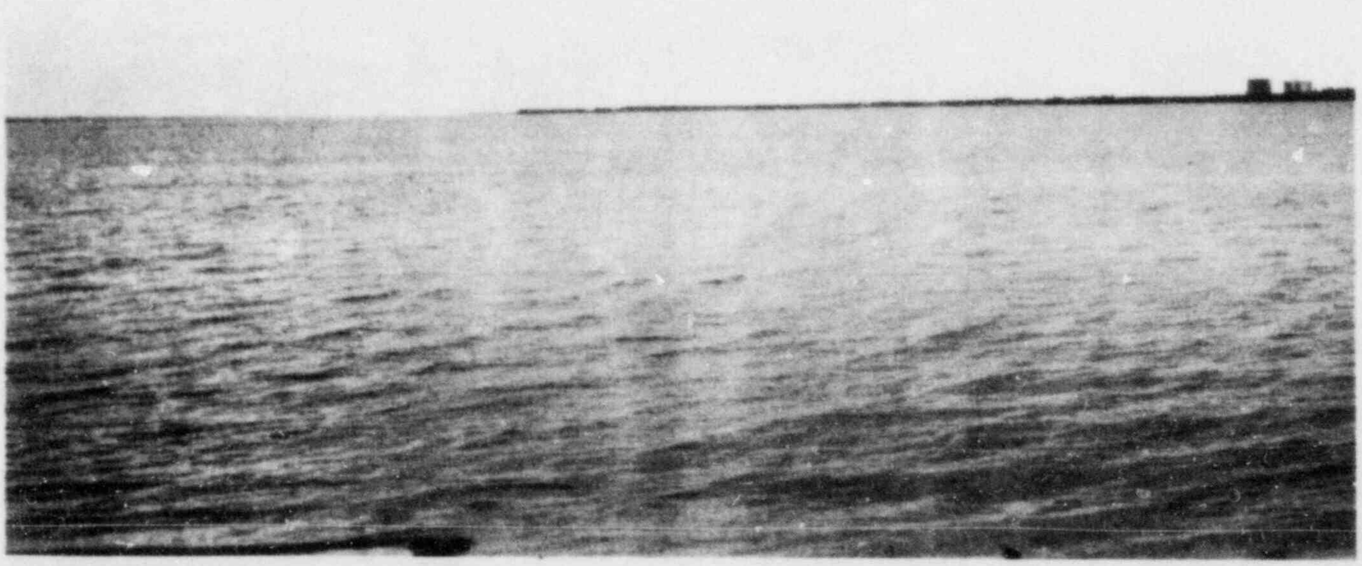
ST. LUCIE PLANT UNIT 2

VIEW FROM ROUTE A1A, LOOKING ACROSS BIG MUD CREEK TO THE POWER PLANT
FIGURE 2.6-5

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

VIEW OF POWER PLANT & TRANSMISSION LINES FROM ROUTE 707
FIGURE 2.6–6



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ST. LUCIE PLANT UNIT 2

VIEW FROM ROUTE 707A
(JENSEN BEACH BRIDGE ROAD)
FIGURE 2.6–7

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VIEW OF POWER PLANT FROM INDIAN RIVER MEMORIAL PARK IN FT. PIERCE

FIGURE 2.6–8

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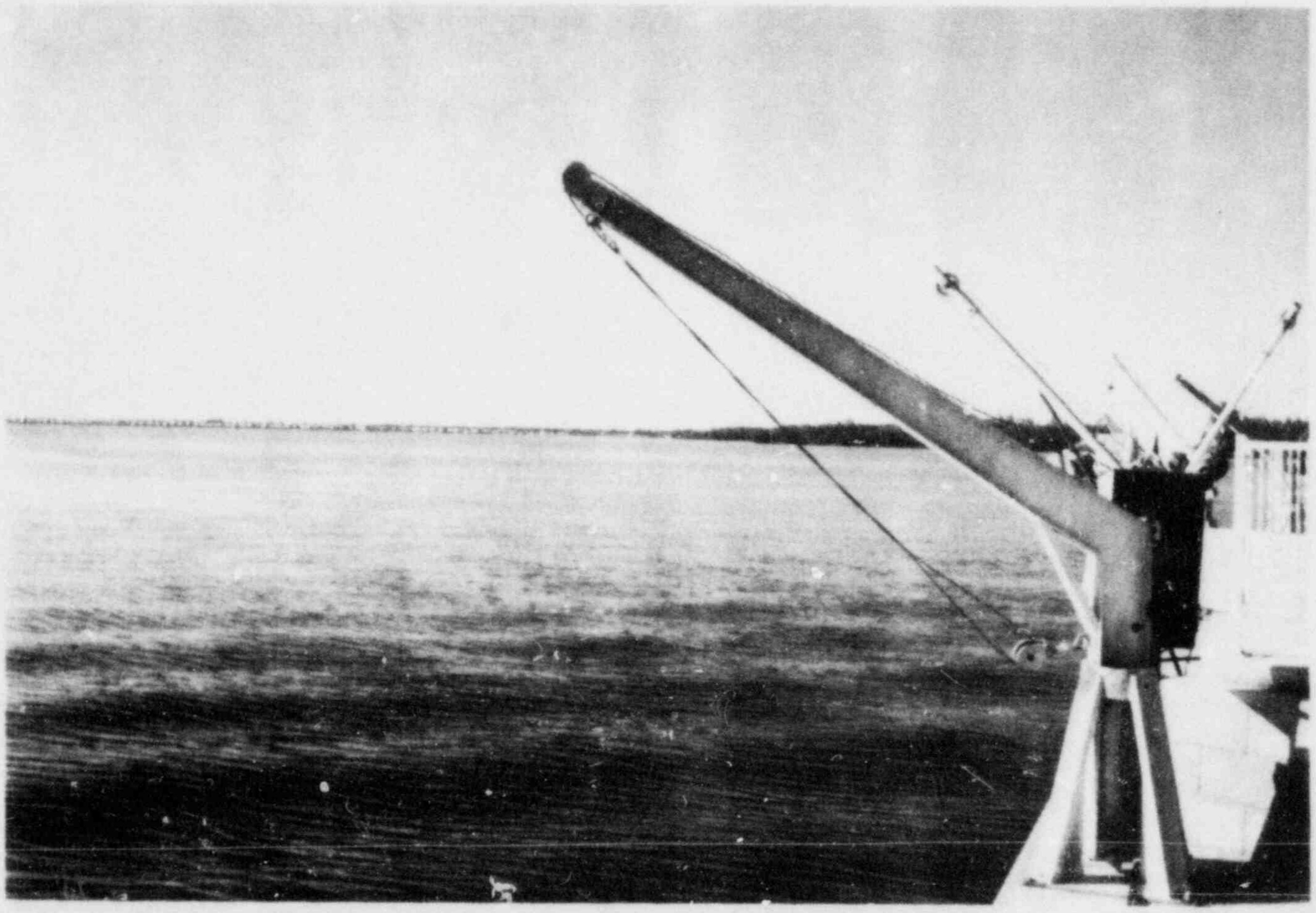
TYPICAL INTERMITTENT VIEW OF PLANT FROM ROUTE 707

FIGURE 2.6–9



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VIEW OF POWER PLANT FROM TRAILER
639 IN THE VENTURE 3 TRAILER PARK

FIGURE 2.6–10

2.7 NOISE

2.7.1 NOISE SURVEY IN THE ST LUCIE UNIT 2 VICINITY

In order to determine the environmental sound levels presently existing in the St Lucie 2 site area, a sound level survey was conducted from Friday, March 16 to Monday, March 19, 1979. These days were considered typical weekday and weekend days. At the time of the survey St Lucie Unit 2 was under construction and St Lucie Unit 1 was operating.

2.7.1.1 Noise Measurement

Ambient noise levels were obtained at nine locations within a radius of five miles of the St Lucie plant. The nine locations were chosen to represent the communities in the St Lucie site vicinity. The measurement locations are shown in Figure 2.7-1.

Ambient noise data were collected in the areas surrounding the St Lucie site with a GR 1945 Community Noise Analyzer, and included measurement of noise levels ranging from L_{min} to L_{max}. During the time period when data were measured, brief sampling measurements were obtained by observing the residual "A" weighted sound level with a GR 1933 Precision Sound Level Meter to supplement the data gathered by the Community Noise Analyzer.

Weather information was taken to assure that weather conditions permitted acoustic monitoring. Informal measurements of wind speed and wet/dry bulb temperature were obtained at each acoustic measurement point with hand held instruments while data were being measured by the GR 1945 Community Noise Analyzer. Hourly barometric pressures were obtained from the National Weather Service for the West Palm Beach Airport, located approximately 50 miles south of the St Lucie site. The weather observations are presented in Tables 2.7-1 to 2.7-4. The barometric pressures presented in the tables are considered to approximate the barometric pressures at the measurement locations. The weather observations presented indicated acceptable conditions for monitoring sound for all locations except for: position 7 on Monday, March, 19, 1979, a weekday night, when the relative humidity exceeded 90 percent; position 2 on Friday, March 16, 1979, a weekday day; and, position 9 Saturday, March 17, 1979, a weekend day, when the wind speed exceeded 11 mph. The sound level data for these three points have been included in Tables 2.7-5 to 2.7-12 because they appear representative of noise conditions near the site.

2.7.1.2 Survey Instrumentation

The GR 1945 Community Noise Analyzer was the primary sound measuring device used in this survey. For this survey, the instrument monitored ambient sound levels at selected locations for 30 minute periods. Just prior to and immediately after taking sound level measurements, the Community Noise Analyzer was calibrated with a GR 1562-A field calibrator.

Brief supplemental measurements were made with a GR 1933 Precision Sound Level Meter equipped with an electret condenser microphone. The observation of the residual noise provides a check on and complements the more complete data obtained by the Community Noise Analyzer.

A microphone wind screen was used for all measurements to reduce wind effects. The informal weather measurements were made using the following instruments held four to five feet above the ground.

a) Bendix Psychrometer Model 566

b) Lambrecht Anenometer Model WP3

2.7.2 AMBIENT NOISE LEVELS NEAR THE ST LUCIE SITE

The environmental sound level measurements obtained with the Community Noise Analyzer are presented in Tables 2.7-5 to 2.7-8 for the nine locations in the St Lucie site vicinity. The residual sound level measurements made with the GR 1933 Precision Sound Level Meter are presented in Tables 2.7-9 to 2.7-12 and correlate well with the data acquired with the Community Noise Analyzer. For each measurement location and time, the residual sound level measured with the Precision Sound Level Meter equals the $L_{90} \pm 3$ dB measured with the Community Noise Analyzer; also, the residual sound level is between the L_{99} and L_{50} sound level.

The L_{90} sound levels presented in Tables 2.7-5 to 2.7-8 range from 34 dB(A) to 55 dB(A) and may be considered typical for a quiet residential area. The L_{90} sound levels on Hutchinson Island appear to be dominated by noise from the surf, insects, leaves rustling in the wind, and traffic. The L_{90} sound levels on the mainland appear to be dominated by noise from insects, leaves rustling in the wind, and traffic. The L_{10} sound levels range from 42 dB(A) to 75 dB(A). The major intrusive noise sources, L_{10}, in the St Lucie site vicinity are man made in origin and consist primarily of transportation noises.

A discussion of noise standards applicable to the St Lucie site and transmission line noise levels is found in Subsection 5.6.2 of this report.

TABLE 2.7-1

WEATHER OBSERVATIONS IN VICINITY ST LUCIE 2 WEEKDAY DAY (07:00 to 22:00)

Position	Day	Date	Time	dT °F	wT °F	RH %	Wind Speed mph	Bar-Press m bar
1	Fri	3/16/79	12:40 13:10	74	64	54	Calm	1027.4
2	Fri	3/16/79	14:45 15:15	73	61	49	12*	1027.1
3	Fri	3/16/79	15:35 16:05	72	63	60	8	1026.8
4	Mon	3/19/79	16:30 17:00	75	64	54	2	1019.0
5	Mon	3/19/79	17:15 17:45	74	64	58	4	1019.3
6	Mon	3/19/79	18:30 19:00	72	63	60	4	1019.3
7	Mon	3/19/79	14:00 14:30	72	64	64	4	1019.3
8	Mon	3/19/79	14:54 15:24	71	64	68	6	1019.0
9	Mon	3/19/79	19:15 19:45	62	57	73	Calm	1019.6

dT Dry Bulb Temperature

wT Wet Bulb Temperature

RH Relative Humidity

Bar-Press Barometric Pressure

* Wind speed exceeded recommended limit

TABLE 2.7-2

WEATHER OBSERVATIONS IN VICINITY ST LUCIE 2 WEEKDAY NIGHT (22:00 to 07:00)

Position	Day	Date	Time	dT °F	wT °F	RH %	Wind Speed mph	Bar-Press m bar
1	Mon	3/19/79	23:35 23:05	64	57	64	Calm	1020.0
2	Fri	3/16/79	22:20 22:50	70	61	60	2	1027.8
3	Fri	3/16/79	23:15 23:45	70	60	56	2	1027.4
4	Mon	3/19/79	01:45 02:15	61	57	77	Calm	1020.7
5	Mon	3/19/79	02:35 03:05	57	54	82	Calm	1020.3
6	Mon	3/19/79	04:05 04:35	57	54	82	Calm	1020.3
7	Mon	3/19/79	06:00 06:30	50	49	93*	Calm	1020.7
8	Mon	3/19/79	06:50 07:20	54	52	88	Calm	1021.0
9	Mon	3/19/79	05:05 05:35	56	51	71	Calm	1020.7

dT Dry Bulb Temperature

wT Wet Bulb Temperature

RH Relative Humidity

Bar-Press Barometric Pressure

* Relative humidity exceeded equipment specification

TABLE 2.7-3

WEATHER OBSERVATIONS IN VICINITY ST LUCIE 2 WEEKEND DAY (07:00 to 22:00)

Position	Day	Date	Time	dT F	wT °F	RH %	Wind Speed mph	Bar-Press m bar
1	Sun	3/18/79	17:33 18:03	72	65	68	Calm	1021.7
2	Sun	3/18/79	15:35 16:05	74	61	47	4	1021.7
3	Sun	3/18/79	16:20 16:50	73	61	50	2	1021.7
4	Sat	3/17/79	12:45 13:15	72	62	56	10	1028.4
5	Sat	3/17/79	13:30 14:00	73	63	57	4	1027.4
6	Sat	3/17/79	14:25 14:55	72	63	60	10	1027.1
7	Sat	3/17/79	11:00 11:30	72	63	60	10	1029.1
8	Sat	3/17/79	12:00 12:30	73	62	53	8	1028.4
9	Sat	3/17/79	16:19 16:49	73	62	53	12*	1026.8

dT Dry Bulb Temperature

wT Wet Bulb Temperature

RH Relative Humidity

Bar Press Barometric Pressure

* Wind speed exceeded recommended limit.

TABLE 2.7-4

WEATHER OBSERVATIONS IN VICINITY ST LUCIE 2 WEEKEND NIGHT (22:00 to 07:00)

Position	Day	Date	Time	dT °F	wT °F	RH %	Wind Speed mph	Bar-Press m bar
1	Sun	3/18/79	02:12 02:42	69	62	67	Calm	1024.4
2	Sun	3/18/79	03:25 03:55	70	60	56	Calm	1024.0
3	Sun	3/18/79	04:15 04:45	69	60	59	Calm	1023.7
4	Sun	3/18/79	24:00 00:30	72	63	60	10	1025.4
5	Sat	3/17/79	00:23 00:53	70	61	60	4	1027.1
6	Sun	3/18/79	01:00 01:30	72	62	57	8	1025.1
7	Sat	3/17/79	01:50 02:20	72	63	60	8	1026.8
8	Sun	3/18/79	06:28 06:58	70	60	55	10	1027.8
9	Sun	3/18/79	05:25 05:55	70	59	51	10	1027.1

dT Dry Bulb Temperature

wT Wet Bulb Temperature

RH Relative Humidity

Bar-Press Barometric Pressure

TABLE 2.7-5

SOUND LEVEL OBSERVATIONS IN ST LUCIE 2 AREA ON WEEKDAY DAY (07:00 to 22:00)
SOUND LEVELS dB(A)

Position	Description	Day	Date	Time	$L_{0.1}$	L_1	L_{10}	L_{50}	L_{90}	L_{99}	L_{min}	L_{max}	L_{eq}
1	Along Route AlA	Fri	3/16/79	12:40 13:10	82	78	72	55	53	53	52	84	67
2*	Along Route AlA	Fri	3/16/79	14:45 15:15	89	80	73	58	53	52	52	91	69
3	Along Route AlA	Fri	3/16/79	15:35 16:05	85	80	75	62	54	54	53	87	71
4	Along Route 712	Mon	3/19/79	16:30 17:00	86	79	71	56	50	50	49	87	67
5	Along Route 707	Mon	3/19/79	17:15 17:45	72	69	60	43	40	38	37	73	57
6	Along Route 707	Mon	3/19/79	18:30 19:00	65	62	56	47	45	43	41	68	52
7	Near Residences	Mon	3/19/79	14:00 14:30	63	57	51	45	42	41	40	66	48
8	Near Residences	Mon	3/19/79	14:54 15:24	65	59	47	43	40	37	35	66	41
9	South of Residences Along Route 1	Mon	3/19/79	19:15 19:45	66	61	57	53	50	46	43	69	54

* Wind speed exceeded recommended limit

TABLE 2.7-6

SOUND LEVEL OBSERVATIONS IN ST LUCIE 2 AREA ON WEEKDAY NIGHT (22:00 to 07:00)
SOUND LEVELS dB(A)

Position	Description	Day	Date	Time	$L_{0.1}$	L_1	L_{10}	L_{50}	L_{90}	L_{99}	L_{min}	L_{max}	L_{eq}
1	Along Route A1A	Mon	3/19/79	22:35 23:05	80	76	56	46	43	42	41	83	61
2	Along Route A1A	Fri	3/16/79	22:20 22:50	82	78	63	56	55	54	54	86	65
3	Along Route A1A	Fri	3/16/79	23:15 23:45	82	77	69	58	54	53	53	86	65
4	Along Route 712	Mon	3/19/79	01:45 02:15	74	61	45	36	35	34	33	76	50
5	Along Route 707	Mon	3/19/79	02:35 03:05	68	50	46	45	42	41	40	75	48
6	Along Route 707	Mon	3/19/79	04:05 04:35	73	64	42	36	34	33	32	78	51
7*	Near Residences	Mon	3/19/79	06:00 06:30	63	59	53	50	46	44	43	69	51
8	Near Residences	Mon	3/19/79	06:50** 07:20	66	59	51	47	43	41	40	67	50
9	South of Residences Along Route 1	Mon	3/19/79	05:05 05:35	67	62	56	46	35	34	33	68	52

* Relative humidity exceeded equipment specification

** Night time is defined as the hours between 22:00 to 07:00. This point is included in the night time period because the sound levels reported are indicative of the end of the night time/beginning of the morning time period.

TABLE 2.7-7

SOUND LEVEL OBSERVATIONS IN ST LUCIE 2 AREA ON WEEKEND DAY (07:00 to 22:00)
SOUND LEVELS dB(A)

Position	Description	Day	Date	Time	$L_{0.1}$	L_1	L_{10}	L_{50}	L_{90}	L_{99}	L_{min}	L_{max}	L_{eq}
1	Along Route A1A	Sun	3/18/79	17:33 18:03	85	81	72	53	48	47	46	87	68
2	Along Route A1A	Sun	3/18/79	15:35 16:05	86	82	74	58	50	48	47	87	70
3	Along Route A1A	Sun	3/18/79	16:20 16:50	83	79	73	57	50	49	48	87	68
4	Along Route 712	Sat	3/17/79	12:45 13:15	77	74	67	55	54	53	53	78	63
5	Along Route 707	Sat	3/17/79	13:30 14:00	77	69	61	54	52	50	49	78	59
6	Along Route 707	Sat	3/17/79	14:25 14:55	66	63	58	52	47	46	45	67	55
7	Near Residences	Sat	3/17/79	11:00 11:30	63	59	51	47	45	44	42	64	49
8	Near Residences	Sat	3/17/79	12:00 12:30	66	62	58	55	54	53	52	68	56
9*	South of Residences Along Route 1	Sat	3/17/79	16:19 16:49	65	62	54	49	45	43	42	66	52

* Wind speed exceeded recommended limit

TABLE 2.7-8

SOUND LEVEL OBSERVATIONS IN ST LUCIE 2 AREA ON WEEKEND NIGHT (22:00 to 07:00)
SOUND LEVELS dB(A)

Position	Description	Day	Date	Time	$L_{0.1}$	L_1	L_{10}	L_{50}	L_{90}	L_{99}	L_{min}	L_{max}	L_{eq}
1	Along Route A1A	Sun	3/18/79	02:12 02:42	82	76	58	54	53	52	52	83	62
2	Along Route A1A	Sun	3/18/79	03:25 03:55	80	61	52	51	50	50	49	82	56
3	Along Route A1A	Sun	3/18/79	04:15 04:45	54	53	52	51	50	49	49	54	51
4	Along Route 712	Sun	3/18/79	24:00 00:30	77	73	62	50	49	48	47	79	60
5	Along Route 707	Sat	3/17/79	00:23 00:53	73	65	57	55	53	52	51	75	56
6	Along Route 707	Sun	3/18/79	01:00 01:30	71	63	56	53	50	49	49	72	54
7	Near Residences	Sat	3/17/79	01:50 02:20	64	53	47	43	41	39	39	67	48
8	Near Residences	Sun	3/18/79	06:28 06:58	59	53	45	40	35	33	31	61	43
9	South of Residences Along Route 1	Sun	3/18/79	05:25 05:55	56	51	43	37	35	33	32	59	41

TABLE 2.7-9

RESIDUAL SOUND LEVEL OBSERVATIONS MADE WITH GR 1933 SOUND LEVEL METER ON WEEKDAY DAY (07:00 to 22:00)

Position	Day	Date	Sound Level dB(A)
1	Fri	3/16/79	55
2*	Fri	3/16/79	53
3	Fri	3/16/79	54
4	Mon	3/19/79	50
5	Mon	3/19/79	41
6	Mon	3/19/79	44
7	Mon	3/19/79	41
8	Mon	3/19/79	39
9	Mon	3/19/79	47

* Wind speed exceeded recommended limit

TABLE 2.7-10

RESIDUAL SOUND LEVEL OBSERVATIONS MADE WITH
GR 1933 SOUND LEVEL METER ON WEEKDAY NIGHT (22:00 to 07:00)

Position	Day	Date	Sound Level dB(A)
1	Mon	3/19/79	43
2	Fri	3/16/79	55
3	Fri	3/16/79	54
4	Mon	3/19/79	35
5	Mon	3/19/79	42
6	Mon	3/19/79	34
7*	Mon	3/19/79	45
8	Mon	3/19/79	42
9	Mon	3/19/79	36

* Relative humidity exceeded equipment specification

TABLE 2.7-11

RESIDUAL SOUND LEVEL OBSERVATIONS MADE WITH
GR 1933 SOUND LEVEL METER ON WEEKEND DAY (07:00 to 22:00)

Position	Day	Date	Sound Level dB(A)
1	Sun	3/18/79	48
2	Sun	3/18/79	52
3	Sun	3/18/79	50
4	Sat	3/17/79	54
5	Sat	3/17/79	51
6	Sat	3/17/79	47
7	Sat	3/17/79	44
8	Sat	3/17/79	53
9*	Sat	3/17/79	45

* Wind speed exceeded recommended limit

TABLE 2.7-12

RESIDUAL SOUND LEVEL OBSERVATIONS MADE WITH
GR 1933 SOUND LEVEL METER ON WEEKEND NIGHT (22:00 to 07:00)

Position	Day	Date	Sound Level dB(A)
1	Sun	3/18/79	54
2	Sun	3/18/79	51
3	Sun	3/18/79	51
4	Sun	3/18/79	48
5	Sat	3/17/79	52
6	Sun	3/18/79	49
7	Sat	3/17/79	41
8	Sun	3/18/79	35
9	Sun	3/18/79	36

THE STATION

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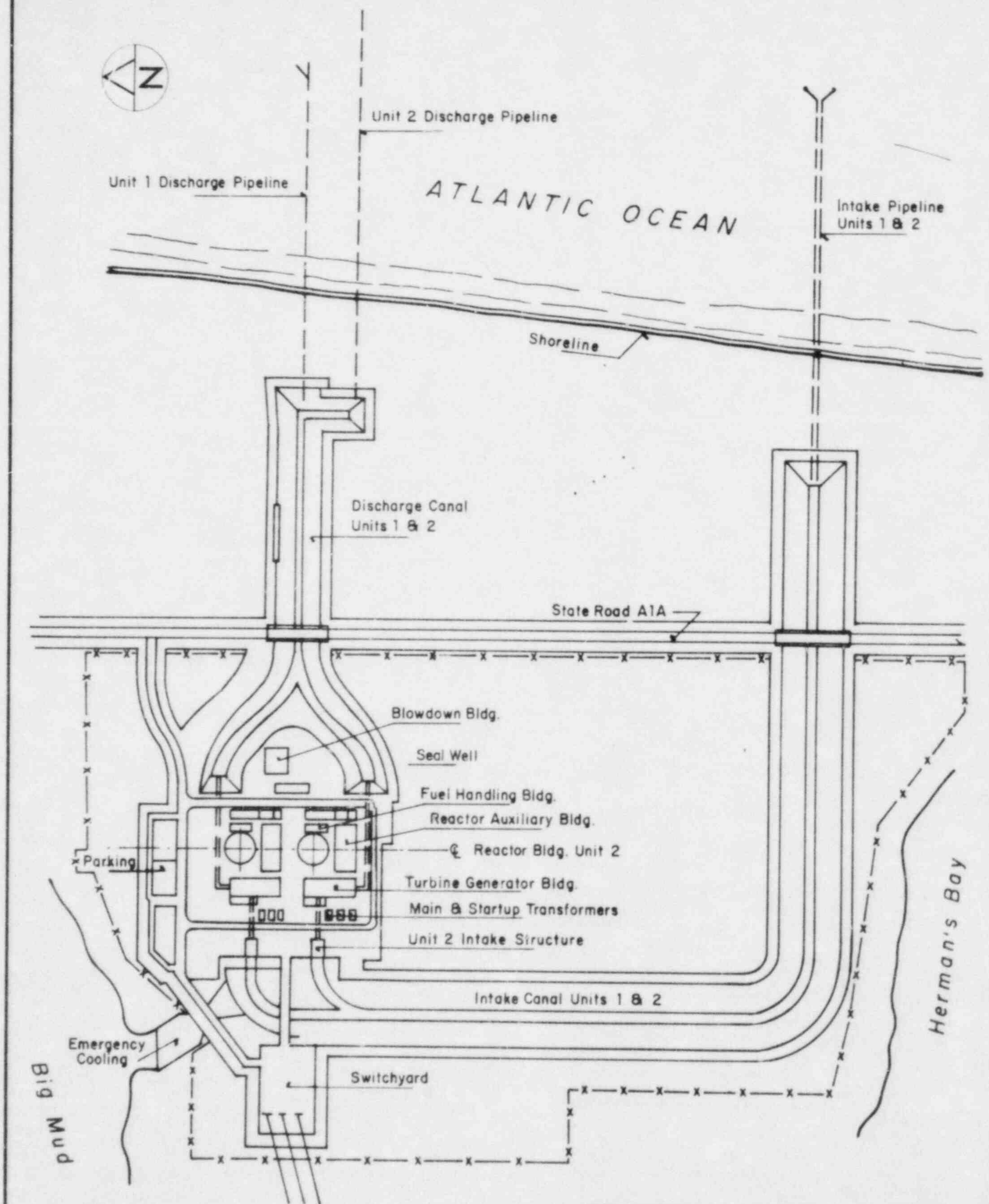
3.1 EXTERNAL APPEARANCE

The external appearance of the St Lucie Plant has been described in the St Lucie Unit 2 Final Environmental Statement and the Environmental Report - Construction Permit.

Figure 3.1-1 is a general plant layout. Figure 3.1-2 is an oblique aerial photograph of the site. Figure 3.1-3 shows the east elevation of St Lucie Unit 2. Figure 3.1-4 is the south elevation of St Lucie Unit 2.

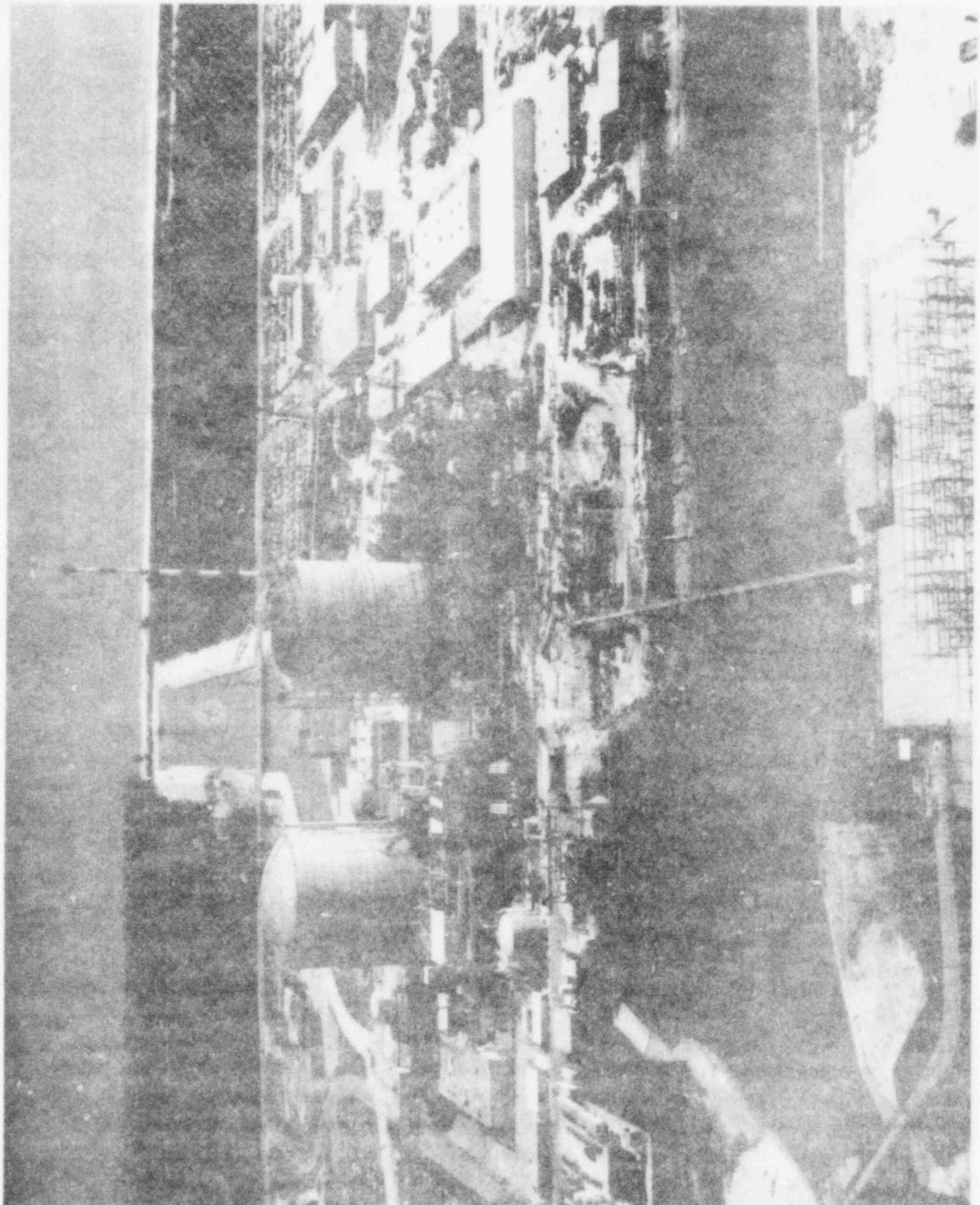
The location (x, y coordinates) and elevation of release points for liquid and gaseous wastes are shown in Figure 3.1-5.



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

GENERAL PLANT LAYOUT

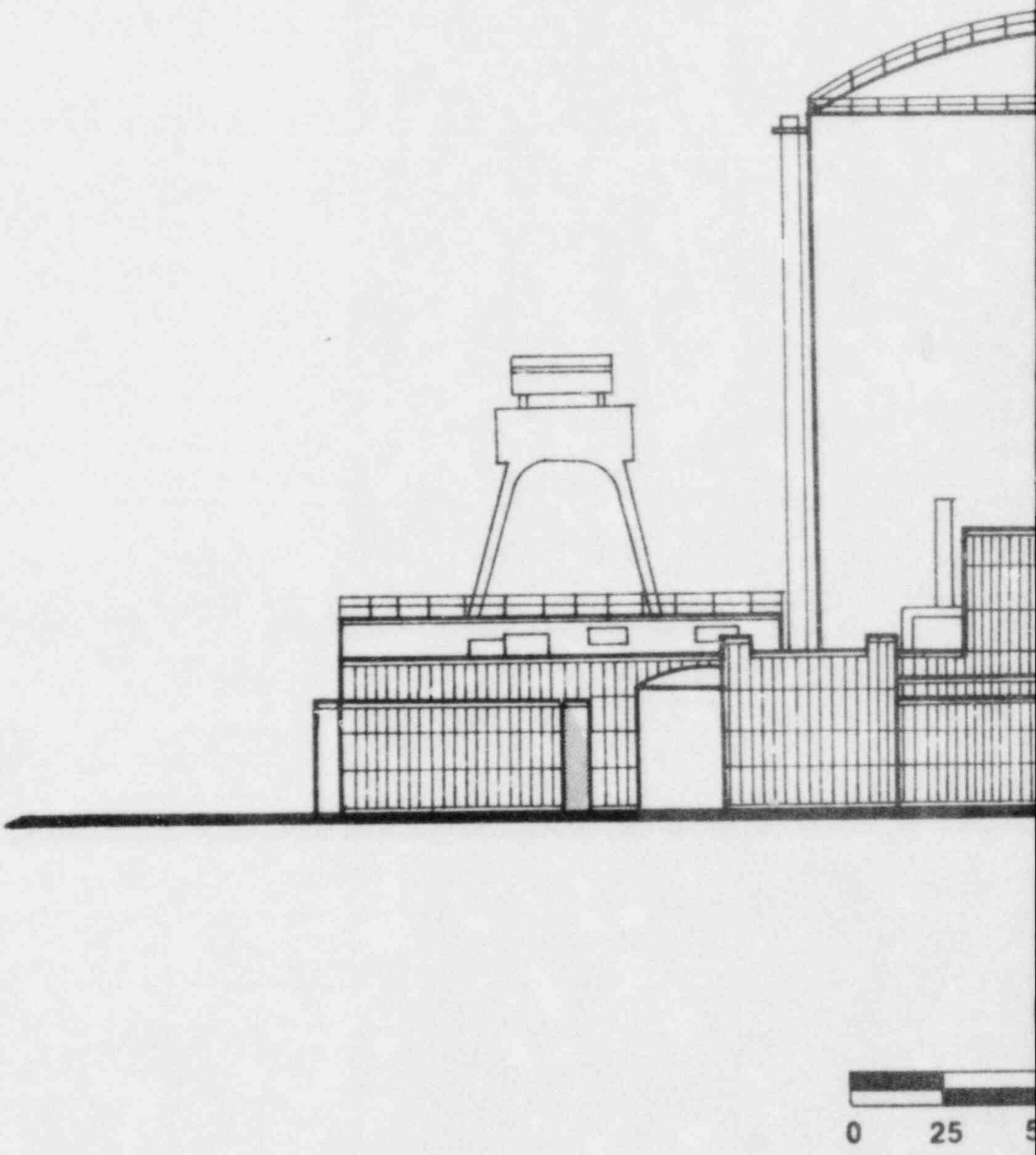
FIGURE 3.1-1



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

OBLIQUE PHOTOGRAPH OF THE SITE

FIGURE 3.1-2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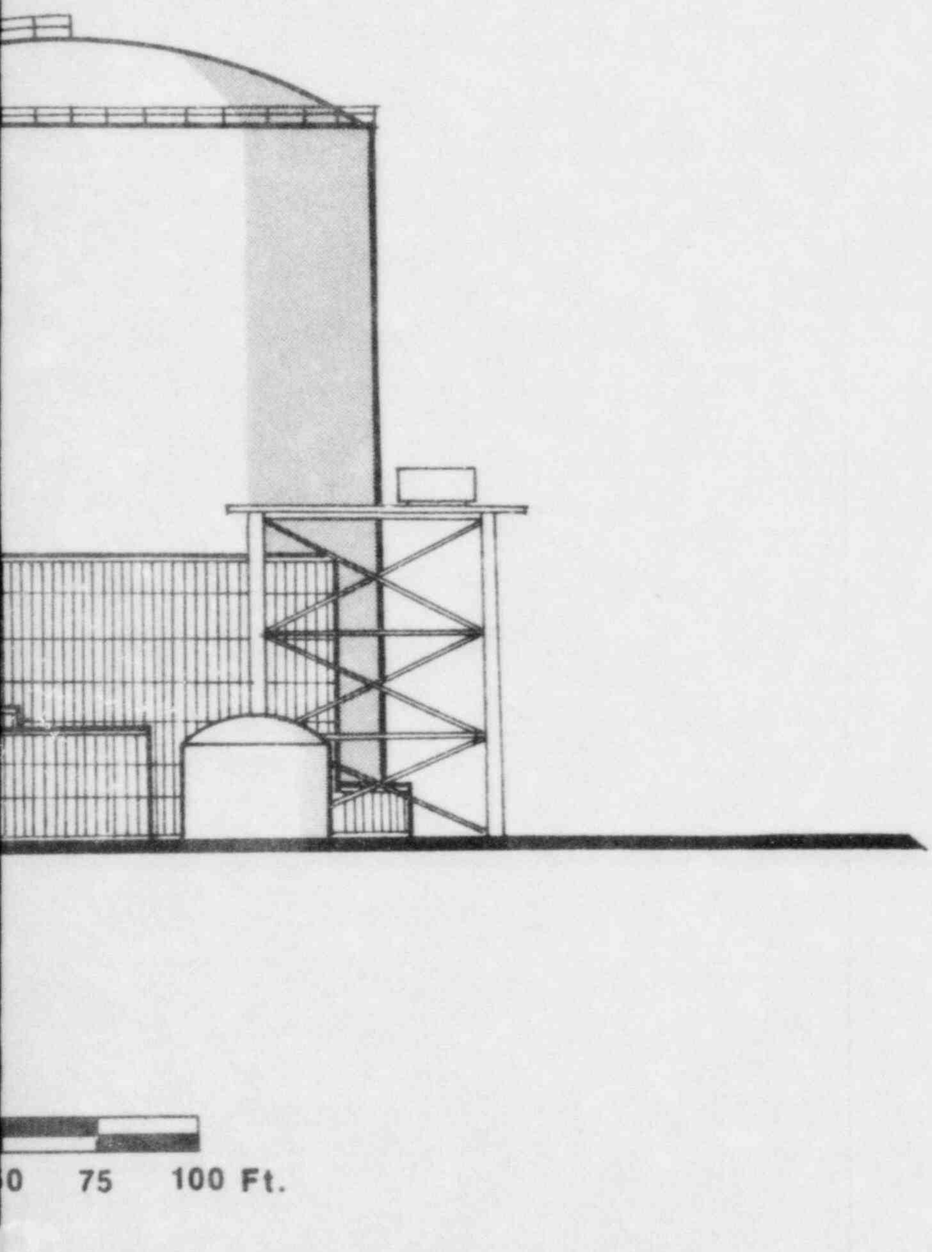

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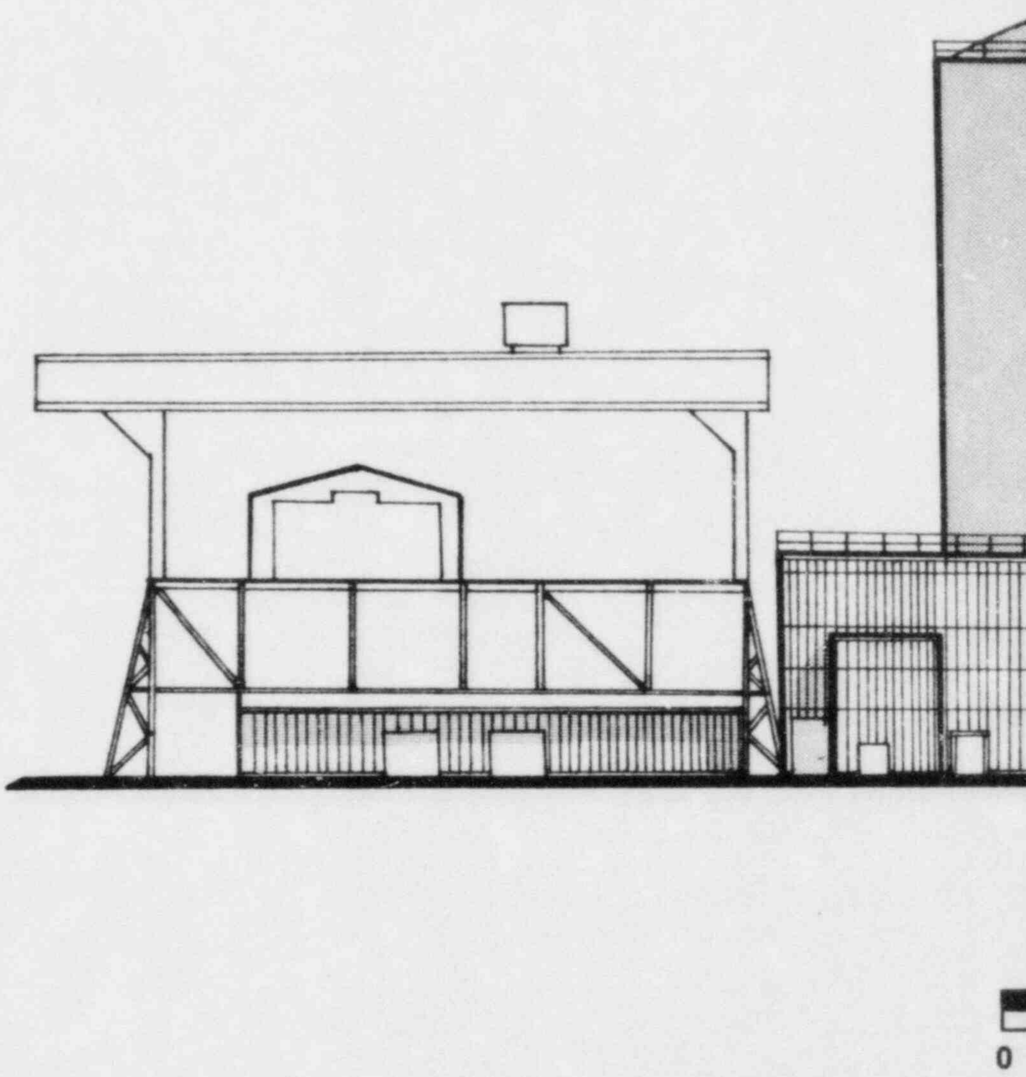
ST. LUCIE PLANT UNIT 2

EAST ELEVATION

FIGURE 3.1-3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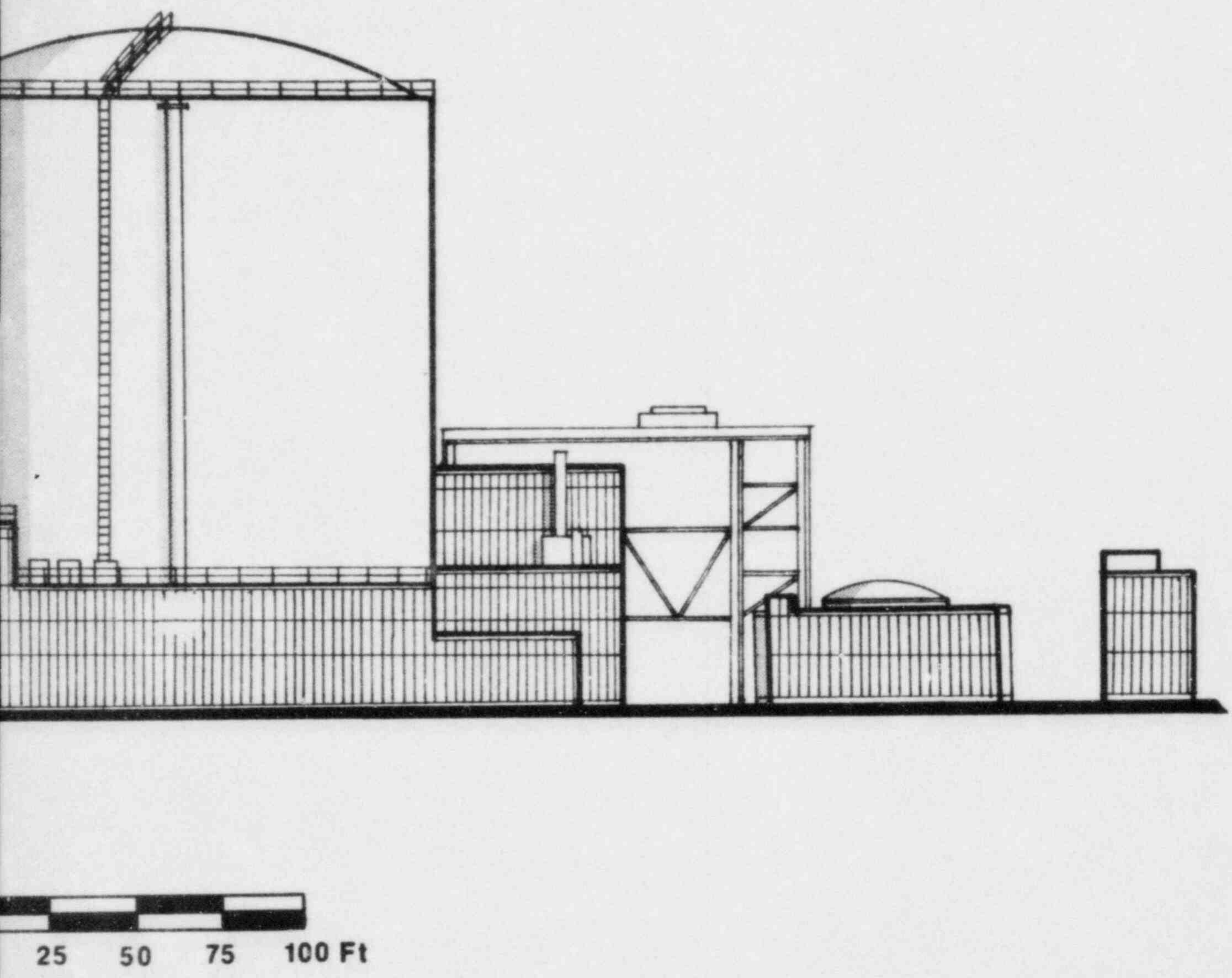
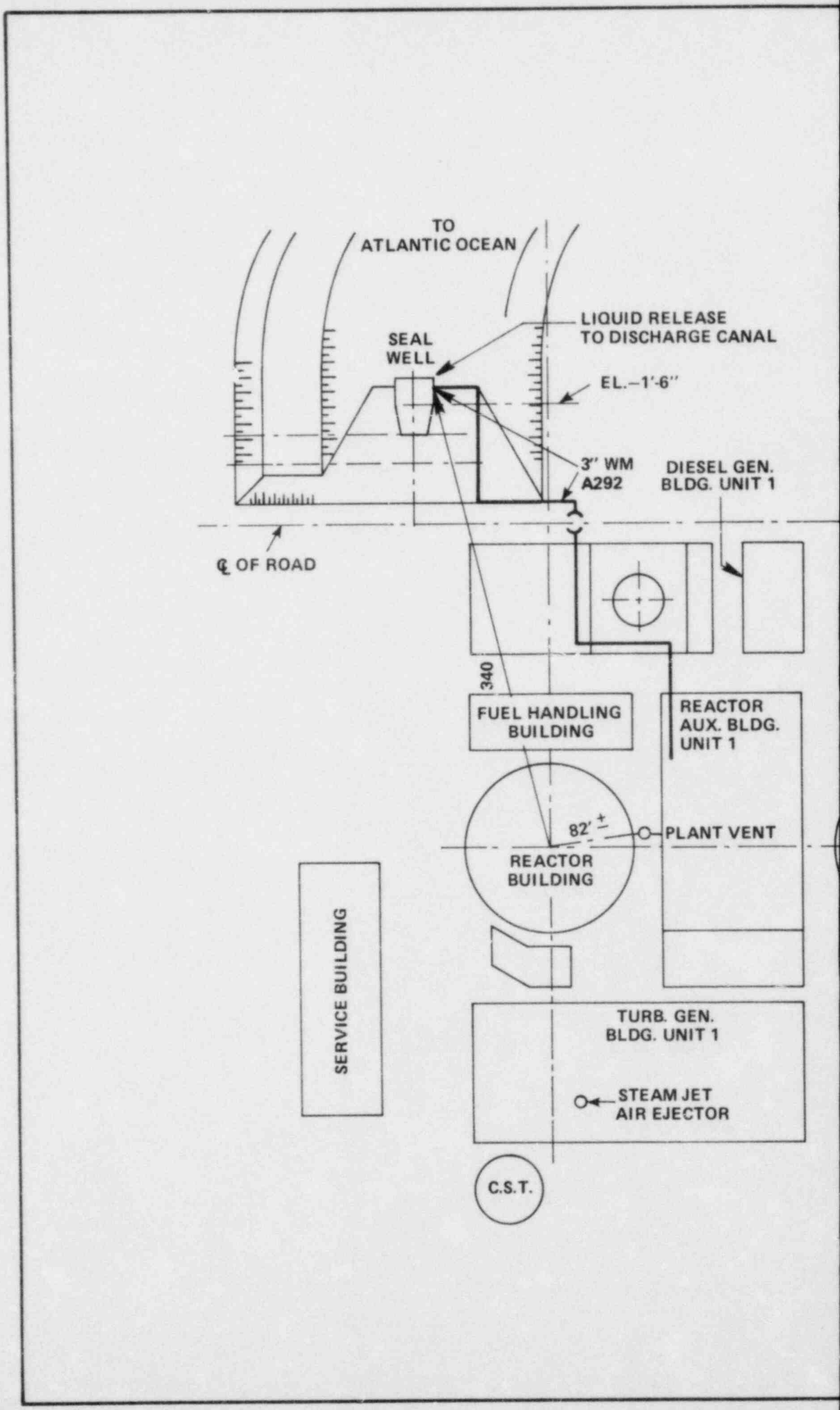
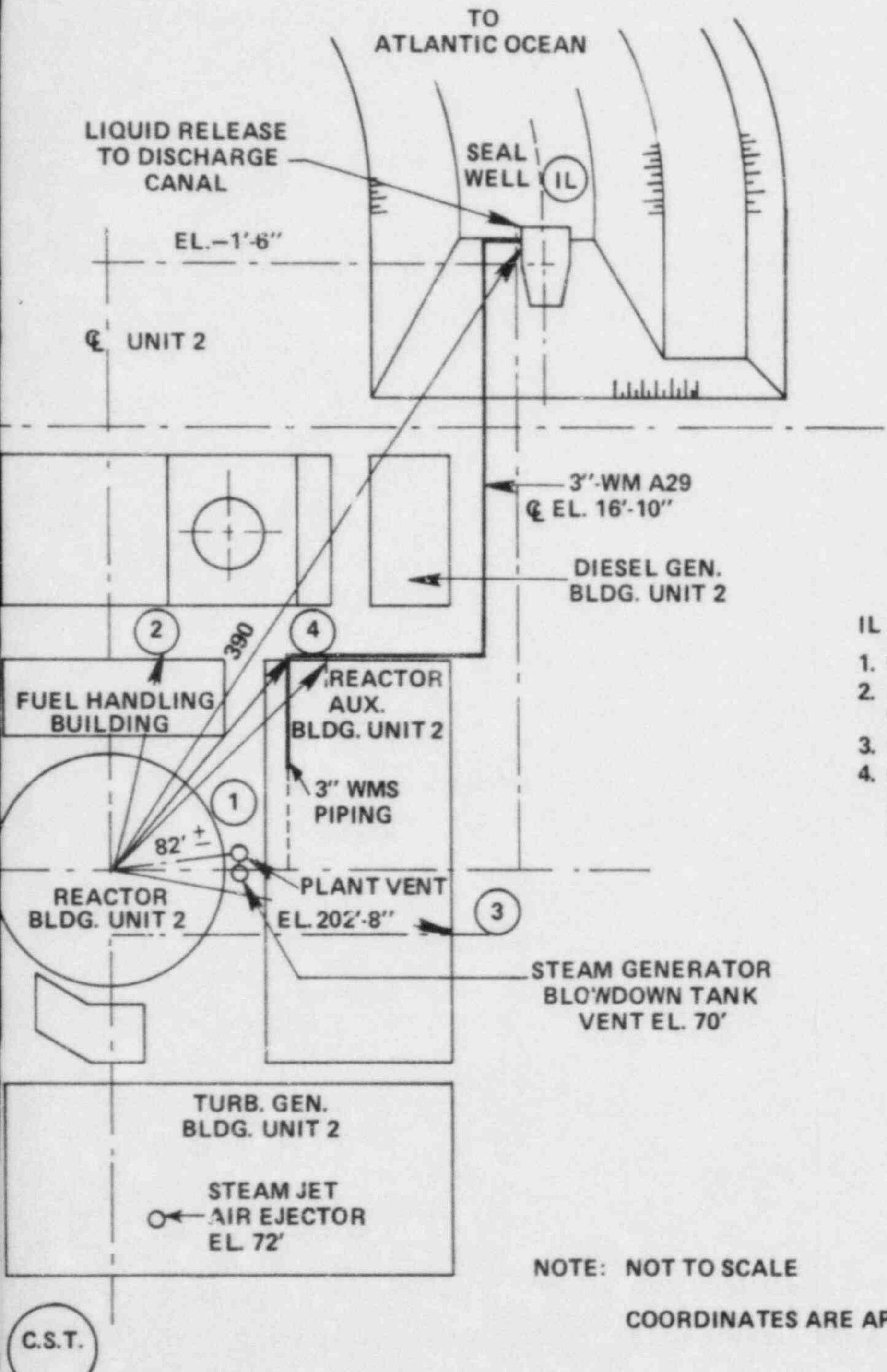


FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

SOUTH ELEVATION

FIGURE 3.1-4


TO
ATLANTIC OCEAN
LIQUID RELEASE
TO DISCHARGE CANAL
SEAL
WELL
EL.–1'-6"
3" WM
A292
DIESEL GEN.
BLDG. UNIT 1
℄ OF ROAD
340
FUEL HANDLING
BUILDING
REACTOR
AUX. BLDG.
UNIT 1
82' ±
PLANT VENT
REACTOR
BUILDING
SERVICE BUILDING
TURB. GEN.
BLDG. UNIT 1
STEAM JET
AIR EJECTOR
C.S.T.



NOTE: NOT TO SCALE

COORDINATES ARE APPROXIMATE

RELEASE POINTS

TYPE	ELEV.	(X, Y)
IL LIQUID WASTE	(–)1'-6"	(227,333)
1. GASEOUS WASTE	202'-6"	(85,5)
2. FHB VENTILATION	109'-6"	(30,105)
3. HVAC RELEASES	38'-0"	(203',-50)
4. POST-ACCIDENT HVAC RELEASES	57'-2"	(108,123)
	57'-2"	(138,123)

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

LIQUID AND GASEOUS
RELEASE POINTS
FIGURE 3.1–5

3.2 REACTOR AND STEAM ELECTRIC SYSTEM

The St Lucie Unit 2 reactor and steam electric system are described in the St Lucie Unit 2 Environmental Report - Construction Permit.

The relationships between station heat rate to expected variation in turbine back pressure for 100, 80 and 60 percent unit load for design circulation flow are shown in Table 3.2-1.

The expected operating life of St Lucie Unit 2 is forty (40) years.

TABLE 3.2-1

RELATIONSHIP OF STATION HEAT RATE TO EXPECTED VARIATION OF TURBINE BACK PRESSURE FOR 100%, 80% and 60% UNIT LOAD

Back Pressure (In. Hg)	Heat Rate (Btu/kWh)	% Change in Heat Rate
	100% Unit Load	
4.0	10614	+1.9
3.5	10489	+0.7
3.2	10416	0
3.0	10374	-0.4
2.5	10270	-1.4
2.0	10208	-2.0
1.5	10228	-1.8
	80% Unit Load	
4.0	10814	+2.3
3.5	10656	+0.8
3.2	10571	0
3.0	10518	-0.5
2.5	10370	-1.9
2.0	10254	-3.0
1.5	10212	-3.4
	60% Unit Load	
4.0	11610	+2.8
3.5	11407	+1.0
3.2	11294	0
3.0	11215	-0.7
2.5	11012	-2.5
2.0	10808	-4.3
1.5	10662	-5.6

3.3 PLANT WATER USES

3.3.1 INTRODUCTION

This section describes St Lucie Unit 2 minimum, average and maximum plant water uses. Table 3.3-1 lists all plant water use systems, their respective water sources and flow characteristics. Figure 3.3-1 illustrates St Lucie Unit 2 station water uses on average daily and maximum bases. For purposes of overall plant water balance, storm water drainage flows are also included. In the following subsections, individual plant water systems with their respective sources are identified. Makeup quantities and discharge flow rates for each system are also estimated (Table 3.3-2).

3.3.2 WATER SOURCES

The St Lucie Unit 2 heat dissipation system including circulating water, and intake cooling water systems utilizes Atlantic Ocean water on a once through basis. The screen wash and sodium hypochlorite generator systems also withdraw ocean water. Ocean water quality near the plant site is presented and discussed in Section 2.4.

The Fort Pierce Municipal Water Supply System provides makeup to the St Lucie site. This makeup is stored in two city water storage tanks. The following St Lucie Unit 2 systems receive water from this source:

- water treatment (i.e., nuclear steam supply system and other primary and secondary system uses);
- service water;
- potable and sanitary; and
- fire protection.

Water quality of the Fort Pierce Municipal System is presented in Section 3.6.

3.3.3 HEAT DISSIPATION SYSTEM

The St Lucie Unit 2 heat dissipation system, consisting of the circulating water system and the intake cooling water system, is described in Section 3.4.

3.3.4 WATER TREATMENT SYSTEM

The St Lucie site water treatment system supplies high quality makeup water to St Lucie Unit 2. The water treatment system consists of four carbon filters in parallel, followed by two parallel demineralizer trains with a treatment capacity of 375 gpm each train. During normal plant operation, St Lucie Unit 2 requires a total of approximately 140 gpm for primary and secondary plant water makeup, as shown on Figure 3.3-1. The quantity and quality of wastewater generated from the water treatment system are discussed in Section 3.6.2.

3.3.5 POTABLE AND SANITARY WATER SYSTEMS

St Lucie Unit 2 potable and sanitary water is supplied by St Lucie site service water system. The sanitary waste is described in Section 3.7.

Based on approximately 170 people per 24 hour period during a normal operating day, and 50 gallons per capita per day, potable and sanitary water requirements are estimated at 8,500 gallons per day, and an average daily flow of approximately six gpm. Maximum intermittent potable and sanitary flows for St Lucie 2 are estimated to be approximately 95 gpm.

3.3.6 SODIUM HYPOCHLORITE GENERATOR SYSTEM

The sodium hypochlorite generation system is described in Section 3.6.5.

3.3.7 TRAVELLING SCREEN WASH SYSTEM

Two travelling screen wash pumps (one standby) are installed in the St Lucie Unit 2 intake structure. Each pump is sized at 1060 gpm capacity. Normal screen washing requires one pump operation for two hours per day, resulting in an average daily flow of 90 gpm.

3.3.8 PLANT SERVICE WATER USES

Water from the St Lucie service water system serves as the makeup source for periodic equipment and floor washdowns in plant areas. Maximum intermittent flow is estimated at 150 gpm while average daily flow is estimated at approximately six gpm.

3.3.9 FIRE PROTECTION SYSTEM

Water from the St Lucie site service water system is used as makeup to the fire protection system. Two 2500 gpm electric motor driven pumps and one 500 gpm portable gasoline engine pump withdraw water from the on-site city water storage tanks for fire protection purposes.

3.3.10 INTERNAL RECYCLING OF WATER

Whenever possible, treated water is recycled to reduce consumptive water use at St Lucie Unit 2. Examples of potential reuse include:

- reuse of liquid waste management system effluent
- reuse of steam generator blowdown for secondary water uses.

TABLE 3.3-1

PLANT WATER USE SYSTEMS AND WATER SOURCES

Plant System	Water Source	Flow Characteristics
Circulating Water	Atlantic Ocean	Continuous
Intake Cooling Water	Atlantic Ocean	Continuous
Water Treatment	City Water Storage Tanks	Continuous/ Intermittent
Potable and Sanitary	City Water Storage Tanks	Intermittent
Sodium Hypochlorite Generation	Atlantic Ocean	Intermittent
Travelling Screen Wash	Atlantic Ocean	Intermittent
Plant Service Water	City Water Storage Tanks	Intermittent
Fire Protection	City Water Storage Tanks	Intermittent

TABLE 3.3-2

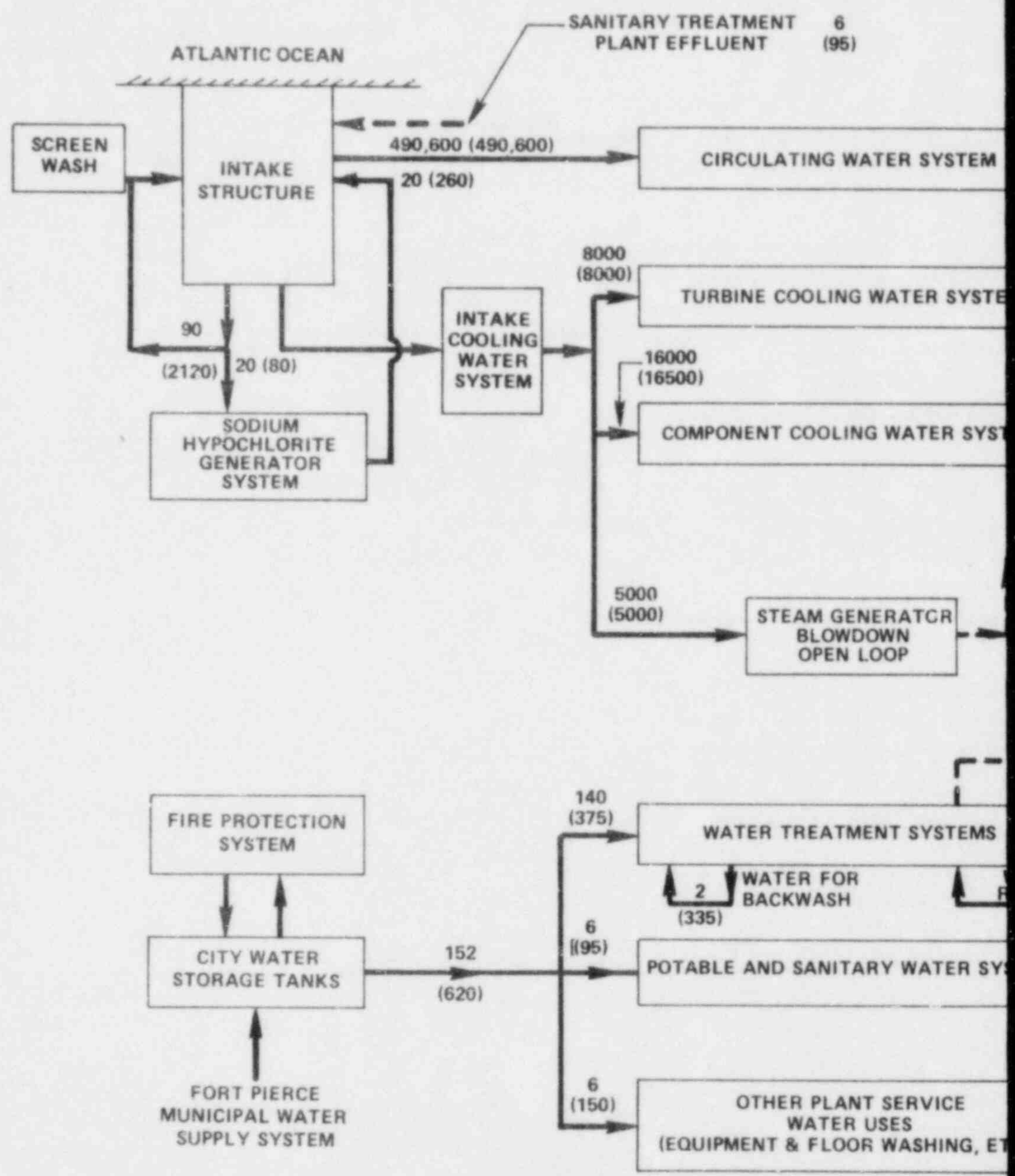
PLANT WATER USE FLOWRATES (GPM)

Plant System	Average Daily	Shutdown	Maximum
Circulating Water	490,600	0	490,600
Intake Cooling Water	29,000	29,500	29,500
Water Treatment	140	375	375
Potable and Sanitary	6	95	95
Sodium Hypochlorite Generator	20	0	80
Travelling Screen Wash	90	0	2,120
Plant Service Water	6	-	150
Fire Protection	-	-	5,500
TOTAL	519,862	29,970	528,420

Notes: (1) Average daily flowrate was estimated on a continuous basis for maintaining normal plant operation.

(2) Shutdown flowrate corresponds to minimum plant water use.

(3) Maximum flowrate estimated on an intermittent basis (except circulating water flow) corresponds to maximum plant water use.

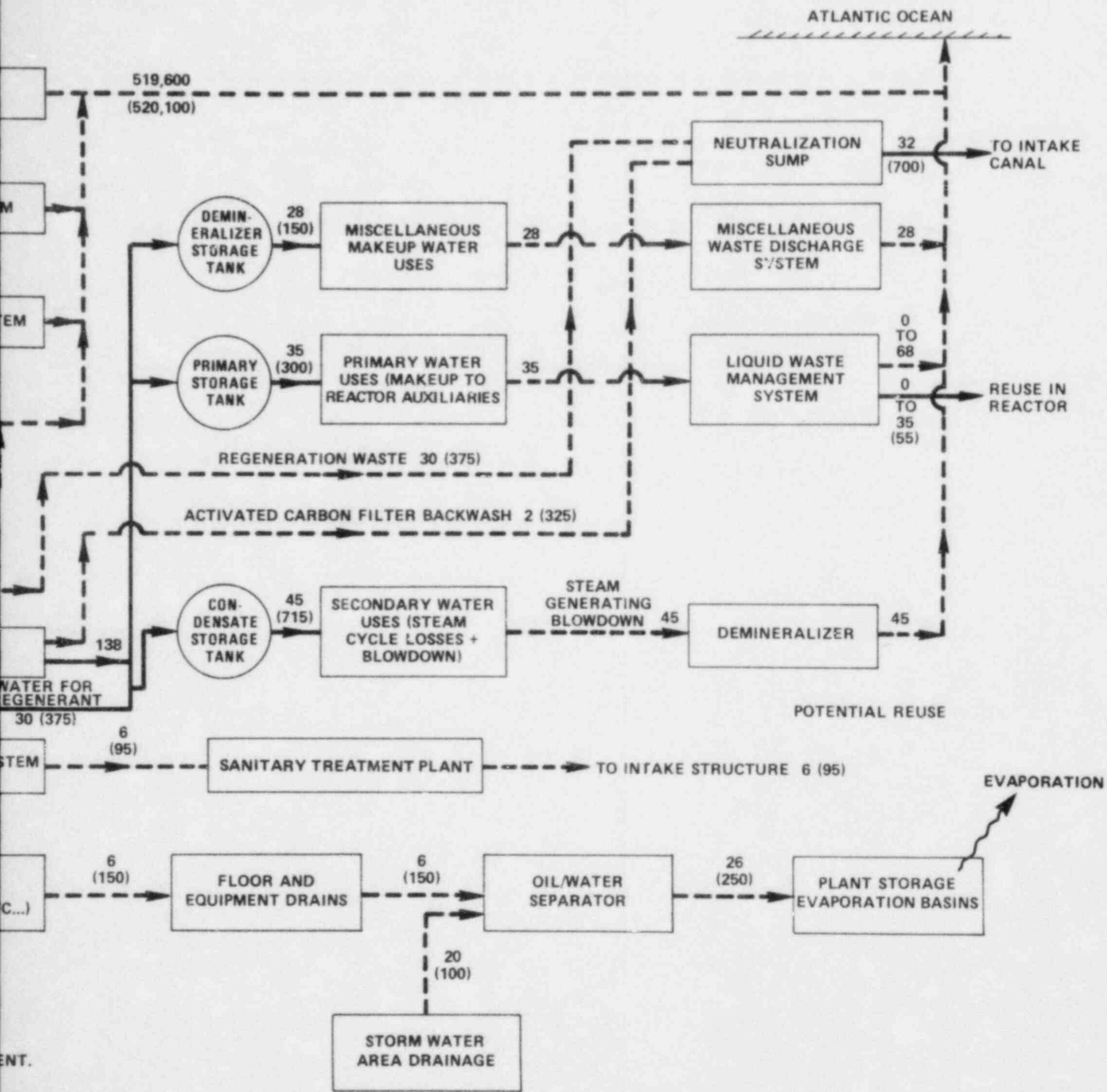


NOTES:

1. ——— DENOTES PROCESS WATER
   – – – – DENOTES WASTEWATER

2. FLOWS IN GPM, ARE AVERAGE DAILY; FLOWS IN PARENTHESES ARE MAXIMUM INTERMITT
   FLOW BALANCE IS BASED ON AVERAGE DAILY.

3. AVERAGE DAILY STORM WATER FLOWS BASED ON AVERAGE YEARLY RAINFALL OF 61.7 I
   YEAR WHILE MAXIMUM FLOWS ARE BASED ON THE 10 YEAR - 24 HOUR RAINFALL EVENT.



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

PLANT WATER USE
FLOW DIAGRAM

FIGURE 3.3–1

3.4 HEAT DISSIPATION SYSTEM

3.4.1 INTRODUCTION

Heat from St Lucie Unit 2 is dissipated through two major systems: (i) the circulating water system (CWS), and (ii) the intake cooling water system (ICW). The total heat rejected during normal operation from St Lucie Unit 2 is about 6.38×10^9 Btu/hr. A flow diagram of these systems is shown in Figure 3.4-1.

The CWS withdraws water from the Atlantic Ocean to condense turbine exhaust steam into water for reuse in the power production cycle. Following its use in the condenser, the circulating water is returned to the ocean. The ICW supplies ocean water to the heat exchangers (HX) of the turbine closed cooling water system, the component cooling water system and steam generator blowdown cooling system. An emergency water supply has been installed to provide an alternate cooling water source, should the CWS be impaired. The source of emergency water is Big Mud Creek.

With the exception of the St Lucie Unit 2 discharge pipeline/diffuser and its separate headwall, other major portions of the intake and discharge facilities of the CWS were installed for St Lucie Unit 1 and have operated since 1976. For the sake of clarity, the CWS, which includes components shared between St Lucie Units 1 and 2, is described below, as well as the St Lucie Unit 2 ICW.

3.4.2 CIRCULATING WATER SYSTEM

The CWS is designed for a maximum calculated heat rejection rate of 6.17 $\times 10^9$ Btu/hr. The maximum temperature rise of the circulating water through the condenser is approximately 25°F at a circulating water flow of 490,600 gpm. There is negligible consumptive water use from this system. No diluents are added to the circulating water system.

The major components of the CWS, as shown in Figure 3.4-2, include two intake pipelines and canal, four 25 percent capacity circulating water pumps, a pumphouse and condenser, a discharge canal, and ocean discharge pipeline and diffuser. The intake pipelines, intake canal and discharge canal are shared with St Lucie Unit 1.

Water is withdrawn from the Atlantic Ocean at a rate of approximately 519,600 gpm (1159 cfs) of which 490,600 gpm pass through the main condenser and the remaining 29,000 gpm serve the ICW.

3.4.2.1 Intake

There are two ocean intake pipes located 1,200 ft offshore and about 2,300 ft south of the discharge pipeline. Maximum expected intake water temperature is 87°F. Each pipe has a velocity cap to minimize fish entrapment (St Lucie Unit 2 Environmental Report - Construction Permit Section 3.4). The top of the velocity cap is approximately eight ft below the water surface at mean low water. A vertical section to prevent sanding is provided. Horizontal entrance velocities are less than one fps. As water passes under the velocity caps, flow becomes vertical (downward) and velocity increases to 2.9 fps. Flow then becomes horizontal as water enters the intake pipes, and velocity increases to approximately ten fps.

From the ocean intake point, water at a rate of approximately 1,039,200 gpm or 2320 cfs (519,600 gpm per unit) flows through two buried 12 ft diameter pipelines to the intake canal. The 300 ft wide intake canal begins 450 ft west of the shoreline and carries the cooling water some 5,000 ft to the plant intake structures. The water velocity in the canal varies with the tide level. The maximum velocity is about 1.1 fps and the minimum velocity is about 0.9 fps.

There are two plant intake structures, one for each unit. The St Lucie Unit 2 intake structure consists of four bays, each containing a coarse screen, a travelling screen and a circulating water pump. The approach velocity to each bay is about one fps.

The four coarse screens consist of a fixed rack with three inch spacing to hold up large pieces of trash. The rack is cleaned with a manually operated rake that is lowered over the rack with the aid of a monorail hoist.

The four travelling screens consist of a continuous belt of baskets fitted with copper mesh screen with a clear opening of 3/8 inch. The basket speed is variable from 2.4 to ten fpm. The travelling screens are normally operated in the automatic mode wherein a differential water level across the screen initiates operation. Debris is cleaned and collected for disposal as described in Section 3.7. Based on St Lucie Unit 1 operating experience, it is expected that the travelling screen duty will be light due to the design of the capped ocean intake.

During normal plant operation, it is anticipated that all four circulating water pumps are utilized. Each pump is sized to provide 25 percent of required design cooling water flow of 490,600 gpm with sufficient head (44 ft) to overcome system losses. CWS pumps are serviced during normal plant outage.

If one of the pumps requires service while the plant is operating the circulating water flow is reduced to 394,600 gpm (880 cfs). Residence time under this plant operating condition is presented in Subsection 3.4.2.4.

Also located in the plant intake structure are three intake cooling water pumps each with a design capacity of 14,500 gpm. The ICW is described in Section 3.4.3.

Sodium hypochlorite solution is used for controlling biofouling in the CWS. Provision and schedules for controlling biofouling and slime formation are discussed in Section 3.6.5.

3.4.2.2 Condenser and Yard Piping

Cooling water entering the plant intake structure is delivered to four six foot diameter concrete pipes at a velocity of about ten fps. These intake pipes are installed below grade and carry the flow to the concrete condenser intake block within the turbine building. From the intake block four seven foot diameter cast iron pipes are turned upward and connected to four separate inlet waterboxes. The condenser is a single-pass type with two shells, each containing two sections, tubed with titanium condenser tubes.

Water flowing through the condenser undergoes a heat transfer process to result in a temperature rise of about 25°F across the condenser under normal plant operation. Under abnormal operation condition (e.g., three pump operation at full load coincident with high tide level and heavy marine fouling), temperature rise could exceed 25°F. The thermal impact under such a condition is discussed in Section 5.1.

The heated water is then discharged into dual buried 700-foot tunnels and piping conduits, each eight feet in diameter, which connect to the discharge canal seal well.

3.4.2.3 Discharge

The St Lucie Unit 2 discharge system consists of a discharge canal with headwall, a discharge pipeline and an ocean diffuser. Of these components, the discharge canal is the only facility that is shared with St Lucie Unit 1. Each of these components is discussed in the following subsections.

3.4.2.3.1 Discharge Canal

The discharge canal is approximately 200 feet wide and 2200 feet long, extending to a point 300 feet west of the shoreline of Hutchinson Island. The canal is trapezoidal in cross section with a 3:1 (horizontal to vertical) slope on both sides. The canal dike is at El+19 feet MLW, sufficiently high to contain the flow within the canal proper. An open spillway at El+15.5 MLW is provided on the northern dike for emergency release of cooling water.

The existing canal collects a combined discharge of about 1,039,200 gpm (2320 cfs) from St Lucie Units 1 and 2 condensers and carries this discharge seaward at about 0.8 fps to two terminating headwalls. Each headwall structure is connected to an ocean discharge pipeline. (One headwall for the existing St Lucie Unit 1 and the other for St Lucie Unit 2 diffuser).

3.4.2.3.2 Discharge Pipeline

The St Lucie Unit 1 discharge pipeline extends about 1200 feet from the shore and terminates in a two port wye nozzle, each of which is 7.5 ft in diameter. St Lucie Unit 1 has been in operation since 1976.

The St Lucie Unit 2 discharge pipeline extends about 3375 feet from the headwall to the ocean and is buried at least five feet below the ocean floor, as shown in Figure 3.4-3. The pipeline has an inside diameter of about 16.0 feet, resulting in an average velocity of about 5.7 feet per second at design conditions. The St Lucie Unit 2 pipeline is sized to compensate for potential increased headlosses due to marine fouling.

The last 1416 feet of the buried pipeline are the diffuser section. The heated water is dispersed into the ocean through high-velocity jets. The following subsection describes the design and function of the diffuser.

3.4.2.3.3 Diffuser

The multiport diffuser consists of 58 ports. Each port issues a water jet of 16 in. in diameter, spaced at 24 feet between centers (see Figure 3.4-4).

To minimize plume interference, the jet ports are oriented at a horizontal angle of 25 degrees in an alternating manner on either side of the manifold, thus making the jets on the same side 48 feet apart, and directing jet flow away from shore. Ocean depths at the proximal and distal discharge points are about 30 and 40 feet below MLW, respectively. Jet velocity of discharge water at each port averages about 13 feet per second. This high velocity, in addition to its submergence, produces a relatively high degree of entrainment of ambient water and thus enhances the diluting characteristics of the plume. As seen in Section 5.1, this is an effective method for diluting heat with minimal environmental effect.

3.4.2.4 <u>System Velocities and Residence Times</u>

Flow velocities at selected locations within the St Lucie Unit 2 CWS for three pump and four pump operations have been calculated. The calculation is based on high tide level. The results are summarized in Table 3.4-1. The corresponding residence times for the St Lucie Unit 2 CWS components have been calculated and tabulated in Table 3.4-2. The total system residence time was estimated to be 9740 seconds (2 hours, 42.3 minutes) for four pump operation, and 11120 seconds (3 hours 5.3 minutes) for three pump operation.

3.4.2.5 <u>Rates of Temperature Change</u>

The rate of temperature change in the CWS discharge is a function of the rate of change power output. The nuclear steam supply system (NSSS) has the capability of accepting a step load change of ten percent and a ramp load change of five percent per minute. The maximum rate of decrease in power output, under normal conditions, is expected to be five percent per minute. This results in a decrease of discharge water temperature at a rate of approximately 1.0^{o}F per minute for four pump operation.

3.4.3 INTAKE COOLING WATER SYSTEM

The ICW consists of three pumps, associated piping and valves. At any given time two pumps (with the remaining one standby), each with a capacity of 14,500 gpm, are in operation to supply ocean water to the heat exchangers of the component cooling water system (CCW), steam generator blowdown cooling system (SGBDCS) and turbine cooling water system (TCW). Total heat rejected from the ICW during normal and shutdown conditions are approximately 2.07 and 3.06 x 10^8 Btu/hr, respectively.

The CCW cools the NSSS related systems. Under normal operating conditions, the ICW flow rate to CCWHX is 16000 gpm. This results in a temperature rise of 11°F. The heated water is returned to the discharge canal and eventually to the ocean.

The TCW cools turbine-generator related systems. Under normal operating conditions, the ICW flow rate to the TCWHX is 8000 gpm. This results in a temperature rise of 13°F. The heated water is returned to the discharge canal.

The SGBDCS, which consists of an open blowdown cooling system (OBDCS) and a closed blowdown cooling system (CBDCS), cools the blowdown from the steam generators. Under normal operting conditions, the ICW flow rate to the OBDCHX is 5000 gpm. The cooling water undergoes a temperature rise of 55°F and is returned to the discharge canal.

The ICW is hypochlorinated to control biofouling in the same manner as the CWS.

3.4.4 EMERGENCY WATER SUPPLY

The requirements and design basis of the emergency water supply were presented in St Lucie Unit 2 Environmental Report - Construction permit Section 3.4.3 and Final Environmental Statement. The primary source of emergency cooling water is the Atlantic Ocean and the secondary source is Big Mud Creek. The emergency water which provides for two units was installed during construction of St Lucie Unit 1. The following description represents the changes:

a) A seismically qualified concrete barrier wall, instead of a sheet piling barrier, was erected to separate the intake canal and the emergency canal connecting the Big Mud Creek.

b) Two valved openings penetrating the concrete barrier are used instead of nine pipe stubs with pneumatic plugs. Each opening provides sufficient flow for St Lucie Units 1 and 2. The valves will be actuated to open (either locally or remotely from control room) in the event emergency cooling water from Big Mud Creek is needed.

c) The valves will be routinely tested quarterly instead of semi-annually.

TABLE 3.4-1

CIRCULATING WATER FLOW VELOCITIES[1]
(fps)

Location	Three Pump Operation	Four Pump Operation
1. Intake		
piping (ocean)	8.8[2]	10.0
canal	0.8[2]	0.9
intake structure approach	0.9[3]	0.9
2. Condenser & Yard Piping		
condenser & intake piping	10.0[3]	10.0
discharge piping	7.7[4]	10.0
3. Discharge		
canal	0.6[2]	0.7
ocean piping (16'0)	5.0	5.7
diffuser (16'0) average	2.5	2.9

Notes:

(1) Velocity calculations were based on: (i) high tide level (approximately +3.0 ft, MLW at Atlantic Ocean and -5.0 ft MLW at intake canal); and (ii) two unit flow (assuming constant Unit 1 four pump flow = 1159 cfs) to compute velocities for intake and discharge canals.

(2) Represents two unit flow (1159 + 880 = 2040 cfs) equally divided in the joint use pipelines and canals.

(3) Outage of one pump has no effect on the other individually isolated pumps and piping.

(4) The three pump flow (880 cfs) equally divided into two pipelines.

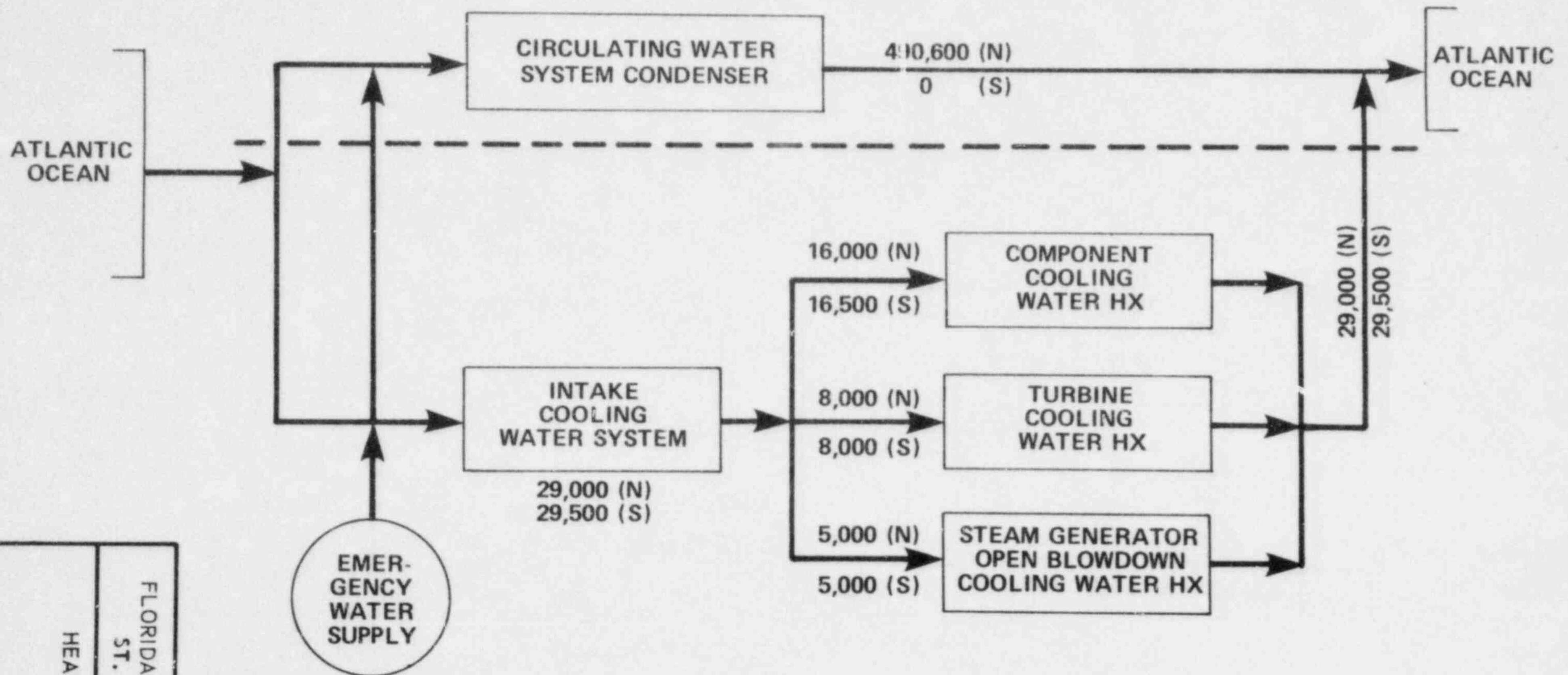
TABLE 3.4-2

RESIDENCE TIME FOR CIRCULATING WATER SYSTEM
(seconds)

Location	Approximate Length (ft)	Three Pump Operation	Four Pump Operation
1. Intake			
piping (ocean)	1200	140	120
canal	5000	6250	5560
intake structure	*	*	*
	Subtotal	6390	5680
2. Condenser & Yard Piping			
condenser & intake piping	200 (approx)	20	20
discharge piping	700	90	70
	Subtotal	110	90
3. Discharge System			
canal	2200	3670	3140
ocean piping	2000	400	350
diffuser	1370	550**	480**
	Subtotal	4620	3970
	Grand Total	11120 (3 hrs, 5.3 min)	9740 (2 hrs, 42.3 min)

* = Negligible
** = Based on average velocity in diffuser

For other notes, see Table 3.4-1



NOTES:

1. FLOW RATES ARE IN GPM
2. (N) = NORMAL PLANT OPERATION
   (S) = SHUTDOWN CONDITION
   HX = HEAT EXCHANGER

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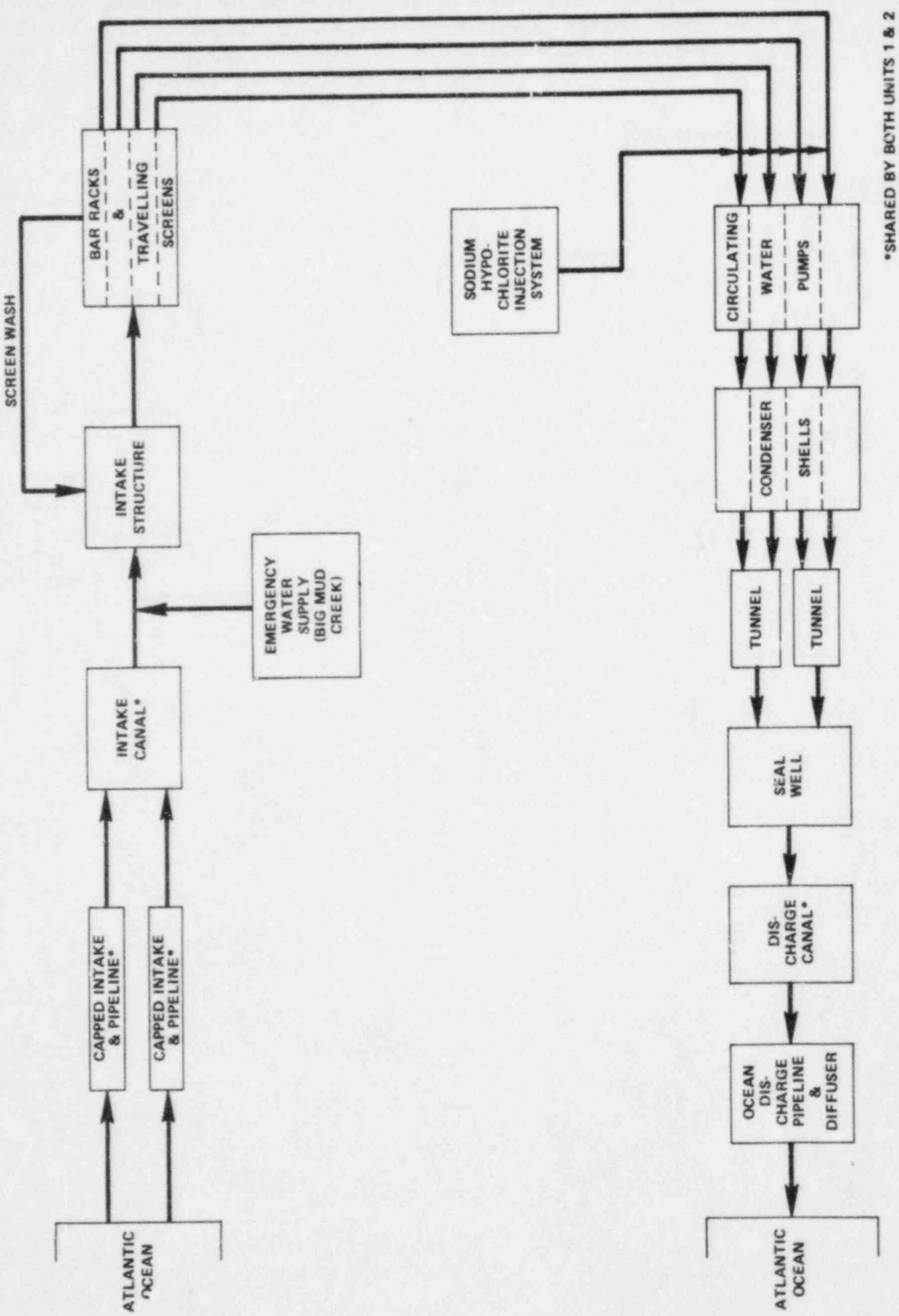
ST. LUCIE PLANT UNIT 2

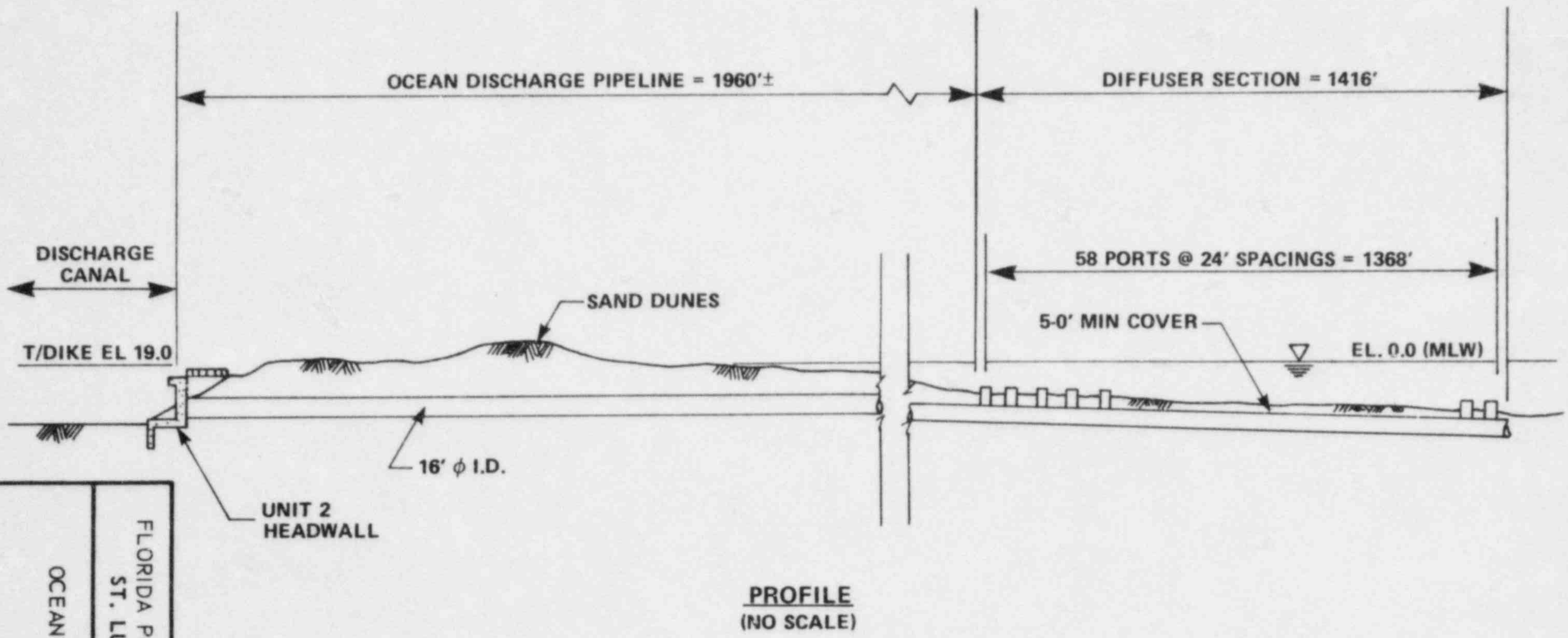
HEAT DISSIPATION SYSTEM
FLOW DIAGRAM

FIGURE 3.4–1



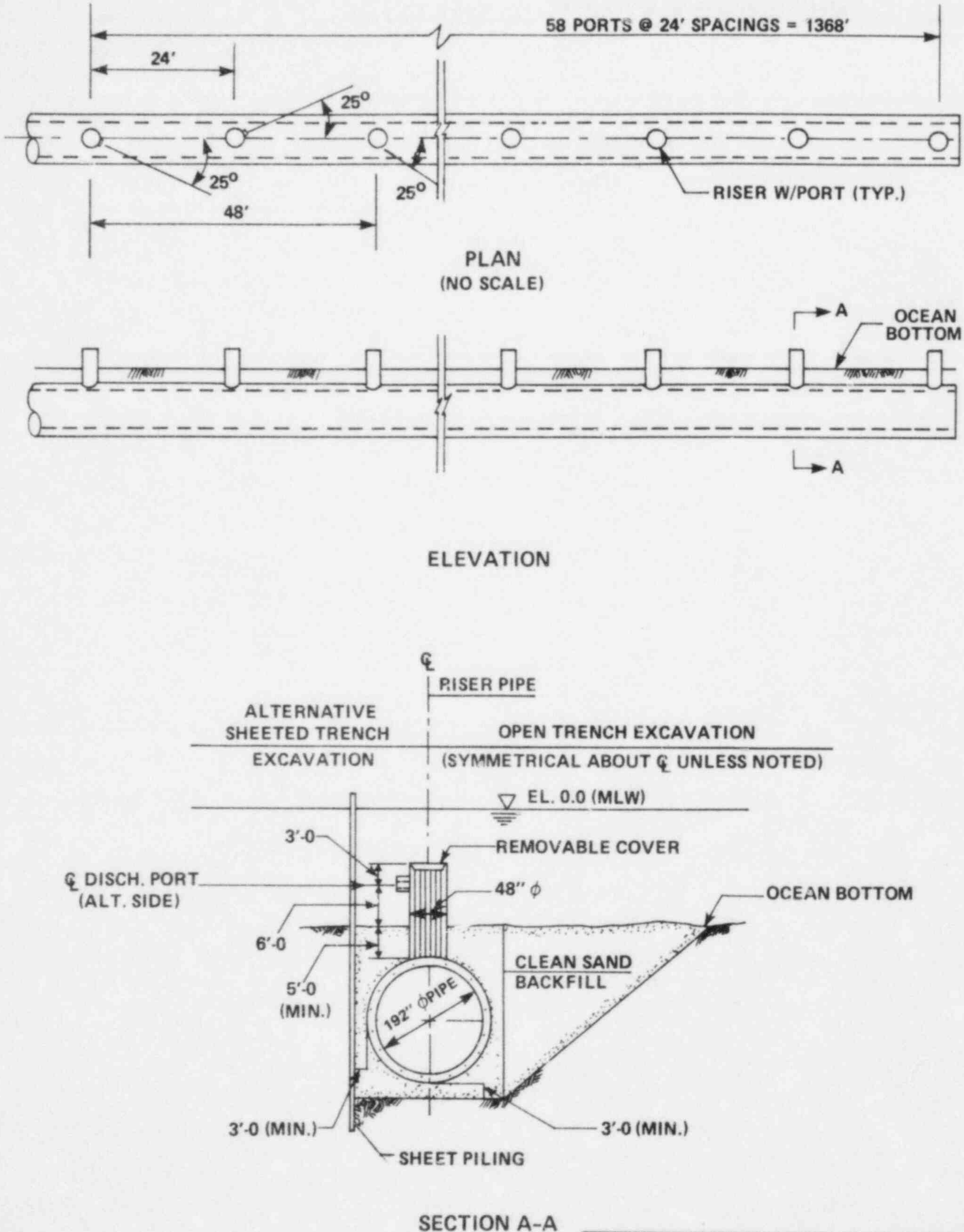
FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

CIRCULATING WATER SYSTEM
FIGURE 3.4–2



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

OCEAN DISCHARGE PIPELINE
FIGURE 3.4–3



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

DETAILS OF THE MULTIPORT DIFFUSER

FIGURE 3.4-4

3.5 RADWASTE SYSTEMS AND SOURCE TERMS

A description of the sources, systems and processes provided for treatment and disposal of liquid, gaseous and solid radioactive wastes is provided in the St Lucie Unit 2 Environmental Report - Construction Permit, Sections 3.5 and 3.8. This section addresses those source terms and systems which have been modified since the submission of the St Lucie Unit 2 Environmental Report - Construction Permit and its amendments, specifically Amendments 7 and 8.

3.5.1 SOURCE TERMS

The sources of radionuclides, including tritium, which may be expected to enter the reactor coolant system, secondary side of the steam generator and the spent fuel pool are described in the St Lucie Unit 2 Environmental Report - Construction Permit, as amended. This description remains unchanged. However, minor changes to the GALE code have been made since the submission of Amendments 7 and 8. Tables 3.5-1, 3.5-2 and 3.5-3 present the revised GALE code analysis of the radionuclide concentrations in the reactor coolant, secondary side of the steam generators and spent fuel pool, respectively, during normal operating conditions, including anticipated operational occurrences. Table 3.5-4 presents all pertinent assumptions. These assumptions are the input parameters into the GALE code. A detailed description of the GALE code is provided in NUREG 0017.

3.5.2 LIQUID RADWASTE SYSTEM

The St Lucie Unit 2 Environmental Report - Construction Permit and Amendments 7 and 8 to that document present a detailed description, including flow diagrams, of the liquid radwaste system and steam generator blowdown system. The design of the systems has not changed since the submission of Amendment 8.

Amendment 8 of the St Lucie Unit 2 Environmental Report - Construction Permit has provided a detailed evaluation to show that doses resulting from releases of liquid radioactive materials are within the numerical design objectives of Appendix I to 10CFR50 (see also Section 5.2). A review of the plant design and site usage characteristic reveals that no significant change has occurred which would require re-evaluation. Amendment 8 of the St Lucie Unit 2 Environmental Report - Construction Permit also provides a cost benefit analysis in Subsection 10.7.8 which is still applicable. However, due to further refinements in the GALE code, a reanalysis of the liquid effluent releases has been performed and is provided in Table 3.5-5. The assumptions are presented in Table 3.5-6. The results reveal that the annual releases are essentially unchanged.

3.5.3 GASEOUS RADWASTE SYSTEM

Section 3.5 of the St Lucie Unit 2 Environmental Report - Construction Permit and Amendments 7 and 8 to that document present a detailed description of the gaseous radwaste system and building ventilation systems, including flow diagrams. Figure 3.5-1 presents a block flow diagram of the ventilation and exhaust systems.

Review of the gaseous radwaste system and building ventilation systems revealed one major system change. A low volume (2000 to 2500 cfm) continuous purge system has been added and the airborne radioactivity removal system has been removed. The continuous purge system is designed to reduce activity within the containment, to allow increased occupancy, and is in response to BTPCSB 6-4. The system contains HEPA and charcoal filters, and removes the need for the airborne radioactivity removal system.

Based on the operating experience provided in NUREG-0017, 1.0 percent per day of the noble gases and 0.001 percent per day of the iodines contained in the reactor coolant will leak directly to the containment atmosphere. Airborne activity will be released to the environment through the continuous purge system charcoal and HEPA filters.

Amendment 8 of the St Lucie Unit 2 Environmental Report - Construction Permit has provided a detailed evaluation to show that doses resulting from release of gaseous radioactive materials are within the numerical design objectives of Appendix I to 10CFR50 (see also Section 5.2). Table 3.5-7 presents the calculated release rates using GALE, as updated, and taking into consideration the design changes to the ventilation system. Table 3.5-8 presents the assumptions. The results reveal that the annual releases are essentially unchanged.

3.5.4 SOLID RADWASTE SYSTEM

Spent resins, concentrator bottoms, used filter cartridges and miscellaneous contaminated waste will be processed during the normal operation of St Lucie Unit 2. This material will be collected, processed, packaged, facility by the solid waste management system (SWMS).

The handling of spent resins, compactible wastes (e.g., waste rags and paper), decontaminatable wastes (e.g., tools and equipment) has not changed from Section 3.8 of the St Lucie Unit 2 Environmental Report - Construction Permit. However, as the need for solidification arises, a portable solidification system will be provided by an onsite contractor. This system will satisfy the following criteria:

a) Provide for the processing and packaging of wastes resulting from plant operations without limiting the operation or availability of the plant;

b) Provide a reliable means of remotely handling spent resins concentrator bottoms, and filter cartridges as required. All handling of this waste will be done while maintaining the exposure levels to plant personnel within the permissible limits of 10CFR20;

c) Prevent the release of significant quantities of radioactive materials to the environs in order to keep the exposure to the public within the requirements of 10CFR20 and 10CFR50, Appendix I;

d) Insure that all radioactive material is packaged in a manner which will allow shipment and disposal in accordance with 49CFR170-179, 10CFR20 and 10CFR71.

The portable solidification system will contain the following equipment:

a) solids pretreatment tank and metering pump;

b) solidification agent storage tank and metering pump;

c) additive (catalyst) tank and metering pump;

d) dewatering pump;

e) remote viewing;

f) portable shielding;

g) solid waste containers;

h) handling and lifting equipment.

A process flow diagram for the portable solidification system is shown in Figure 3.5-2. Types of wastes, quantities and radionuclide distributions on inputs to the portable solidification system are given in Tables 3.5-9 to 3.5-15.

Concentrates from the radioactive waste concentrator and the two boric acid concentrators are pumped directly to the solids pretreatment tank. Spent resins from ion exchangers in the chemical and volume control system, and liquid waste management system and the fuel pool purification system are sluiced to the spent resin tank. After storage for decay, the resins that are to be solidified are sluiced to the solids pretreatment tank for preparation. Flexibility of controlling the final composition and activity of the solidified waste is provided by adjusting the composition of the waste in the solids pretreatment tank prior to solidification.

Desired volumes of resins and/or concentrates can be transferred to this process tank and the waste conditioned for processing and solidification. The volume per batch depends on the type and activity of the waste to be solidified, the size of container used and the number of containers to be filled.

Based on information provided by the contractor, a plant specific process control program for St Lucie Unit 2 is established. Per the process control program, the contractor will establish a set of process parameters which provide boundary conditions within which reasonable assurance can be given that solidification will be complete. During batch processing, tests will be performed to verify solidification. If any test fails to verify solidification (i.e., excess water is detected), the solidification of the batch under test will be suspended until such time as: 1) additional test specimens can be obtained; 2) alternative solidification parameters can be implemented in accordance with the process control program; and 3) a subsequent test verifies solidification. Solidification of the batch may then be resumed using the alternative solidification parameters. After producing a desirable mixture of wastes and solidification agent, the operator can set the total amount and rate of feed for both the waste and solidifying agent.

Thus, the portable solidification system has provisions for controlling process flows and waste mixtures prior to solidification operations. The plant operators maintain appropriate records showing conformance with the parameters established by the contractor. Process flows and volumes are also controlled for solidification operations by adjusting the solidification agent metering pumps. Controlled mixing conditions assure that the liquids have been combined into a matrix that will solidify into a monolithic mass. The waste and solidification agents are processed through a fill stations into disposable liners or 55 gallon drums. Remote viewing is available to monitor for any excess water on the top of the liner or drum. The containers, after monitoring for solidification, are remotely capped and transferred to the drumming storage area for temporary storage.

Prior to transporting the filled liner to an offsite disposal facility, the containers and the transport vehicle are monitored for loose surface radioactivity and decontaminated as required for offsite shipment. The radioactive content of the containers is determined and additional packaging used, if necessary, to allow shipment and disposal in accordance with 49CFR170-179, 10CFR20, and 10CFR71. The expected volumes of solid waste to be shipped offsite are given in Table 3.5-16. The expected volumes of wastes to be shipped were calculated using the inputs to the solid waste management system and a ratio of two volumes of waste to one volume of solidification material. The associated curie content, including a listing by principal nuclides is given in Table 3.5-17 for spent resins, Table 3.5-18 for filter cartridges, Table 3.5-19 for waste concentrates and Table 3.5-20 for boric acid concentrates. These activities are based on the radionuclides removed from the liquid processing streams.

3.5.5 PROCESS AND EFFLUENT RADIATION MONITORING

The radiation monitoring system consists of the process and effluent monitoring subsystem, the area monitoring subsystem, and the airborne radiation monitoring system. These subsystems consist of radiation monitor channels located throughout the plant; each channel containing a detector and its associated electronics, a local control and display unit, a power supply and a microprocessor. All channel information is processed through a dedicated local microprocessor and then transmitted to a central radiation monitor computer system.

The central radiation monitor computer system receives the input from the radiation monitors and enables the data to be logged, processed, edited and displayed. A dual computer and three input/output control panels with cathode ray tubes (CRT) are provided. Each computer or CRT display has access to the data from every monitor in the system. Those channels identified as safety related are also indicated and recorded on a seismic Category I panel in the control room.

The monitors in the process and effluent monitoring subsystem provide a means for continuously monitoring all major and potentially significant paths for release of radioactive material during normal operations, including anticipated operational occurrences; and to monitor the operation of various process systems throughout the plant. These monitors continually indicate and record radiation levels, and alarm when radiation levels exceed some preset value. Certain monitors also initiate control actions.

3.5.5.1 Effluent Radiation Monitors

The continuous effluent radiation monitors are designed to meet the requirements of 10CFR20, 10CFR50 General Design Criteria 60 and 64, and follow the recommendations of Regulatory Guide 1.21 Rev 1 (1974). These monitors provide continuous monitoring, storage of information and indication of liquid and gaseous radioactivity levels. The monitors provide radiation level indication and alarm annunciation to the control room operators whenever Technical Specifications limits for release of radioactivity are approached or exceeded. They also initiate closure of the appropriate discharge valve should preset limits be exceeded during the release of radioactive liquid or gaseous wastes.

The release points for effluents and locations of the monitors are shown in Figure 3.5-3. The effluent radiation monitors are shown in Table 3.5-21.

3.5.5.2 Process Radiation Monitors

The continuous process radiation monitors are designed to provide assistance to the operators to insure proper performance of selected equipment, to detect radioactive leakage into normally non-radioactive systems, to provide information on radiation levels in certain process lines, and to warn of abnormal increases in normally radioactive or potentially radioactive system. The process radiation monitors are shown in Table 3.5-21.

TABLE 3.5-1

RCS ACTIVITIES DURING NORMAL OPERATIONS
INCLUDING ANTICIPATED OPERATION OCCURRENCES

Nuclide	Specific Activity @ 70°F μCi/cc	Nuclide	Specific Activity @ 70°F μCi/cc
H-3	1.0 (0)*	Y-91M	3.4 (-4)
N-16	1.24 (+2)	Y-93	3.7 (-5)
KR-83M	1.9 (-2)	ZR-95	8.2 (-5)
KR-85M	1.0 (-1)	NB-95	6.8 (-5)
KR-85	1.1 (-1)	MO-99	1.1 (-1)
KR-87	5.5 (-2)	TC-99M	5.0 (-2)
KR-88	1.8 (-1)	RU-103	6.2 (-5)
KR-89	4.6 (-3)	RU-106	1.4 (-5)
XE-131M	9.5 (-2)	RH-103M	4.2 (-5)
XE-133M	2.0 (-1)	RH-106	9.2 (-6)
XE-133	1.6 (+1)	TE-125M	4.0 (-5)
XE-135M	1.2 (-2)	TE-127M	3.9 (-4)
XE-135	3.2 (-1)	TE-127	9.2 (-4)
XE-137	8.3 (-3)	TE-129M	1.9 (-3)
XE-138	4.0 (-2)	TE-129	1.5 (-3)
BR-83	4.7 (-3)	TE-131M	3.0 (-3)
BR-84	2.4 (-3)	TE-131	1.0 (-3)
BR-85	2.8 (-4)	TE-132	3.5 (-2)
I-130	2.3 (-3)	BA-137M	1.5 (-2)
I-131	3.6 (-1)	BA-140	3.0 (-4)
I-132	9.7 (-2)	LA-140	1.9 (-4)
I-133	4.4 (-1)	CE-141	9.6 (-5)
I-134	4.4 (-2)	CE-143	4.9 (-5)
I-135	2.0 (-1)	CE-144	4.5 (-5)
RB-86	1.2 (-4)	PR-143	6.8 (-5)
RB-88	1.8 (-1)	PR-144	3.1 (-5)
CS-134	3.7 (-2)	NP-239	1.5 (-3)
CS-136	1.9 (-2)	CR-51	2.6 (-3)
CS-137	2.7 (-2)	MN-54	4.3 (-4)
SR-89	4.8 (-4)	FE-55	2.2 (-3)
SR-90	1.4 (-5)	FE-59	1.4 (-3)
SR-91	7.0 (-4)	CO-58	2.2 (-2)
Y-90	1.5 (-6)	CO-60	2.8 (-3)
Y-91	8.8 (-5)		

* numbers in ( ) are powers of 10

TABLE 3.5-2

RADIONUCLIDE CONCENTRATIONS IN THE STEAM GENERATORS UNDER NORMAL OPERATING CONDITIONS

Isotope	Concentration (μCi/cc)
H-3	1.00 (-03)*
CR-51	5.33 (-07)
MN-54	1.30 (-07)
FE-55	4.54 (-07)
FE-59	3.30 (-07)
CO-58	4.59 (-06)
CO-60	5.84 (-07)
NP-239	2.46 (-07)
BR-83	2.10 (-07)
RB-86	2.46 (-08)
SR-89	1.32 (-07)
SR-91	6.94 (-08)
Y-91M	4.46 (-08)
Y-91	1.97 (-08)
ZR-95	1.97 (-08)
NB-95	1.99 (-08)
MO-99	2.39 (-05)
TC-99M	3.76 (-05)
RU-103	1.32 (-08)
RH-103M	2.96 (-08)
RU-106	3.25 (-09)
TE-127M	5.88 (-08)
TE-127	2.32 (-07)
TE-129M	3.98 (-07)
TE-129	8.81 (-07)
I-130	2.76 (-07)
TE-131M	4.60 (-07)
TE-131	7.58 (-07)
I-131	7.84 (-05)
TE-132	6.23 (-06)
I-132	1.54 (-05)
I-133	6.46 (-05)
I-134	8.47 (-07)
CS-134	7.12 (-06)
I-135	1.73 (-05)
CS-136	3.12 (-06)
CS-137	4.74 (-06)
BA-137M	1.23 (-05)
BA-140	6.17 (-08)
LA-140	6.95 (-08)
CE-141	1.99 (-08)
PR-143	1.37 (-08)
CE-144	1.30 (-08)
PR-144	3.05 (-08)

* numbers in ( ) denote powers of 10

TABLE 3.5-3

FISSION AND CORROSION PRODUCT ACTIVITIES
IN THE SPENT FUEL POOL UNDER NORMAL CONDITIONS
INCLUDING ANTICIPATED OPERATIONAL OCCURRENCES

Nuclide	Specific Activity @ 70°F (μCi/cc)	Nuclide	Specific Activity @ 70°F (μCi/cc)
H-3	1.0 (0)*	Y-91M	0.
N-16	0.	Y-93	3.4 (-08)
KR-83M	6.6 (-12)	ZR-95	2.0 (-06)
KR-85M	1.2 (-06)	NB-95	1.7 (-06)
KR-85	2.8 (-03)	MO-99	1.7 (-03)
KR-87	4.0 (-15)	TC-99M	4.6 (-06)
KR-88	2.6 (-08)	RU-103	1.5 (-06)
KR-89	0.	RU-106	3.5 (-07)
XE-131M	2.1 (-03)	RH-103M	0.
XE-133M	2.7 (-03)	RH-106	0.
XE-133	3.1 (-01)	TE-125M	9.9 (-07)
XE-135M	0.	TE-127M	9.7 (-06)
XE-135	2.0 (-04)	TE-127	6.2 (-07)
XE-137	0.	TE-129M	4.6 (-05)
XE-138	0.	TE-129	0.
BR-83	9.6 (-11)	TE-131M	2.5 (-05)
BR-84	0.	TE-131	0.
BR-85	0.	TE-132	5.7 (-04)
I-130	3.8 (-06)	BA-137M	0.
I-131	7.6 (-03)	BA-140	6.8 (-06)
I-132	9.7 (-10)	LA-140	2.1 (-06)
I-133	2.2 (-03)	CE-141	2.3 (-06)
I-134	0.	CE-143	4.5 (-07)
I-135	3.3 (-05)	CE-144	1.1 (-06)
RB-86	2.8 (-06)	PR-143	1.6 (-06)
RB-88	0.	PR-144	0.
CS-134	9.3 (-04)	NP-239	2.1 (-05)
CS-136	4.3 (-04)	CR-51	6.2 (-05)
CS-137	6.8 (-04)	MN-54	1.1 (-05)
SR-89	1.2 (-05)	FE-55	5.6 (-05)
SR-90	3.5 (-07)	FE-59	3.4 (-05)
SR-91	5.4 (-07)	CO-58	5.5 (-04)
Y-90	2.2 (-08)	CO-60	7.1 (-05)
Y-91	2.2 (-06)		

* Numbers in ( ) are powers of 10

TABLE 3.5-4

ASSUMPTIONS FOR NORMAL RADIONUCLIDE CONCENTRATIONS IN THE STEAM GENERATORS

ST LUCIE 2	PWR
Thermal Power Level (MWt)	2560.0
Plant Capacity Factor	0.80
Mass of Coolant in Primary System (10^3 lbs)	452.000
Percent Fuel with Cladding Defects	0.120
Primary System Letdown Rate (GPM)	40.000
Letdown Cation Demineralizer Flow Rate (GPM)	0.000
Number of Steam Generators	2.000
Total Steam Flow Rate (10^6 lbs/hr)	11.200
Mass of Steam in each Steam Generator (10^3 lbs)	9.500
Mass of Liquid in each Steam Generator (10^3 lbs)	130.500
Mass of Water in Steam Generators (Thousand lbs)	261.000
Total Mass of Secondary Coolant (10^3 lbs)	1106.000
Blowdown Rate (gal/min)	40.00
Primary to Secondary Leak Rate (lbs/day)	100.
Condensate Demineralizer Regeneration Time (days)	0.000
Fission Product Carry-Over Fraction	0.001
Halogen Carry-Over Fraction	0.010
Fraction of Feed Water through Condensate Demineralizer	0.000

TABLE 3.5-5

LIQUID EFFLUENTS

NUCLIDE	ANNUAL RELEASES TO DISCHARGE CANAL: BORON RS (CURIES)	MISC. WASTES (CURIES)	SECONDARY (CURIES)	TURB BLDG (CURIES)	TOTAL LWS (CURIES)	ADJUSTED TOTAL (CI/YR)	LAUNDRY WASTES (CI/YR)	TOTAL (CI/YR)
CORROSION AND ACTIVATION PRODUCTS								
CR-51	0.00001	0.00000	0.00041	0.00001	0.00042	0.00066	0.00000	0.00066
MN-54	0.00000	0.00000	0.00010	0.00000	0.00010	0.00016	0.00100	0.00120
FE-55	0.00001	0.00000	0.00035	0.00000	0.00037	0.00057	0.00000	0.00057
FE-59	0.00000	0.00000	0.00025	0.00000	0.00026	0.00041	0.00000	0.00041
CO-58	0.00007	0.00002	0.00354	0.00004	0.00368	0.00568	0.00400	0.00970
CO-60	0.00001	0.00000	0.00045	0.00001	0.00047	0.00073	0.00870	0.00940
ZR-95	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00140	0.00140
NB-95	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00200	0.00200
NP-239	0.00000	0.00000	0.00018	0.00000	0.00018	0.00029	0.00000	0.00029
FISSION PRODUCTS								
BR-83	0.00000	0.00002	0.00004	0.00000	0.00007	0.00011	0.00000	0.00011
RB-86	0.00001	0.00001	0.00002	0.00000	0.00003	0.00005	0.00000	0.00005
RB-88	0.00001	0.00006	0.00000	0.00000	0.00007	0.00011	0.00000	0.00011
SR-89	0.00000	0.00000	0.00010	0.00000	0.00010	0.00016	0.00000	0.00016
SR-91	0.00000	0.00000	0.00004	0.00000	0.00004	0.00006	0.00000	0.00006
Y-91M	0.00000	0.00000	0.00003	0.00000	0.00003	0.00004	0.00000	0.00004
Y-91	0.00001	0.00000	0.00002	0.00000	0.00003	0.00004	0.00000	0.00004
ZR-95	0.00000	0.00000	0.00002	0.00000	0.00002	0.00002	0.00000	0.00002
NB-95	0.00000	0.00000	0.00002	0.00000	0.00002	0.00002	0.00000	0.00002
MO-99	0.00004	0.00008	0.01776	0.00022	0.01810	0.02797	0.00000	0.02800
TC-99M	0.00004	0.00008	0.02407	0.00029	0.02447	0.03781	0.00000	0.03800
RU-103	0.00000	0.00000	0.00001	0.00000	0.00001	0.00002	0.00014	0.00016
RH-103M	0.00000	0.00000	0.00001	0.00000	0.00001	0.00002	0.00000	0.00002
RU-106	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00240	0.00240
AG-110M	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00044	0.00044
TE-127M	0.00000	0.00000	0.00005	0.00000	0.00005	0.00007	0.00000	0.00007
TE-127	0.00000	0.00000	0.00014	0.00000	0.00015	0.00023	0.00000	0.00023
TE-129M	0.00000	0.00000	0.00031	0.00000	0.00032	0.00049	0.00000	0.00049
TE-129	0.00000	0.00000	0.00022	0.00000	0.00023	0.00036	0.00000	0.00036
I-130	0.00000	0.00006	0.00017	0.00002	0.00025	0.00039	0.00000	0.00039
TE-131M	0.00000	0.00000	0.00032	0.00000	0.00033	0.00051	0.00000	0.00051
TE-131	0.00000	0.00000	0.00006	0.00000	0.00006	0.00009	0.00000	0.00009
I-131	0.00173	0.03375	0.05874	0.00732	0.10153	0.15688	0.00006	0.16000
TE-132	0.00002	0.00003	0.00466	0.00006	0.00476	0.00735	0.00000	0.00740
I-132	0.00016	0.00323	0.00655	0.00030	0.01025	0.01584	0.00000	0.01600
I-133	0.00089	0.01805	0.04317	0.00519	0.06730	0.10398	0.00000	0.10000
I-134	0.00000	0.00008	0.00002	0.00000	0.00010	0.00016	0.00000	0.00016
CS-134	0.00354	0.00192	0.00629	0.00008	0.01183	0.01828	0.01300	0.03100
I-135	0.00014	0.00284	0.00839	0.00093	0.01230	0.01900	0.00000	0.01900
CS-136	0.00070	0.00089	0.00271	0.00003	0.00434	0.00671	0.00000	0.00670
CS-137	0.00260	0.00138	0.00419	0.00005	0.00823	0.01271	0.02400	0.03700

TABLE 3.5-5

NUCLIDE	ANNUAL RELEASES TO DISCHARGE CANAL BORON RS (CURIES)	MISC. WASTES (CURIES)	SECONDARY (CURIES)	TURB BLDG (CURIES)	TOTAL LWS (CURIES)	ADJUSTED TOTAL (CI/YR)	LAUNDRY WASTES (CI/YR)	TOTAL (CI/YR)
FISSION PRODUCTS (Cont'd)								
BA-137M	0.00047	0.00003	0.00392	0.00005	0.00447	0.00691	0.00000	0.00690
BA-140	0.00000	0.00000	0.00005	0.00000	0.00005	0.00008	0.00000	0.00007
LA-140	0.00000	0.00000	0.00005	0.00000	0.00006	0.00009	0.00000	0.00009
CE-141	0.00000	0.00000	0.00002	0.00000	0.00002	0.00002	0.00000	0.00002
PR-143	0.00000	0.00000	0.00001	0.00000	0.00001	0.00002	0.00000	0.00002
CE-144	0.00000	0.00000	0.00001	0.00000	0.00001	0.00002	0.00520	0.00520
PR-144	0.00000	0.00000	0.00001	0.00000	0.00001	0.00002	0.00000	0.00002
ALL OTHERS	0.00000	0.00000	0.00002	0.00000	0.00002	0.00004	0.0	0.00004
TOTAL (EXCEPT H-3)	0.01047	0.06256	0.18749	0.01463	0.27515	0.42515	0.06234	0.49000

TRITIUM RELEASE 430 CURIES PER YEAR

TABLE 3.5-6

LIQUID WASTE INPUTS

STREAM	FLOW RATE (GAL/DAY)	FRACTION OF PCA	FRACTION DISCHARGED	COLLECTION TIME (DAYS)	DECONTAMINATION FACTORS I	CS	OTHERS
SHIMBLEED RATE	2.78E+03	1.000	0.100	46.000	1.00E+05	2.00E+03	1.00E+04
EQUIPMENT DRAINS	9.60E+01	0.200	0.100	3.100	5.00E+02	1.00E+03	5.00E+04
CLEAN WASTES	2.74E+02	0.093	1.000	2.900	5.00E+02	1.00E+03	5.00E+04
DIRTY WASTES	1.65E+02	0.076	1.000	3.100	5.00E+02	1.00E+03	5.00E+04
BLOWDOWN	5.75E+04		1.000	0.000	1.00E+02	1.00E+02	1.00E+02

TABLE 3.5-7

ST LUCIE UNIT 2

GASEOUS RELEASE RATE - CURIES PER YEAR

	GAS STRIPPING		BUILDING VENTILATION					
NUCLIDE	SHUTDOWN	CONTINUOUS	REACTOR	AUXILIARY	TURBINE	BLOWDOWN VENT OFFGAS	AIR EJECTOR EXHAUST	TOTAL
KR-83M	0.	0.	1.0E+00	0.	0.	0.	0.	1.0E+00
KR-85M	0.	0.	1.4E+01	2.0E+00	0.	0.	1.0E+00	1.7E+01
KR-85	5.0E+00	1.9E+02	7.0E+00	0.	0.	0.	0.	2.0E+02
KR-87	0.	0.	3.0E+00	1.0E+00	0.	0.	0.	4.0E+00
KR-88	0.	0.	1.8E+01	4.0E+00	0.	0.	2.0E+00	2.4E+01
KR-89	0.	0.	0.	0.	0.	0.	0.	0.
XE-131M	6.0E+00	1.9E+02	1.4E+01	0.	0.	0.	0.	2.1E+02
XE-133M	3.0E+00	3.9E+01	5.7E+01	2.0E+00	0.	0.	1.0E+00	1.0E+02
XE-133	7.9E+02	1.9E+04	3.5E+03	1.3E+02	0.	0.	8.0E+01	2.4E+04
XE-135M	0.	0.	0.	0.	0.	0.	0.	0.
XE-135	0.	0.	7.0E+01	6.0E+00	0.	0.	1.0E+00	8.0E+01
XE-137	0.	0.	0.	0.	0.	0.	0.	0.
XE-138	0.	0.	0.	0.	0.	0.	0.	0.
TOTAL NOBLE GASES								2.5E+04
I-131	0.	0.	2.5E-02	6.1E-02	7.9E-04	0.	3.8E-02	1.2E-01
I-133	0.	0.	1.9E-02	7.2E-02	8.3E-04	0.	4.5E-02	1.4E-01

TRITIUM GASEOUS RELEASE 594 CURIES/YR

0.0 APPEARING IN THE TABLE INDICATES RELEASE IS LESS THAN 1.0 CI/YR FOR NOBLE GAS, 0.0001 CI/YR FOR I

TABLE 3.5-7

ST LUCIE UNIT 2

AIRBORNE PARTICULATE RELEASE RATE-CURIES PER YEAR

NUCLIDE	WASTE GAS SYSTEM	BUILDING VENTILATION REACTOR	BUILDING VENTILATION AUXILIARY	TOTAL
MN-54	4.5E-03	2.2E-04	1.8E-04	4.9E-03
FE-59	1.5E-03	7.5E-05	6.0E-05	1.6E-03
CO-58	1.5E-02	7.5E-04	6.0E-04	1.6E-02
CO-60	7.0E-03	3.4E-04	2.7E-04	7.6E-03
SR-89	3.3E-04	1.7E-05	1.3E-05	3.6E-04
SR-90	6.0E-05	3.0E-06	2.4E-06	6.5E-05
CS-134	4.5E-03	2.2E-04	1.8E-04	4.9E-03
CS-137	7.5E-03	3.8E-04	3.0E-04	8.2E-03

TABLE 3.5-8

ASSUMPTIONS USED TO CALCULATE

RADIONUCLIDE RELEASE THROUGH THE GWMS

Gaseous Waste Inputs

There is continuous low vol. purge of vol. control tk	
There is continuous stripping of full letdown flow	
Holdup time (days) for XE form primary coolant system	9.3000
Holdup time (days) for KR form primary coolant system	9.3000
Fill time (days) for holdup system for gas stripping	9.3000
Gas waste system-particulate release fraction	1.00000
Auxiliary bldg -iodine release fraction	1.00000
-particulate release fraction	0.01000
Containment free volume (10**6 Ft**3)	2.5000
Frequency of Cntmt bldg high vol. purge (times/yr)	4.
Cntmt-high vol.-purgiodine release fraction	1.00000
-particulate release fraction	0.01000
Cntmt-low vol. -purgrate (cfm)	2000.00
Cntmt-low vol. -iodine release fraction	0.10000
particulate release fraction	0.10000
State leak to turbine bldg (lbs/hr)	1700.00000
Fraction of iodine released from condenser air ejector offgas treatment system	1.0000
There is no cryogenic offgas system	

TABLE 3.5-9

INPUTS TO SOLID WASTE MANAGEMENT SYSTEM

Source	Form	Table Reference for Radionuclide Distribution	Quantity (ft^3 /yr)
Spent Resins			
CVCS[(1)]	Dewatered	Table 3.5-10	96
Fuel Pool	Dewatered	Table 3.5-11	64
Liquid Waste Management System[(2)]	Dewatered	Table 3.5-12	160
Concentrator Bottoms			
Liquid Waste[(3)]		Table 3.5-10, 3.5-13	940
Filters			
Cartridges[(4)]	14 Cartridges	Table 3.5-11, 3.5-14, 3.5-15	35
Compressible Waste	Plastic, Bags Paper, etc.	Negligible	2,500
Non-Compressible Wastes	Tools, etc.	Negligible	1000

Notes:

1) Normally changed annually.

2) Normally changed once per year.

3) Based on volume reduction ratio of 20.

4) Based on changing each filter cartridge twice per year.

TABLE 3.5-10 Sheet 1 of 2

CHEMICAL AND VOLUME CONTROL SYSTEM COMPONENT INVENTORIES (CURIES)

ION EXCHANGERS

NUCLIDE	PURIFICATION	DEBORATING	PRECONCENTRATOR	BORIC ACID CONDENSATE
N-16	3.6E-08	0.	0.	0.
KR-83M	2.0E-02	2.0E-02	1.2E-04	1.2E-07
KR-85M	1.1E-01	1.1E-01	1.4E-03	1.4E-06
KR-85	1.2E-01	1.2E-01	5.2E-02	5.2E-05
KR-87	5.9E-02	5.9E-02	2.3E-04	2.3E-07
KR-88	1.9E-01	1.9E-01	1.6E-03	1.6E-06
KR-89	5.0E-03	5.0E-03	8.1E-07	8.1E-10
XE-131M	1.0E-01	1.0E-01	3.0E-02	3.0E-05
XE-133M	2.2E-01	2.2E-01	2.7E-02	2.7E-05
XE-133	1.7E+01	1.7E+01	3.6E+00	3.6E-03
XE-135M	1.3E-02	1.3E-02	1.0E-05	1.0E-08
XE-135	3.4E-01	3.4E-01	9.2E-03	9.2E-06
XE-137	8.9E-03	8.9E-03	1.8E-06	1.8E-09
XE-138	4.3E-02	4.3E-02	3.2E-05	3.2E-08
BR-83	1.4E-01	1.3E-02	8.3E-06	7.4E-10
BR-84	1.5E-02	1.5E-03	2.0E-07	1.8E-11
BR-85	1.7E-04	1.7E-05	2.1E-10	1.9E-14
I-130	3.4E-01	3.4E-02	1.1E-04	1.0E-08
I-131	8.4E+02	3.4E+01	2.9E+00	2.6E-04
I-132	2.7E+00	2.6E-01	1.5E-04	1.4E-08
I-133	1.1E+02	1.1E+01	6.1E-02	5.5E-06
I-134	4.6E-01	4.5E-02	1.0E-05	9.1E-10
I-135	1.6E+01	1.6E+00	2.8E-03	2.5E-07
RB-86	4.2E-01	6.5E-05	1.1E-02	3.9E-10
RB-88	4.1E-01	9.7E-02	2.6E-05	1.5E-09
CS-134	1.2E+03	2.0E-02	4.1E+01	1.6E-07
CS-136	4.6E+01	1.0E-02	1.1E+00	5.6E-08
CS-137	1.0E+03	1.5E-02	3.4E+01	1.2E-07
SR-89	6.9E+00	5.2E-05	4.0E-02	6.2E-09
SR-90	8.1E-01	1.5E-06	5.4E-03	2.0E-10
SR-91	8.1E-02	7.5E-05	2.1E-05	3.9E-10
Y-90	1.2E-03	1.6E-07	1.9E-06	5.3E-12
Y-91	1.4E+00	9.5E-06	8.6E-03	1.1E-09
Y-91M	3.4E-03	3.7E-05	7.3E-08	1.6E-11
Y-93	4.5E-03	4.0E-06	1.2E-06	2.2E-11
ZR-95	1.5E+00	8.8E-06	8.9E-03	1.1E-09
NB-95	6.9E-01	7.3E-06	3.8E-03	8.3E-10
MO-99	8.8E+01	1.2E-02	1.5E-01	4.0E-07
TC-99M	3.6E+00	5.4E-03	5.6E-04	1.7E-08
RU-103	7.1E-01	6.7E-06	4.0E-03	7.7E-10
RU-106	6.3E-01	1.5E-06	4.1E-03	2.0E-10
RH-103M	4.8E-04	4.5E-06	1.1E-08	2.2E-12
RH-106	9.2E-07	9.9E-07	1.9E-13	4.2E-15

NOTE: E - denotes powers of 10

TABLE 3.5-10

NUCLIDE	PURIFICATION	DEBORATING	PRECONCENTRATOR	BORIC ACID CONDENSATE
TE-125M	6.5E-01	4.7E-03	3.9E-03	3.5E-07
TE-127M	1.0E+01	4.7E-02	6.5E-02	5.8E-06
TE-127	1.0E-01	1.0E-02	2.5E-05	2.3E-09
TE-129M	1.9E+01	2.2E-01	1.0E-01	9.3E-06
TE-129	2.1E-02	2.0E-03	6.0E-07	5.4E-11
TE-131M	1.1E+00	1.0E-01	8.7E-04	7.8E-08
TE-131	5.0E-03	4.9E-04	5.2E-08	4.7E-12
TE-132	3.3E+01	2.4E+00	6.2E-02	5.6E-06
BA-137M	7.7E-03	1.6E-03	8.2E-09	3.5E-11
BA-140	1.1E+00	3.2E-05	4.7E-03	2.8E-09
LA-140	9.2E-02	2.0E-05	9.8E-05	4.4E-10
CE-141	9.0E-01	1.0E-05	4.9E-03	1.2E-09
CE-143	1.9E-02	5.3E-06	1.7E-05	9.4E-11
CE-144	1.9E+00	4.8E-06	1.2E-02	6.4E-10
PR-143	2.7E-01	7.3E-06	1.2E-03	6.4E-10
PR-144	1.1E-04	3.3E-06	7.8E-10	4.9E-13
NP-239	1.0E+00	1.6E-04	1.5E-03	4.7E-09
CR-51	2.1E+00	3.0E-02	5.9E-03	1.6E-09
MN-54	1.9E+00	5.2E-03	6.7E-03	3.4E-10
FE-55	1.2E+01	2.7E-02	4.3E-02	1.8E-09
FE-59	1.8E+00	1.6E-02	5.6E-03	9.6E-10
CO-58	4.3E+01	2.6E-01	1.4E-01	1.6E-08
CO-60	1.6E+01	3.4E-02	5.8E-02	2.3E-09

NOTE: E - denotes powers of 10

TABLE 3.5-11

FUEL POOL SYSTEM COMPONENT INVENTORIES (CURIES)

NUCLIDE	ION EXCHANGER	PURIFICATION FILTER	HEAT EXCHANGER
N-16	0.	0.	0.
KR-83M	7.0E-12	1.5E-13	1.7E-11
KR-85M	1.3E-06	2.7E-08	3.0E-06
KR-85	3.0E-03	6.3E-05	7.0E-03
KR-87	4.2E-15	0.	1.0E-14
KR-88	2.8E-08	5.9E-10	6.6E-08
KR-89	0.	0.	0.
XE-131M	2.3E-03	4.9E-05	5.4E-03
XE-133M	2.9E-03	6.2E-05	6.8E-03
XE-133	3.3E-01	7.0E-03	7.8E-01
XE-135M	0.	0.	0.
XE-135	2.2E-04	4.7E-06	5.2E-04
XE-137	0.	0.	0.
XE-138	0.	0.	0.
BR-83	3.6E-09	2.2E-12	2.4E-10
BR-84	0.	0.	0.
BR-85	0.	0.	0.
I-130	6.5E-04	8.7E-08	9.7E-06
I-131	6.4E+00	1.7E-04	1.9E-02
I-132	3.5E-08	2.2E-11	2.4E-09
I-133	5.6E-01	5.0E-05	5.6E-03
I-134	0.	0.	0.
I-135	3.3E-03	7.5E-07	8.4E-05
RB-86	2.9E-03	6.4E-08	7.1E-06
RB-88	0.	0.	0.
CS-134	1.2E+00	2.1E-05	2.4E-03
CS-136	4.1E-01	5.8E-06	1.1E-03
CS-137	9.1E-01	1.6E-05	1.7E-03
SR-89	1.4E-02	2.7E-07	3.0E-05
SR-90	4.7E-04	8.0E-09	8.9E-07
SR-91	7.4E-05	1.2E-08	1.4E-06
Y-90	1.2E-05	5.1E-10	5.6E-08
Y-91	2.6E-03	4.9E-08	5.5E-06
Y-91M	0.	0.	0.
Y-93	4.9E-06	7.8E-10	8.7E-08
ZR-95	2.5E-03	4.6E-08	5.1E-06
NB-95	1.9E-03	3.8E-08	4.2E-06
MO-99	9.1E-01	3.8E-05	4.2E-03
TC-99M	4.1E-04	1.1E-07	1.2E-05
RU-103	1.7E-03	3.4E-08	3.8E-06
RU-106	4.6E-04	8.0E-09	8.9E-07
RH-103M	0.	0.	0.
RH-106	0.	0.	0.
TE-125M	1.2E-03	2.2E-08	2.5E-06
TE-127M	1.2E-02	2.2E-07	2.5E-05

NOTE: E - denotes powers of 10

TABLE 3.5-11

NUCLIDE	ION EXCHANGER	PURIFICATION FILTER	HEAT EXCHANGER
TE-127	8.2E-05	1.4E-08	1.6E-06
TE-129M	5.2E-02	1.0E-06	1.2E-04
TE-129	0.	0.	0.
TE-131M	8.2E-03	5.6E-07	6.2E-05
TE-131	0.	0.	0.
TE-132	3.4E-01	1.3E-05	1.4E-03
BA-137M	0.	0.	0.
BA-140	6.5E-03	1.5E-07	1.7E-05
LA-140	8.4E-04	4.7E-08	5.2E-06
CE-141	2.6E-03	5.3E-08	5.9E-06
CE-143	1.6E-04	1.0E-08	1.1E-06
CE-144	1.5E-03	2.6E-08	2.9E-06
PR-143	1.5E-03	3.5E-08	3.9E-06
PR-144	0.	0.	0.
NP-239	1.0E-02	4.7E-07	5.3E-05
CR-51	6.9E-03	6.9E-02	1.6E-04
MN-54	1.4E-03	1.4E-02	2.7E-05
FE-55	7.3E-03	7.3E-02	1.4E-04
FE-59	4.0E-03	4.0E-02	8.6E-05
CO-58	6.6E-02	6.6E-01	1.4E-03
CO-60	9.4E-03	9.4E-02	1.8E-04

NOTE: E - denotes powers of 10

TABLE 3.5-12

LIQUID WASTE MANAGEMENT SYSTEM COMPONENT INVENTORIES (CURIES)

MISC COMPONENTS

Nuclide	Waste Condensate I-X	Waste Concentrator	Nuclide	Waste Condensate I-X	Waste Concentrator
N-16	0.	0.	Y-91M	1.0E-09	2.2E-05
KR-83M	0.	0.	Y-93	3.9E-09	6.9E-06
KR-85M	0.	0.	ZR-95	2.2E-06	2.6E-05
KR-85	0.	0.	NB-95	1.0E-06	2.1E-05
KR-87	0.	0.	MO-99	1.1E-04	3.0E-02
KR-88	0.	0.	TC-99M	2.8E-06	8.2E-03
KR-89	0.	0.	RU-103	1.0E-06	2.0E-05
XE-131M	0.	0.	RU-106	9.4E-07	4.5E-06
XE-133M	0.	0.	RH-103M	1.6E-10	2.9E-06
XE-133	0.	0.	RH-106	2.9E-15	6.2E-09
XE-135M	0.	0.	TE-125M	9.6E-07	1.3E-05
XE-135	0.	0.	TE-127M	1.5E-05	1.2E-04
XE-137	0.	0.	TE-127	8.7E-08	1.7E-04
XE-138	0.	0.	TE-129M	2.7E-05	6.0E-04
BR-83	7.7E-08	5.7E-04	TE-129	7.8E-09	1.2E-04
BR-84	3.0E-09	1.0E-04	TE-131M	1.2E-06	7.1E-04
BR-85	3.2E-12	1.1E-06	TE-131	7.8E-10	3.4E-05
I-130	3.1E-07	4.5E-04	TE-132	4.2E-05	9.7E-03
I-131	1.2E-03	1.1E-01	BA-137M	1.2E-10	5.2E-05
I-132	1.5E-06	1.2E-02	BA-140	1.6E-06	9.2E-05
I-133	1.1E-04	9.6E-02	LA-140	1.1E-07	4.8E-05
I-134	1.4E-07	2.9E-03	CE-141	1.3E-06	3.0E-05
I-135	1.3E-05	3.4E-02	CE-143	2.2E-08	1.2E-05
RB-86	9.4E-07	3.7E-05	CE-144	2.8E-06	1.4E-05
RB-88	7.1E-08	4.3E-03	PR-143	3.8E-07	2.1E-05
CS-134	2.8E-03	1.2E-02	PR-144	1.2E-11	7.2E-07
CS-136	1.0E-04	5.8E-03	NP-239	1.3E-06	4.0E-04
CS-137	2.3E-03	8.7E-03	CR-51	3.1E-06	8.2E-05
SR-89	1.0E-05	1.5E-04	MN-54	2.8E-06	1.4E-05
SR-90	1.2E-06	4.5E-06	FE-55	1.7E-05	7.0E-05
SR-91	7.0E-08	1.3E-04	FE-59	2.7E-06	4.4E-05
Y-90	1.5E-09	4.1E-07	CO-58	6.3E-05	7.0E-04
Y-91	2.1E-06	2.8E-05	CO-60	2.3E-05	9.0E-05

NOTE: E denotes powers of 10

TABLE 3.5-13

CHEMICAL AND VOLUME CONTROL SYSTEM COMPONENT INVENTORIES (CURIES)

MISC COMPONENTS

Nuclide	Boric Acid Concentrator	Nuclide	Boric Acid Concentrator
N-16	0.	Y-91M	4.4E-07
KR-83M	3.3E-04	Y-93	6.1E-07
KR-85M	4.0E-03	ZR-95	3.0E-05
KR-85	1.5E-01	NB-95	2.3E-05
KR-87	6.4E-04	MO-99	1.1E-02
KR-88	4.6E-03	TC-99M	4.8E-34
KR-89	2.3E-06	RU-103	2.1E-05
XE-131M	8.5E-02	RU-106	5.6E-06
XE-133M	7.4E-02	RH-103M	6.1E-08
XE-133	1.0E+01	RH-106	1.2E-10
XE-135M	2.9E-05	TE-125M	1.5E-05
XE-135	2.6E-02	TE-127M	1.5E-04
XE-137	4.9E-06	TE-127	1.4E-05
XE-138	8.8E-05	TE-129M	6.4E-04
BR-83	1.8E-05	TE-129	2.7E-06
BR-84	2.0E-06	TE-131M	1.5E-04
BR-85	2.1E-08	TE-131	6.4E-07
I-130	4.6E-05	TE-132	4.1E-03
I-131	7.6E-02	BA-137M	9.8E-07
I-132	3.4E-04	BA-140	7.8E-05
I-133	1.5E-02	LA-140	1.2E-05
I-134	5.9E-05	CE-141	3.2E-05
I-135	2.1E-03	CE-143	2.6E-06
RB-86	1.1E-05	CE-144	1.8E-05
RB-88	4.1E-05	PR-143	1.8E-05
CS-134	4.4E-03	PR-144	1.4E-08
CS-136	1.6E-03	NP-239	1.3E-04
CS-137	3.3E-03	CR-51	4.5E-05
SR-89	1.7E-04	MN-54	9.6E-06
SR-90	5.7E-06	FE-55	5.0E-05
SR-91	1.1E-05	FE-59	2.7E-05
Y-90	1.5E-07	CO-58	4.5E-04
Y-91	3.2E-05	CO-60	6.4E-05

NOTE: E denotes powers of 10

TABLE 3.5-14

LIQUID WASTE MANAGEMENT SYSTEM COMPONENT INVENTORIES (CURIES)

FILTERS

Nuclide	Waste	Laundry	Nuclide	Waste	Laundry
N-16	0.	0.	Y-91M	9.3E-09	4.0E-09
KR-83M	0.	0.	Y-93	2.9E-09	7.9E-10
KR-85M	0.	0.	ZR-95	1.1E-08	1.9E-09
KR-85	0.	0.	NB-95	9.2E-09	1.5E-09
KR-87	0.	0.	MO-99	1.3E-05	2.5E-06
KR-88	0.	0.	TC-99M	3.5E-06	1.0E-06
KR-89	0.	0.	RU-103	8.4E-09	1.4E-09
XE-131M	0.	0.	RU-106	1.9E-09	3.2E-10
XE-133M	0.	0.	RH-103M	1.3E-09	5.3E-10
XE-133	0.	0.	RH-106	2.7E-12	1.4E-12
XE-135M	0.	0.	TE-125M	5.4E-09	9.1E-10
XE-135	0.	0.	TE-127M	5.3E-08	8.9E-09
XE-137	0.	0.	TE-127	7.2E-08	2.0E-08
XE-138	0.	0.	TE-129M	2.6E-07	4.3E-08
BR-83	2.4E-07	8.3E-08	TE-129	5.2E-08	2.1E-08
BR-84	4.4E-08	2.1E-08	TE-131M	3.0E-07	6.7E-08
BR-85	4.9E-10	2.6E-10	TE-131	1.4E-08	7.2E-09
I-130	1.9E-07	5.0E-08	TE-132	4.2E-06	7.9E-07
I-131	4.6E-05	8.2E-06	BA-137M	2.2E-08	1.2E-08
I-132	4.9E-06	1.7E-06	BA-140	4.0E-08	6.8E-09
I-133	4.1E-05	9.7E-06	LA-140	2.0E-08	4.2E-09
I-134	1.2E-06	5.3E-07	CE-141	1.3E-08	2.2E-09
I-135	1.4E-05	4.1E-06	CE-143	5.1E-09	1.1E-09
RB-86	1.6E-08	2.7E-09	CE-144	6.2E-09	1.0E-09
RB-88	1.8E-06	9.6E-07	PR-143	9.0E-09	1.5E-09
CS-134	5.1E-06	8.4E-07	PR-144	3.1E-10	1.6E-10
CS-136	2.5E-06	4.3E-07	NP-239	1.7E-07	3.4E-08
CS-137	3.7E-06	6.1E-07	CR-51	1.6E-02	9.5E-03
SR-89	6.5E-08	1.1E-08	MN-54	1.5E-02	8.4E-03
SR-90	1.9E-09	3.2E-10	FE-55	9.1E-02	5.3E-02
SR-91	5.5E-08	1.5E-08	FE-59	1.4E-02	8.2E-03
Y-90	1.7E-10	3.4E-11	CO-58	3.3E-01	1.9E-01
Y-91	1.2E-08	2.0E-09	CO-60	1.2E-01	7.1E-02

NOTE: E denotes powers of 10

TABLE 3.5-15

CHEMICAL AND VOLUME CONTROL SYSTEM COMPONENT INVENTORIES (CURIES)

FILTERS

Nuclide	Letdown	Preconcentrator	Nuclide	Letdown	Preconcentrator
N-16	5.0E-08	0.	Y-91M	7.7E-06	3.8E-09
KR-83M	4.3E-04	2.8E-06	Y-93	8.4E-07	5.2E-09
KR-85M	2.3E-03	3.4E-05	ZR-95	1.9E-06	2.6E-07
KR-85	2.5E-03	1.2E-03	NB-95	1.5E-06	2.0E-07
KR-87	1.2E-03	5.5E-06	MO-99	2.5E-03	9.6E-05
KR-88	4.1E-03	3.9E-05	TC-99M	1.1E-03	4.1E-06
KR-89	1.0E-04	1.9E-08	RU-103	1.4E-06	1.8E-07
XE-131M	2.2E-03	7.3E-04	RU-106	3.2E-07	4.8E-08
XE-133M	4.5E-03	6.4E-04	RH-103M	9.5E-07	5.3E-10
XE-133	3.6E-01	8.7E-02	RH-106	2.1E-07	1.0E-12
XE-135M	2.7E-04	2.5E-07	TE-125M	9.1E-07	1.2E-07
XE-135	7.3E-03	2.2E-04	TE-127M	8.9E-06	1.3E-06
XE-137	1.9E-04	4.2E-08	TE-127	2.1E-05	1.2E-07
XE-138	9.1E-04	7.6E-07	TE-129M	4.3E-05	5.5E-06
BR-83	1.1E-04	1.5E-07	TE-129	3.4E-05	2.3E-08
BR-84	5.5E-05	1.7E-08	TE-131M	6.8E-05	1.3E-06
BR-85	6.4E-06	1.8E-10	TE-131	2.3E-05	5.5E-09
I-130	5.2E-05	4.0E-07	TE-132	7.9E-04	3.5E-05
I-131	8.2E-03	6.5E-04	BA-137M	3.4E-04	8.4E-09
I-132	2.2E-03	2.9E-06	BA-140	6.8E-06	6.7E-07
I-133	1.0E-02	1.3E-04	LA-140	4.3E-06	1.1E-07
I-134	1.0E-03	5.1E-07	CE-141	2.2E-06	2.8E-07
I-135	4.5E-03	1.8E-05	CE-143	1.1E-06	2.3E-08
RB-86	2.7E-06	9.4E-07	CE-144	1.0E-06	1.5E-07
RB-88	4.1E-03	3.5E-06	PR-143	1.5E-06	1.5E-07
CS-134	8.4E-04	3.8E-04	PR-144	7.0E-07	1.2E-10
CS-136	4.3E-04	1.3E-04	NP-239	3.4E-05	1.1E-06
CS-137	6.1E-04	2.8E-04	CR-51	1.7E+01	5.9E-02
SR-89	1.1E-05	1.5E-06	MN-54	5.7E+00	6.7E-02
SR-90	3.2E-07	4.9E-08	FE-55	3.1E+01	4.3E-01
SR-91	1.6E-05	9.3E-08	FE-59	1.2E+01	5.6E-02
Y-90	3.4E-08	1.3E-09	CO-58	2.3E+02	1.4E+00
Y-91	2.0E-06	2.8E-07	CO-60	4.0E+01	5.8E-01

NOTE: E denotes powers of 10

TABLE 3.5-16

QUANTITIES OF OUTPUT FROM
SOLID WASTE MANAGEMENT SYSTEM

Source	Form	Quantity[3] (ft^3/yr)
Spent Resins		
CVCS[1]	Dewatered	144
Fuel Pool	Dewatered	96
Liquid Waste Management System[2]	Dewatered	240
Concentrator Bottoms		
Liquid Waste	12% $Na_2B_4O_7$	1410
Filters		
Cartridges	14 Cartridges	35
Compressible Wastes	Plastic, Bags Paper, etc.	500
Non-Compressible Wastes	Tools, etc.	100

Notes:

1) Normally changed annually.

2) Normally changed once per year.

3) Based on two volumes of waste per volume solidification agent.

TABLE 3.5-17

SPENT RESIN ACTIVITY (CURIES/FT^3(2))

Nuclide	Dewatered	Solidified W/cement(1)
I-129	0	0
I-131	3.4E+00	2.3E+00
RB-86	1.7E-03	1.1E-03
CS-134	5.1E+00	3.4E+00
CS-136	1.8E-01	1.2E-01
CS-137	3.9	2.6
SR-89	2.7E-02	1.8E-02
SR-90	3.2E-03	2.1E-03
ZR-95	5.8E-03	3.9E-03
NB-95	2.7E-03	1.8E-03
RU-103	2.8E-03	1.8E-03
RU-106	2.5E-03	1.6E-03
TE-125M	2.6E-03	1.7E-03
TE-127M	3.9E-02	2.6E-02
TE-129M	7.4E-02	4.9E-02
BA-140	4.3E-03	2.9E-03
CE-141	3.6E-03	2.4E-03
CE-144	7.4E-03	4.9E-03
PR-143	1.1E-03	7.0E-04
CR-51	8.2E-03	5.5E-03
MN-54	7.4E-03	5.0E-03
FE-55	4.7E-02	3.1E-02
FE-59	7.0E-03	4.7E-03
CO-58	1.7E-01	1.1E-01
CO-60	6.2E-02	4.2E-02

Bases

(1) 0.667 ft^3 spent resins when solidified with cement will have a volume of 1.0 ft^3.

(2) 256 ft^3 resin/resin tank.

TABLE 3.5-18

SPENT FILTERS ACTIVITY SHIPPED (CURIES/BATCH (1))

Nuclide	CVCS Letdown	CVCS Preconcentrator	LWMS Waste	LWMS Laundry	Fuel Pool Purification
Co-60	4.0 E + 01	5.8 E - 01	1.2 E-01	7.1 E-01	9.4 E-02
Fe-59	1.2 E + 01	5.6 E - 02	1.4 E-02	8.2 E-03	4.0 E-02
Co-58	2.3 E + 02	1.4 E - 00	3.3 E-01	1.9 E-01	6.6 E-01
Mn-54	5.7 E + 00	6.7 E - 02	1.5 E-02	8.4 E-03	1.4 E-02
Cr-51	1.7 E + 01	5.9 E - 02	1.6 E-02	9.5 E-03	6.9 E-02
Fe-55	3.1 E + 01	4.3 E - 01	9.1 E-02	5.3 E-02	7.3 E-02

Bases

(1) One filter per 55 gallon container, encapsulated with solidification agent.

TABLE 3.5-19

SOLIDIFIED WASTE CONCENTRATES (μCi/CC SOLIDIFIED WASTE(1))

Nuclide	Waste Concentrates(2)	Nuclide	Waste Concentrates
Br-83	1.3 E-04		
84	2.2 E-05	RH-103M	6.4 E-07
85	2.4 E-07	106	1.4 E-09
I-130	9.9 E-05	TE-125M	2.9 E-06
131	2.4 E-02	127M	2.6 E-05
132	2.6 E-03	127	3.7 E-05
133	2.1 E-02	129M	1.3 E-04
134	6.4 E-04	129	2.6 E-05
135	7.5 E-03	131M	1.6 E-04
RB-86	8.1 E-06	132	2.1 E-03
88	9.5 E-04	BA-137M	1.1 E-05
CS-134	2.6 E-03	140	2.0 E-05
136	1.3 E-03	LA-140	1.1 E-05
137	1.9 E-03	CE-141	6.6 E-06
SR-89	3.3 E-05	143	2.6 E-06
90	9.9 E-07	144	3.1 E-06
91	2.9 E-05	PR-143	4.6 E-05
Y-90	9.0 E-08	144	1.6 E-07
91	6.2 E-06	NP-239	8.8 E-05
91M	4.8 E-06		
93	1.5 E-06		
ZR-95	5.7 E-06	CR-51	1.8 E-05
NB-95	4.6 E-06	MN-54	3.1 E-06
MO-99	6.6 E-03	FE-55	1.5 E-05
TC-99M	1.8 E-03	59	9.7 E-06
RU-103	4.4 E-06	CO-58	1.5 E-04
106	9.9 E-07	60	2.0 E-05

Bases

(1) .6667 cc waste when solidified has a volume of one cc

(2) Volume of waste concentrator = 800 gallons.

TABLE 3.5-20

SOLIDIFIED BORIC ACID CONCENTRATES

(μ CURIES/cc SOLIDIFIED WASTE[(1)])

Nuclide	Activity[(2)]	Nuclide	Activity	Nuclide	Activity
KR-83M	8.8 E-08	CS-134	1.1 E-03	BA-137M	6.7 E-11
85M	2.6 E-06	136	3.0 E-04	140	1.5 E-05
85	3.2 E-03	137	8.1 E-04	LA-140	8.1 E-07
87	1.2 E-07	SR -89	4.0 E-05	CE-141	7.1 E-06
88	1.9 E-06	90	7.3 E-07	143	1.4 E-07
89	1.8 E-11	91	1.7 E-07	144	4.3 E-06
XE-131M	1.5 E-03	Y -90	1.4 E-08	PR 143	3.5 E-06
133M	5.5 E-04	91	7.3 E-06	144	6.3 E-12
133	1.3 E-01	91M	5.9 E-10	NP-239	1.1 E-05
135M	1.1 E-09	93	1.0 E-08	CR- 51	9.5 E-06
135	3.4 E-05	ZR -95	7.0 E-06	MN- 54	2.3 E-06
137	4.6 E-11	NB -95	5.1 E-06	FE- 55	1.2 E-05
138	3.0 E-09	MO -99	1.1 E-03	59	6.1 E-06
BR-83	6.8 E-08	TC -99M	4.6 E-06	CO- 58	1.0 E-04
84	1.7 E-09	RU -103	4.8 E-06	60	1.5 E-05
85	1.7 E-12	106	1.3 E-06		
I-130	8.8 E-07	RH-103M	9.5 E-11		
131	1.2 E-02	106	1.5 E-15		
132	1.2 E-06	TE-125M	3.4 E-06		
133	5.0 E-04	127M	3.5 E-05		
134	8.1 E-08	127	2.1 E-07		
135	2.3 E-05	129M	1.4 E-04		
RB-86	2.3 E-06	129	4.9 E-09		
88	1.9 E-08	131M	7.0 E-06		
		131	4.3 E-10		
		132	4.3 E-04		

Bases: (1) 0.667 cc waste when solidified has a volume of one cc
(2) Volume of boric acid holdup tank = 2400 gallons.

TABLE 3.5-21

PROCESS AND EFFLUENT RADIATION MONITORS

Monitor	Type	Frequency	Location	Action
Effluent				
1. Steam Generator Blowdown	Liquid	Continuous	One monitor in each of blowdown sample lines*.	1. Alarm if primary/secondary leakage 2. Close blowdown valve-
2. Liquid Waste Discharge	Liquid	Continuous**	Liquid waste discharge to circulating water canal.	1. Alarm if release approaches Tech Spec limit 2. Close discharge valve
3. Gaseous Waste Discharge	Gas	Continuous	Waste gas discharge downstream of gas decay tanks	1. Alarm if release approaches Tech Spec limit 2. Close discharge valve
4. Condenser Air Ejector	Gas	Continuous	Condenser air ejector discharge common header	Alarm if primary/secondary leakage
5. Plant Vent	Particulate Iodine Gas	Continuous	Plant vent downstream of all inputs and filters	Alarm if release approaches Tech Spec limit
6. Fuel Handling Building Stack	Particulate Iodine Gas	Continuous	FHB stack, downstream of all inputs and filters	Alarm if release approaches Tech Spec limit
7. ECCS Area Ventilation System Exhaust	Particulates Iodine Gas	Continuous	One monitor in each of two ECCS area exhaust ducts.	Alarm if release approaches Tech Spec limit

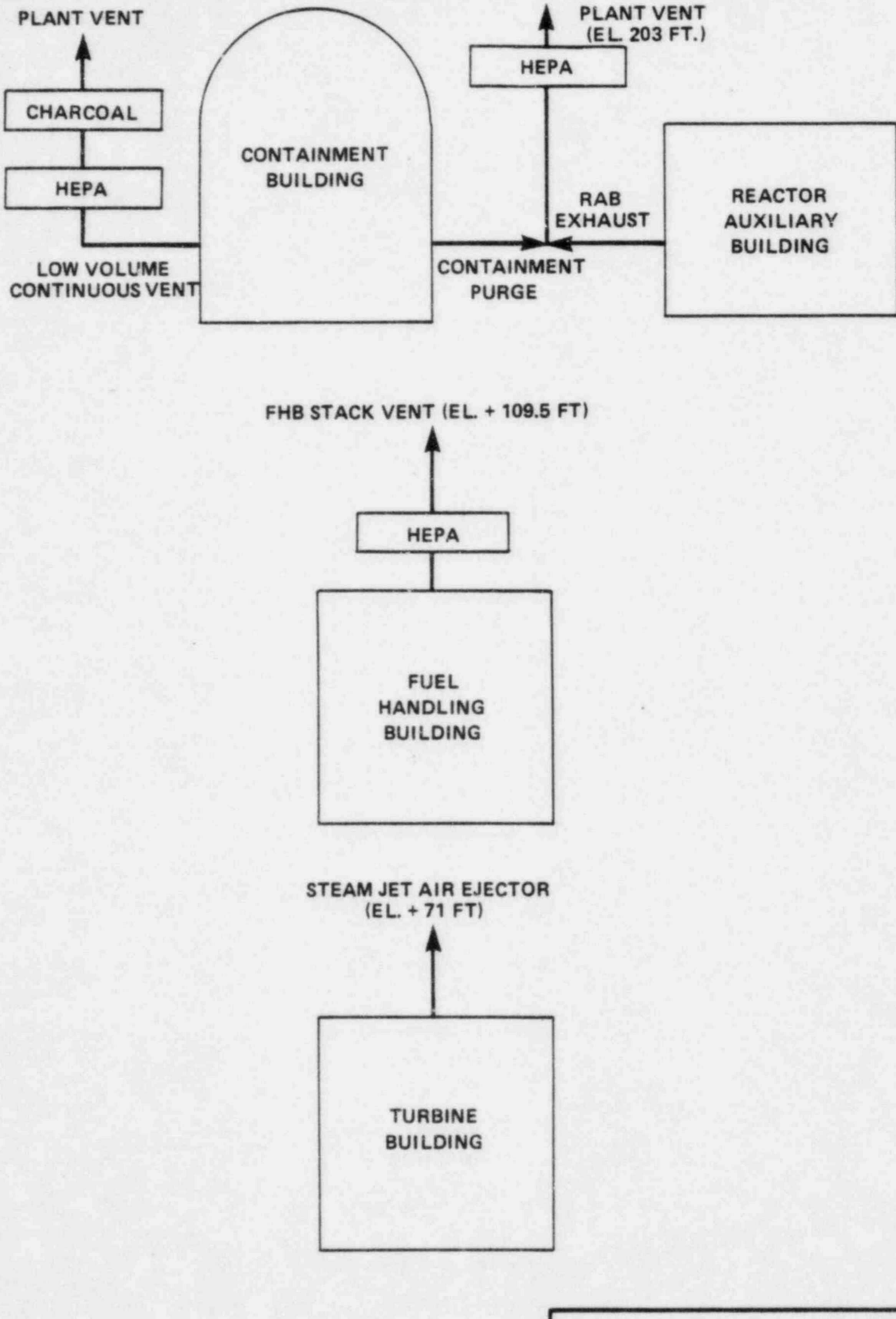
TABLE 3.5-21

PROCESS AND EFFLUENT RADIATION MONITORS

Monitor	Type	Frequency	Location	Action
Process				
1. Component Cooling Water	Liquid	Continuous	One monitor downstream of each of two CCWS heat exchangers	1. Alarm if leakage occurs into non-radioactive CCWS 2. Close vent valve on CCW surge tank
2. CVCS Process	Liquid	Continuous	Letdown line, upstream of purification filter	Alarm if sudden increase in reactor coolant activity
3. Boric Acid and Waste Evaporator Condensate	Liquid	Continuous**	Condensate recovery tank drain line	Alarm if leakage into secondary makeup

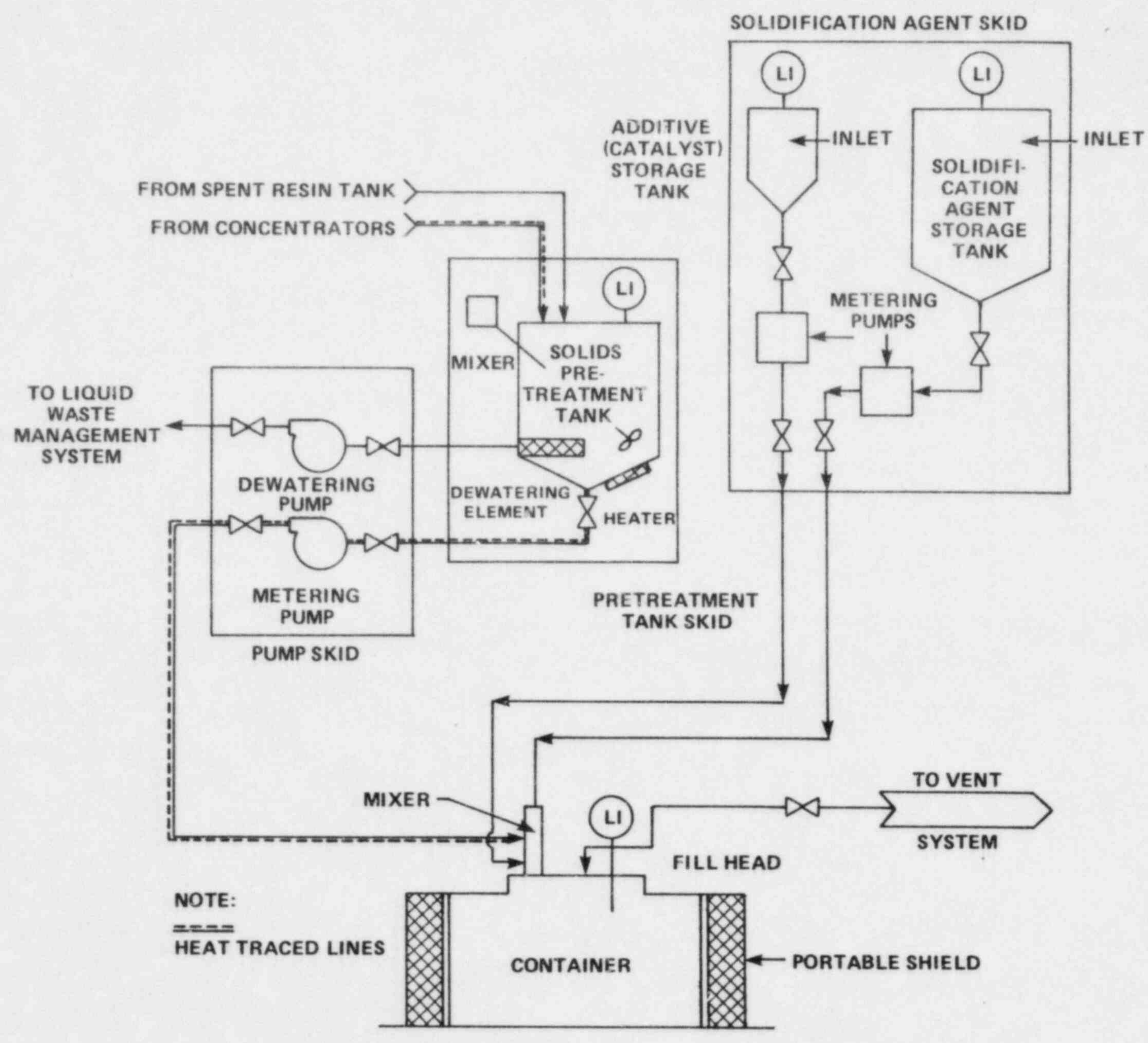
* Blowdown is routed to a treatment facility common to both Unit 1 and 2. Discharge from this facility is routed through an additional monitor.

** Monitor operates only when process fluid is in the line.



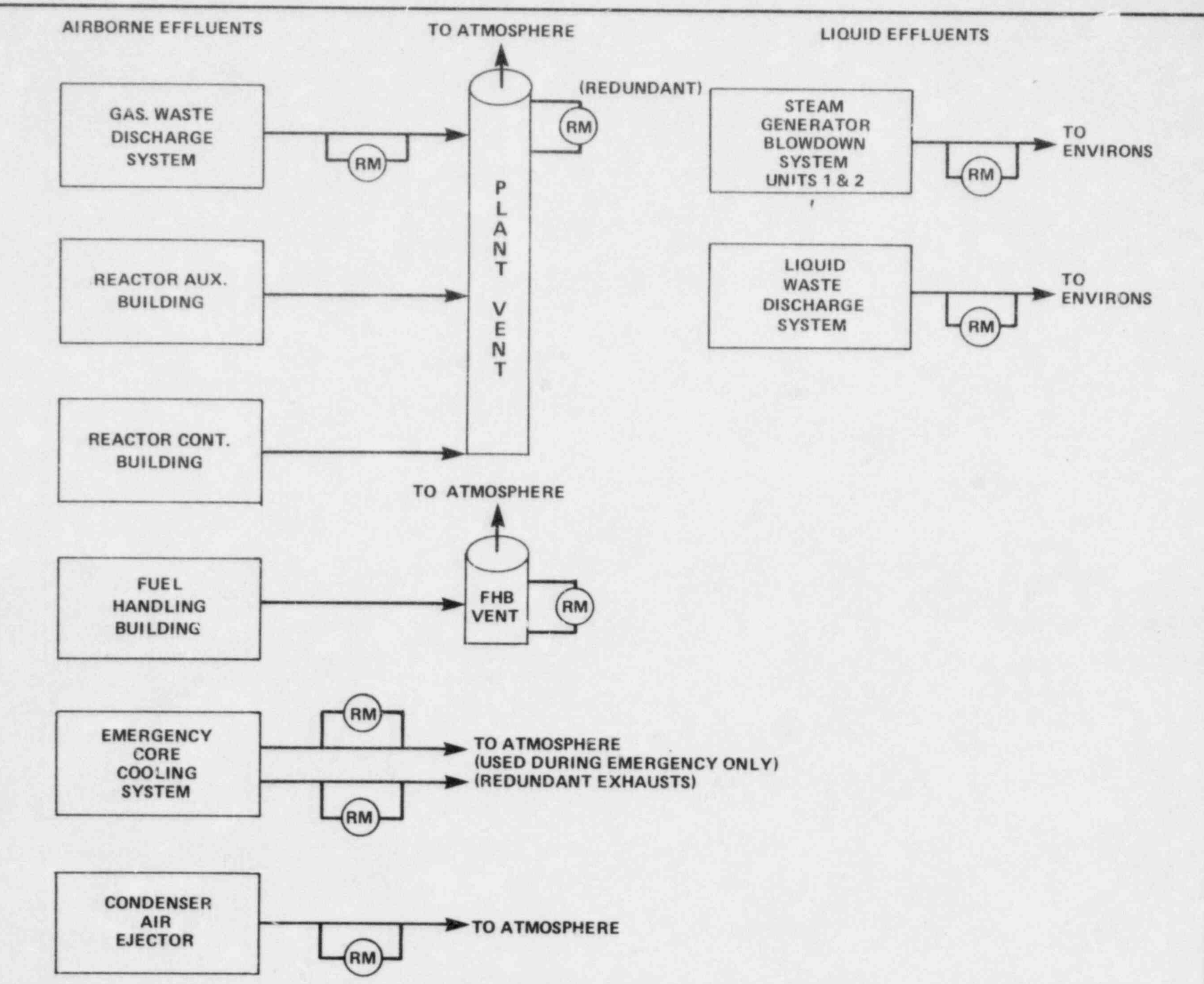
FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

BLDG. VENTILATION & EXHAUST SYSTEM
SIMPLIFIED BLOCK FLOW DIAGRAM
FIGURE 3.5–1



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

PORTABLE SOLID WASTE MANAGEMENT SYSTEM PROCESS FLOW DIAGRAM
FIGURE 3.5–2



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

EFFLUENT PATHS MONITORED BY DEDICATED RADIATION MONITORS

FIGURE 3.5–3

3.6 CHEMICAL AND BIOCIDE WASTES

3.6.1 INTRODUCTION

Operation of St Lucie Unit 2 generates chemical and biocide wastes from various plant process systems. This section identifies and describes the non-radioactive chemical waste streams, and biocide wastes with respect to their sources, quality, treatment and/or reuse processes. Radioactive wastes are discussed in Section 3.5. Potable and sanitary wastes are discussed in Section 3.7.

Table 3.6-1 presents a summary of chemical and biocide wastes anticipated for plant operation; the treated wastes are in full compliance with the applicable State of Florida and Federal effluent limitations set forth in 40CFR423 (as amended June 10, 1976). Figure 3.6-1 summarizes normally discharged wastes, their treatment and subsequent release to the environment. A list of chemicals added to plant systems on annual average and maximum bases is given in Table 3.6-2. Individual chemical and biocide wastes are discussed in the following subsections.

3.6.2 WATER TREATMENT WASTES

The St Lucie Unit 1 service water system is the freshwater source for St Lucie Unit 2 primary and secondary plant water uses. Water quality of this source is presented in Table 3.6-3. Table 3.6-1 summarizes the quality and quantity of water treatment wastes.

3.6.3 STEAM GENERATOR BLOWDOWN WASTES

During normal plant operation, approximately 40 gpm of continuous steam generator blowdown (SGBD) are required to maintain the total dissolved solids (TDS) content in steam at or below the operating limit. The SGBD is cooled, filtered and demineralized in the treatment system prior to entering monitoring tanks for sampling. The treated effluent (see Table 3.6-1) is directed to the condensate storage tank for reuse, or released to the discharge canal, if unacceptable for reuse.

In the event that radioactivity is detected in the treated SGBD, it will be diverted to the liquid waste management system for further treatment, as discussed in Section 3.5.

3.6.4 LABORATORY CHEMICAL RELEASES

The St Lucie Unit 2 Environmental Report - Construction Permit, Section 3.6.3, discussed laboratory chemical use and disposal.

3.6.5 CHEMICAL RELEASE FROM HYPOCHLORITE GENERATION SYSTEM

An onsite sodium hypochlorite generation system is installed for St Lucie Units 1 and 2 to control biological fouling in plant cooling water systems. Sodium hypochlorite (NaOCl) is generated by electrolysis of seawater according to the following reactions:

(1) $2\ NaCl + 2\ H_2O \rightarrow 2\ NaOH + H_2 + Cl_2$

(2) $2 NaOH + Cl_2 \rightarrow NaOCl + NaCl + H_2O$

Sodium hypochlorite is formed at the anode while the hydrogen gas is released at the cathode.

As shown in Figure 3.6-2, the complete sodium hypochlorite generation system consists of seawater strainers, hypochlorite generator, gas release tank, NaOCl solution storage tank, NaOCl transfer and injection pumps, and chlorine residual analyzers. Ocean water is withdrawn at an average rate of 80 gpm from the intake structure to the hypochlorite generator, which is capable of producing 2,000 pounds of equivalent chlorine per day (83 lb/hr) to produce a maximum dosage of 4 mg/l equivalent chlorine in the St Lucie Unit 2 circulating water system.

In general, hypochlorination of each of the four compartments (water boxes) of the condenser is achieved by injecting successively 0.4 percent NaOCl solution into each of the four circulating water intake bays at a rate of 260 gpm. The injection pump is automatically controlled to cycle twice with a duration of 15 minutes per compartment per cycle for a total of two hours per day. A residual chlorine analyzer is installed to monitor and maintain one mg/l of free residual chlorine at the outlet water box. The chlorinated flow after mixing with the unchlorinated flows from the other water boxes is further diluted by ratios of 3:1 or 7:1 depending upon whether one or both units are operating (Figure 3.6-2). In addition to physical dilution, total residual chlorine concentrations will be further reduced due to sunlight and the chlorine demand of the unchlorinated flows. Based on this, it is expected that maximum total residual chlorine is less than 0.1 mg/l at the terminus of the discharge canal.

Based on an average ocean water salinity of 35.5 ppt (Table 2.4-5), the additional sodium ion resulting from hypochlorination by a 0.4 percent solution of sodium hypochlorite at a flow rate of 260 gpm was estimated to be 0.02 percent. This increase, after dilution, is negligible over the background concentration in the discharge canal.

Hydrochloric acid is used periodically as a cleaning agent for the sodium hypochlorite generator assemblies. The acid cleaning waste, containing carbonate and noncarbonate hardness as well as small concentrations of heavy metals, is collected for off-site disposal by a licensed contractor.

Hydrogen gas, the by-product from the electrolysis process, is vented as described in Section 3.7.5.2.

3.6.6 CHEMICAL RELEASES FROM CORROSION CONTROL SYSTEMS

3.6.6.1 Hydrazine

Hydrazine is added continuously to the condensate feedwater system at a rate of 0.8 lb/hr to maintain a concentration of 35 microgram/l ($\mu g/l$) in the steam for corrosion control. Hydrazine reacts with oxygen to form free nitrogen gas and water. The treated steam generator blowdown is described in Section 3.6.3.

3.6.6.2 Cyclohexylamine

Cyclohexylamine is added continuously to the condensate feedwater system at a rate of about 2.5 lb/hr to maintain a 20 mg/l concentration in the condensate feedwater for pH control. Treated SGBD is described in Section 3.6.3.

3.6.6.3 Potassium Dichromate

As discussed in Section 3.6.2 of the St Lucie Unit 2 Environmental Report - Construction Permit, potassium dichromate is added to the turbine cooling and component cooling systems to inhibit corrosion. The following describes changes from the St Lucie Unit 2 Environmental Report - Construction Permit:

- a 1000 to 2000 mg/l concentration is maintained in the cooling systems;
- any leakage from the turbine cooling system is directed to the storm water basins, which will have a concentration not exceeding 0.2 mg/l in the basins.

3.6.6.4 Phosphates

During a condenser leakage, phosphates are added to the condensate feedwater system at a rate of 2.8 lb/hr to produce approximately a 25 mg/l concentration for corrosion control. Treated SGBD is described in Section 3.6.3.

3.6.7 FLOOR DRAINAGE WASTES

Non-radioactive floor drainage is collected from the floor wash and equipment drains located in the turbine generator building (TGB), component cooling building, diesel generator building and the diesel oil storage tanks enclosure.

The intermittent drainage flows are estimated as follows:

Source	Average Daily Flow (gpm)	Instantaneous Maximum (gpm)
Turbine Generator Building	6	150
Component Cooling Enclosure	3	75
Diesel Generating Building	3	75
Diesel Oil Storage Tank Building	3	75

The floor drainage sources from the TGB are the TGB oil sump, hydrogen seal oil sump, lube oil filter pump and transfer pump area sump. The floor drainage collected from the diesel generator building includes diesel oil day tanks, diesel generator accessory rack drains and floor drainage. Floor drainage primarily contains suspended solids, and oil/grease with estimated concentrations ranging from 30 to 400 mg/l and 15 to 500 mg/l, respectively.

Floor drainage wastewater collected from the TGB and component cooling building are directed to oil traps for gravity separation of oil and grease. The skimmed waste oil and settled sludge in oil traps is cleaned periodically for off-site disposal. Floor drainage wastewater from the diesel generator building and diesel oil storage tanks enclosure are collected in sumps and cleaned periodically for eventual disposal off-site. The oil trap effluent is subsequently conveyed to the storm water basins for further suspended solids removal.

3.6.8 RELEASE OF MISCELLANEOUS CHEMICALS

3.6.8.1 Boric Acid

Boric acid is utilized for reactor reactivity control. During normal plant operation, the boric acid is recirculated and reused within the system. Boric acid solution is filtered before entering the concentrators where it undergoes a simple evaporative process. The bottom stream in the concentrators, with boron concentrations of 10,900 to 21,000 mg/l is transferred to the boric acid holding tank where boric acid solution may be either recycled for further concentration transferred to boric acid makeup tank for reuse or rejected to the solid waste management system for off-site disposal. The distillate from the boric acid concentrator is pumped to the boric acid condensate tanks for reuse or disposal to the circulating water system.

The capacity of each of the two boric acid condensate tanks is 7300 gallons. Therefore, the maximum release of boric acid to the circulating water system, over a period of three hours at a pumping rate of 50 gpm, would be 7300 gallons of boric acid with a maximum concentration of ten mg/l. This release would result in a concentration of approximately one μg/l boric acid in the 490,600 gpm circulating water flow.

3.6.8.2 Heavy Metal Release

Condenser design employs titanium tubes (ASTM B-338, Grade 2) and copper-alloy tube sheets. The compositions of these tubes and the copper-alloy tube sheets are presented in Tables 3 6-4 and 3.6-5, respectively.

Titanium is extremely corrosion resistant in seawater environs. Therefore, tube corrosion is negligible. Assuming a copper corrosion rate of two mils/year, copper released from the copper-alloy tube sheets is about 0.1 lbs/day, or 0.02 μg/l in the circulating water, based on a total tube sheet surface area of approximately 67,000 in^2.

3.6.8.3 Hydrogen, Carbon Dioxide and Nitrogen Releases

Hydrogen, carbon dioxide and nitrogen releases are discussed in the St Lucie Unit 2 Environmental Report - Construction Permit.

TABLE 3.6-1

ST LUCIE UNIT 2 CHEMICAL AND BIOCIDE WASTE DISCHARGES - SUMMARY

Type of Waste	Source	Frequency of Discharge	Quantity	Chemical Constituent	Estimated Concentration In Waste (mg/l)	Estimated Concentration After Treatment (mg/l)	Released to	EPA and State of Florida Effluent Limitations (40CFR423) (mg/l) Average	Maximum
1. Water Treatment System Wastes									
a. Demineralizer Regeneration Waste	Demineralizer Beds (Cation, Anion, Mixed, Organic Scavenger)	Once/16hrs/train	76,400 gpd	TDS	7,000	(directed to neutralization basin for treatment)			
				Chloride (as $CaCO_3$)	600				
				Sulfate (as $CaCO_3$)	300				
				pH	1-2				
				TSS	<30				
				Oil/Grease	<15				
b. Activated Carbon Bed Backwash	Activated Carbon Bed	Once/week/filter	25,000 gal/week (3600 gpd)	TDS	200-350	(directed to neutralization basin for treatment)			
				TSS	150				
				Chloride (as $CaCO_3$)	90				
				Sulfate (as $CaCO_3$)	45				
				pH	7.5-8.5				
				Oil/Grease	<15				
c. Equalized Water Treatment System Wastes	Neutralization Basin	Daily	80,000 gpd	TDS		7800	Released to intake canal	-	-
				TSS		<30		30	100
				Chloride (as $CaCO_3$)		580		-	-
				Sulfate (as $CaCO_3$)		290		-	-
				pH		6.0-8.5		6.0-9.0	
				Oil/Grease		<15		15	20
2. Steam Generator Blowdown	Steam Generator Blowdown, Demineralizer System	Continuous	40 gpm	TDS (as $CaCO_3$)	10	0.2	Sent to the condensate storage tank or to the circulating water discharge canal, after treatment	-	-
				TSS	<1	<1		30	100
				pH	6.5-7.5	6.5-7.5		6.0-9.0	
				SiO_2	>1.0*	0.01		-	-
				Cu	>1.0*	<0.01		1.0	1.0
				Fe	>1.0*	<0.01		1.0	1.0
				Oil & Grease	<0.1	<0.1		15	20
3. Biocide Waste	Circulating and Intake Cooling Water	Intermittent	519,600 gpm	Total Residual Chlorine	Max - 0.1		To circulating water discharge canal		0.1**
4. Floor Drainage	Non-radioactive Floor and Equipment Drains	Intermittent	Avg - 15 gpm Max - 400 gpm	pH	6-9	6-9	Directed to the storm water basins, after treatment in oil separators	6.0-9.0	
				TSS	30-400	<30		30	100
				Oil & Grease	15-500	<15		15	20

Note: State of Florida Department of Environmental Regulations has adopted and incorporated the EPA Effluent Limitations (40CFR423, as amended June 10, 1976) for new and existing point sources which discharge pollutants for steam electric power generation

*Potential

**Based on St Lucie Unit 1 NPDES limitations.

TABLE 3.6-1

ST LUCIE UNIT 2 CHEMICAL AND BIOCIDE WASTE DISCHARGES - SUMMARY

Type of Waste	Source	Frequency of Discharge	Quantity	Chemical Constituent	Estimated Concentration In Waste (mg/l)	Estimated Concentration After Treatment (mg/l)	Released to	EPA and State of Florida Effluent Limitations (40CFR423) (mg/l) Average		Maximum
1. Water Treatment System Wastes										
a. Demineralizer Regeneration Waste	Demineralizer Beds (Cation, Anion, Mixed, Organic Scavenger)	Once/16hrs/train	76,400 gpd	TDS	7,000	(directed to neutralization basin for treatment)				
				Chloride (as $CaCO_3$)	600					
				Sulfate (as $CaCO_3$)	300					
				pH	1-2					
				TSS	<30					
				Oil/Grease	<15					
b. Activated Carbon Bed Backwash	Activated Carbon Bed	Once/week/filter	25,000 gal/week (3600 gpd)	TDS	200-350	(directed to neutralization basin for treatment)				
				TSS	150					
				Chloride (as $CaCO_3$)	90					
				Sulfate (as $CaCO_3$)	45					
				pH	7.5-8.5					
				Oil/Grease	<15					
c. Equalized Water Treatment System Wastes	Neutralization Basin	Daily	80,000 gpd	TDS		7800	Released to intake canal	-		-
				TSS		<30		30		100
				Chloride (as $CaCO_3$)		580		-		-
				Sulfate (as $CaCO_3$)		290		-		-
				pH		6.0-8.5			6.0-9.0	
				Oil/Grease		<15		15		20
2. Steam Generator Blowdown	Steam Generator Blowdown Demineralizer System	Continuous	40 gpm	TDS (as $CaCO_3$)	10	0.2	Sent to the condensate storage tank or to the circulating water discharge canal, after treatment	-		-
				TSS	<1	<1		30		100
				pH	6.5-7.5	6.5-7.5			6.0-9.0	
				SiO_2	>1.0*	0.01		-		-
				Cu	>1.0*	<0.01		1.0		1.0
				Fe	>1.0*	<0.01		1.0		1.0
				Oil & Grease	<0.1	<0.1		15		20
3. Biocide Waste	Circulating and Intake Cooling Water	Intermittent	519,600 gpm	Total Residual Chlorine	Max - 0.1		To circulating water discharge canal			0.1**
4. Floor Drainage	Non-radioactive Floor and Equipment Drains	Intermittent	Avg - 15 gpm Max - 400 gpm	pH	6-9	6-9	Directed to the storm water basins, after treatment in oil separators		6.0-9.0	
				TSS	30-400	<30		30		100
				Oil & Grease	15-500	<15		15		20

Note: State of Florida Department of Environmental Regulations has adopted and incorporated the EPA Effluent Limitations (40CFR423, as amended June 10, 1976) for new and existing point sources which discharge pollutants for steam electric power generation

*Potential

**Based on St Lucie Unit I NPDES limitations.

TABLE 3.6-2

ST LUCIE UNIT 2 ANNUAL CHEMICAL USES

System	Chemicals	Annual Chemical Uses[1] Average	Maximum
Water Treatment System	Sulfuric Acid (66°Be)	436 tons	546 tons
	Sodium Hydroxide (100%)	153 tons	191 tons
Neutralization Basin	Sodium Hydroxide (100%)	274 tons[2]	344 tons[2]
Circulating Water System	Sodium Hypochlorite (100%)	97 tons[3]	188 tons[3]
Steam Feedwater System	Hydrazine	2.8 tons	3.5 tons
	Cyclohexylamine	8.8 tons	11 tons
	Phosphate	10 tons	12.3 tons
Reactor Reactivity Control	Boric Acid	2 lbs[4]	450 lbs[4]
Turbine Cooling	Potassium Dichromate	5 lbs[5]	9 lbs[5]

Notes:

(1) Annual average and maximum chemical uses are based on 80 percent and 100 percent availability, respectively.

(2) Annual average and maximum NaOCl uses are based on 300-day normal operation and 65-day shutdown.

(3) Annual average and maximum uses of sodium hypochloride are based on dosage concentrations of 2.5 mg/l and 4 mg/l equivalent chlorine, respectively.

(4) Annual average boric acid use is based on the makeup quantity for draining two boric acid condensate tanks once per year. Maximum boric use is based on the makeup quantity for cleaning the boric acid hold-up tank once per year.

(5) Annual average and maximum uses of potassium dichromate are based on the allowable discharge into the two storm water basins during maintenance of the turbine cooling system once per year.

TABLE 3.6-3

ST LUCIE UNIT 1 SERVICE WATER QUALITY*

Parameter	Concentration (mg/l as $CaCO_3$)**
Total Hardness	100-200
P Alkalinity	0-5
M Alkalinity	40-50
Chloride	70-137
Fluoride	0.2-0.4
Sulfate	45
Silica (as SiO_2)	8-12
Conductivity (microohms/cm)	400-500
pH (No unit)	7.5-8.5
Turbidity (APHA units)	2.4
Iron (as Fe)	0.05-0.1
TOC, ppm*** (as Carbon)	10-20

* Based on 1975-1978.
** Except as noted.
*** Based on 1973-1974 data.

TABLE 3.6-4

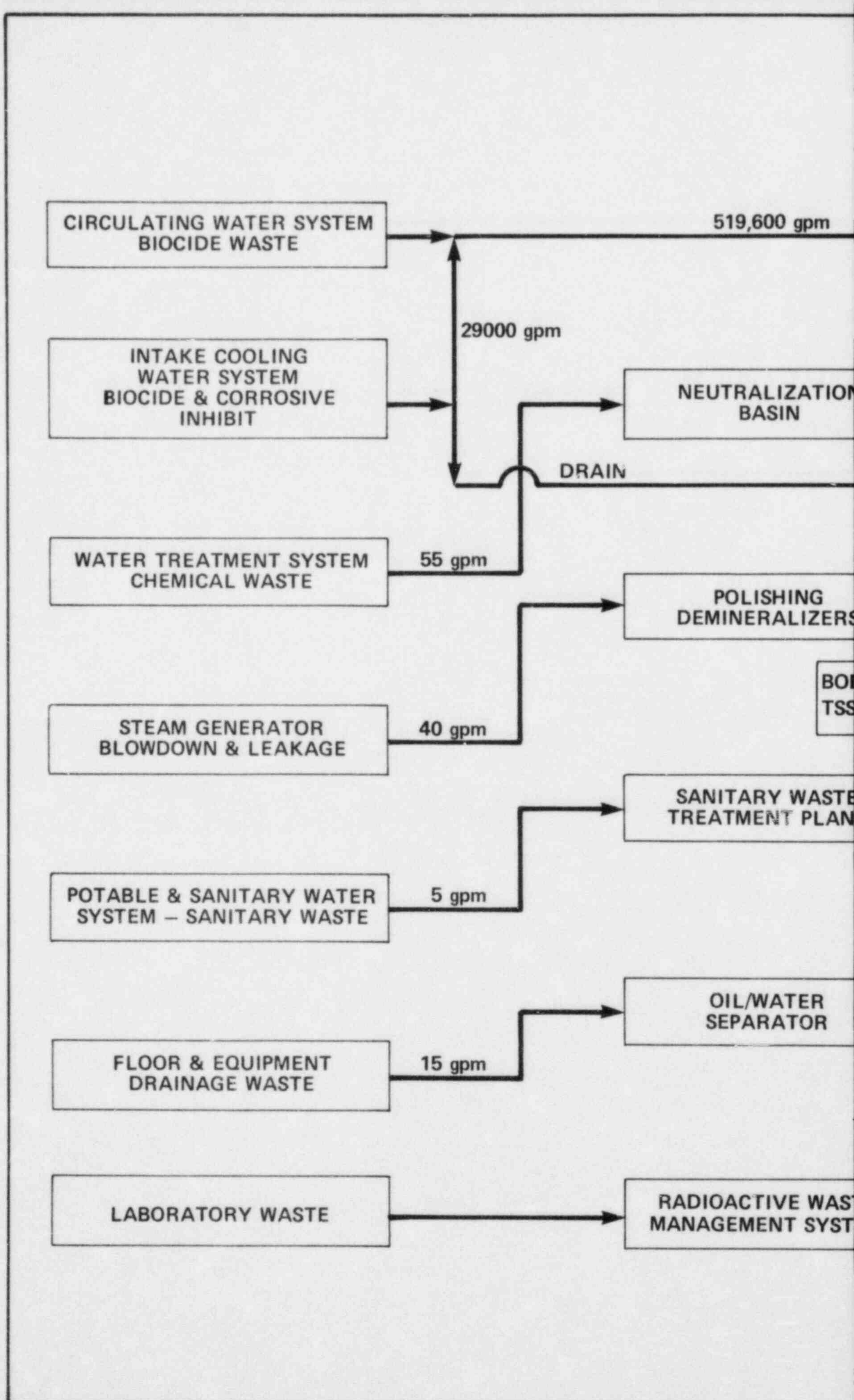
COMPOSITION OF TITANIUM TUBES

Element	Percent
Titanium	99.0
Nitrogen	0.03
Carbon	0.10
Hydrogen	0.02
Iron	0.30
Oxygen	0.25
Other, Total	0.30-0.40

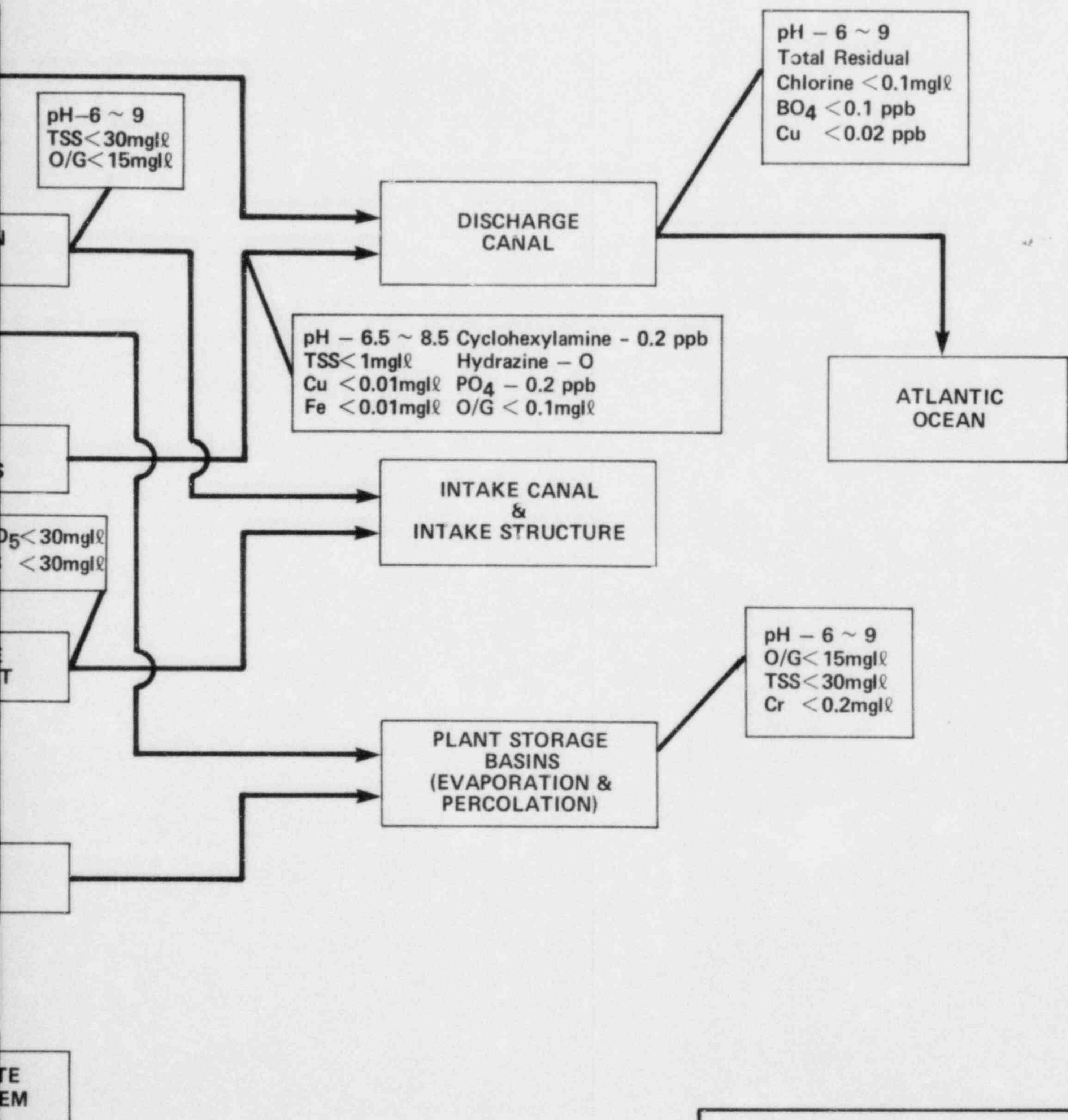
TABLE 3.6-5

COMPOSITION OF TUBE SHEET

Element	Percent
Copper	88-92.5
Aluminum	6.0-8.0
Iron	1.5-3.5
Manganese, max	1.0
Zinc, max	0.2
Lead, max	0.01
Phosphorous, max	0.015



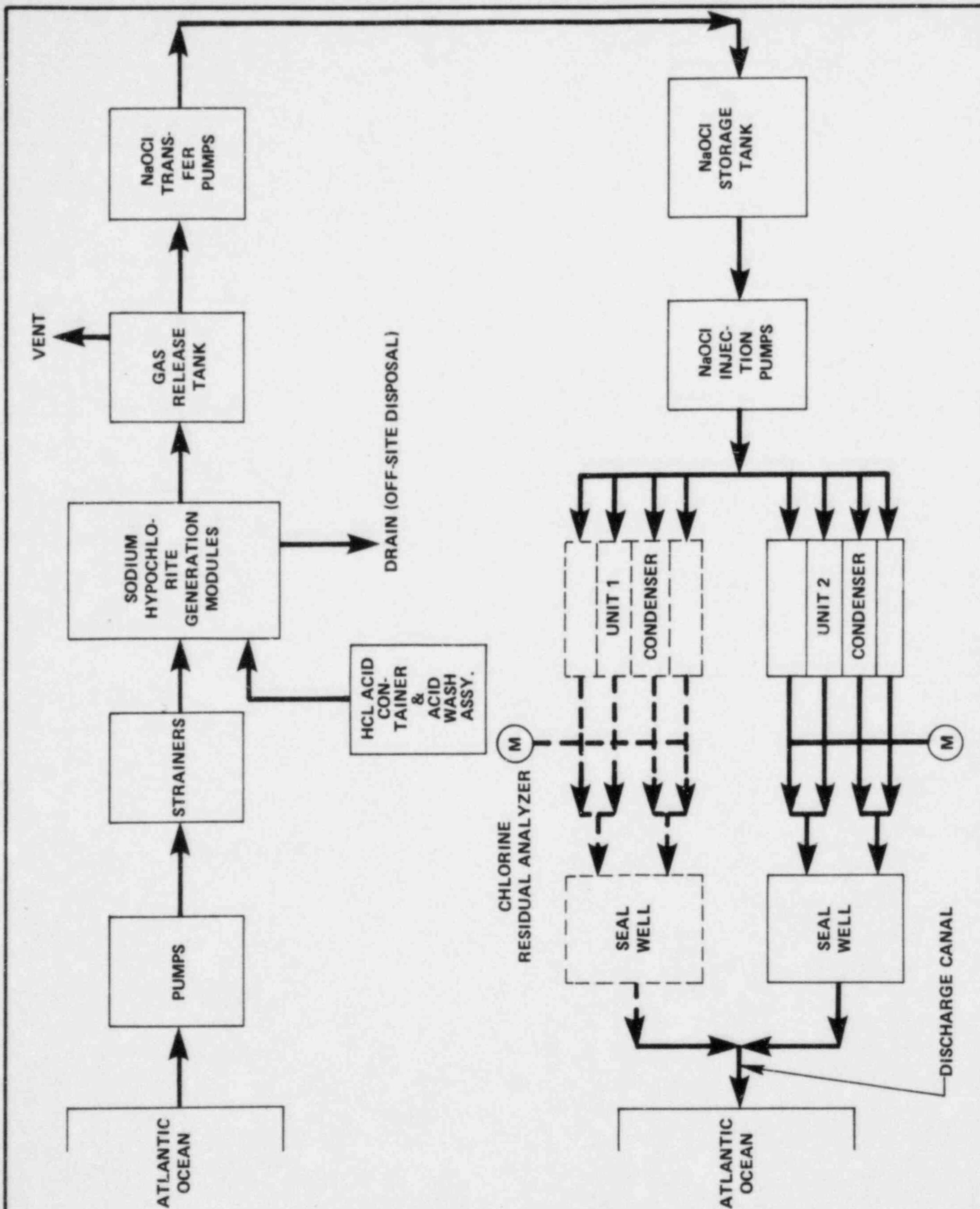
CIRCULATING WATER SYSTEM BIOCIDE WASTE
519,600 gpm
29000 gpm
INTAKE COOLING WATER SYSTEM BIOCIDE & CORROSIVE INHIBIT
NEUTRALIZATIO
BASIN
DRAIN
WATER TREATMENT SYSTEM CHEMICAL WASTE
55 gpm
POLISHING
DEMINERALIZER
STEAM GENERATOR BLOWDOWN & LEAKAGE
40 gpm
SANITARY WASTE
TREATMENT PLAN
POTABLE & SANITARY WATER SYSTEM – SANITARY WASTE
5 gpm
OIL/WATER SEPARATOR
FLOOR & EQUIPMENT DRAINAGE WASTE
15 gpm
LABORATORY WASTE
RADIOACTIVE WAS
MANAGEMENT SYS



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

CHEMICAL & BIOCIDE WASTES
EFFLUENT QUANTITY & QUALITY

FIGURE 3.6–1



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

SODIUM HYPOCHLORITE GENERATION & INJECTION SYSTEM

FIGURE 3.6–2

3.7 SANITARY AND OTHER WASTE SYSTEMS

3.7.1 INTRODUCTION

This section describes the sanitary waste, intake travelling screen wash and storm water drainage systems. In addition, the gaseous wastes from diesel engines and sodium hypochlorite generators are discussed in this section. Potentially radioactive wastes, chemical laboratory wastes, and laundry wastes are discussed in Section 3.5.

3.7.2 SANITARY WASTE SYSTEM

A factory-fabricated extended-aeration sanitary treatment plant is installed to treat the sanitary wastes from both St Lucie Units 1 and 2. The sanitary wastes originate from restrooms, shower facilities and miscellaneous sources located throughout the plant. The St Lucie Unit 2 sanitary wastes flow by gravity into the lift station located at the northwest corner, outside the St Lucie Unit 2 reactor auxiliary building. The collected wastes are then pumped to the sanitary manhole located at the northwest corner outside the St Lucie Unit 1 reactor auxiliary building. From there, the combined sanitary wastes from both units flow to the sanitary treatment plant for treatment and disposal. The treatment plant is located at an area northwest of the intake structure and immediately west of the water treatment system (Figure 2.1-4).

The characteristics of the sanitary waste, the design of the lift station and the treatment plant are described in the following subsections.

3.7.2.1 Characteristics of Sanitary Waste

The sanitary treatment plant is designed to handle 17,000 gallons/day and 34 lb five-day biochemical oxygen demand (BOD_5)/day of raw sanitary waste from St Lucie Units 1 and 2. This is based on plant staff of 340 persons for both units, a waste generation rate of 50 gallons/capita/day and a BOD_5 load of 0.10 lbs/capita/day. This loading corresponds to a BOD_5 concentration of 240 mg/l. The waste is typical sanitary waste containing a high concentration of suspended solids (approximately 240 mg/l) and a low concentration of dissolved oxygen.

3.7.2.2 St Lucie Unit 2 Sanitary Waste Lift Station

The St Lucie Unit 2 sanitary waste lift station is four ft in diameter and eight ft deep with a volume of 752 gallons. This station is equipped with a 30 gpm duplex expelsor pneumatic ejector pumping system for transferring the St Lucie Unit 2 sanitary wastes to the treatment plant via the St Lucie Unit 1 sanitary waste collection system.

3.7.2.3 Sanitary Waste Treatment Plant

Figure 3.7-1 shows the flow diagram of the sanitary treatment plant. The plant is capable of achieving 90 to 95 percent removal of both BOD_5 and suspended solids from the sanitary wastes. Details of the various unit operations and processes at the treatment plant are given below:

a) Comminutor and Bypass Screen - Sanitary wastes enter the influent box of the treatment plant where the solids in the wastes is cut by the comminuter to facilitate subsequent treatment processes. To permit continuing treatment during a temporary malfunction or routine maintenance of the comminutor, a bypass channel equipped with a bar screen is also provided.

b) Surge Tank - The comminuted waste flows by gravity into a 1825 gallon surge tank which serves as an equalization tank to minimize the fluctuation of raw wastewater entering into the treatment plant. The surge tank is aerated continuously to prevent solids from settling to the bottom of the tank and becoming septic. Air is provided through a diffuser at a rate of eight cfm. From the surge tank wastes are transferred to the flow regulator box by two vertical submersible pumps, each with a capacity of 70 gpm and a total dynamic head (TDH) of 17.5 ft.

c) Flow Regulator Box - The flow regulator box regulates the inflow by routing a controlled volume through a V-notch weir to the aeration tank, and returning excess flow to the surge tank. The minimum regulating condition corresponds to one pump operation at low surge tank level processing 75 percent average daily flow or 12,750 gpd and the maximum regulating condition corresponds to two pumps operating at high surge tank level to treat up to 150 percent average daily flow or 25,500 gpd.

d) Aeration - The extended aeration process is carried out in a series of four precast reinforced concrete tanks with a total capacity of 17,000 gallons. These tanks provide a total detention time of 24 hours which was calculated based on a raw waste flow of 17,000 gallons/day. For the maximum waste loading conditions (i.e., 50 lb BOD_5/day and 25,000 gpd) the air requirement for the aeration and end roll is estimated to be 90 cfm based on 2600 cfm/lb of BOD_5. The dissolved oxygen level in the aeration tanks is maintained at a maximum of two mg/l.

Two blowers are installed in the treatment plant. Normally, one blower (the other standby) supplies 111 cfm at 4.5 psig to satisfy all air requirements for aeration tanks, aerobic digester, surge tank, and air lift eductors and skimmer of the treatment plant.

During the extended aeration process, biodegradable material is oxidized and the process operates in the endogenous respiration phase. In this operation, the aeration tanks receive activated sludge from the settling tank by an automatic air lift eductor so that a mixed liquor suspended solid (MLSS) concentration of 3,000 to 5,000 mg/l is maintained. When the MLSS concentration exceeds 5,000 mg/l, some of the activated sludge is wasted to the aerobic digester for digestion.

The aeration tanks are also equipped with spray nozzles for froth suppression. A submersible pump in the settling tank with a capacity of 32 gpm at a TDH of ten ft supplies spray water.

e) Final Settling - The mixed liquor from the aeration tanks is discharged into the settling tank where it is retained under quiescent conditions for about 4.35 hours, based on an average raw waste flow of 17,000 gallons/day. The effective capacity of the settling tank is 3,082 gallons with a surface settling rate of 193 gpd/ft^2 for average daily flow. The activated sludge that settles to the bottom is then returned to the aeration tanks, as described previously. The overflow (effluent) from the settling tank then flows to the chlorine contact tank for disinfection. A scum removal system is also installed in the settling tank to return the scum by air lift surface skimming to the surge tank for reprocessing.

f) Chlorination and Discharge - The effluent from the settling tank is disinfected by injecting sodium hypochlorite solution from a 2,199 gallon chlorine contact tank for a contact time of 124 minutes based on a maximum flow of 25,500 gallons per day. The chlorination system consists of a hypochlorinator with a 30-gallon PVC container. The maximum dosing capacity of the hypochlorinator is 32 gallons per day at 50 psi. The chlorinated effluent, which has a free residual chlorine concentration of 1.0 to 1.5 mg/l, is measured by a flow meter and discharged by gravity to the intake canal. The average concentrations of BOD_5 or suspended solids in the discharged effluent will not exceed 30 mg/l.

g) Sludge Treatment and Disposal - Excess activated sludge that is wasted from the settling tank to the aerobic digester (2,660 gallons) is retained and aerated for about 15 days for digestion and stabilization of the biodegradable material. Air at about seven cfm is supplied to maintain the dissolved oxygen at one to two mg/l at all times in the digester. The supernatant liquor is returned to the aeration tanks while the digested sludge in the bottom is removed for off-site disposal.

3.7.3 INTAKE TRAVELLING SCREEN WASH WATER

Two 1060 gpm capacity travelling screen wash pumps located at the St Lucie Unit 2 intake structure withdraw ocean water for screen cleaning. One pump (the other standby) is normally in operation for two hours per day, resulting in an average daily wash flow of 90 gpm. The wash water is returned to the intake canal through a collection sump and drain system. If the collection sump and drain system are clogged, the wash water overflows to the storm water drainage system. (The ocean water quality is discussed in Section 2.4.) The trash collected in the sump is manually removed and disposed of as solid waste.

3.7.4 STORM WATER DRAINAGE SYSTEM

The storm water drainage system collects (1) drainage from building roofs and yards, (2) occasional overflow from the intake travelling screen wash water, and (3) floor drainage wastes. The quantity and quality of the intake travelling screen wash water and floor drainage wastes are discussed in Section 3.7.3 and 3.6.7, respectively.

Wastes from the storm water drainage system are discharged into the two storm water basins for evaporation and percolation. These two basins are designed for a rainfall intensity of six inches per hour, corresponding to the recorded maximum one-hour rainfall in the western part of the West Palm Beach area. The design storm runoff from St Lucie Unit 2 was estimated to be 40 cfs. An overflow basin located south of the two basins provides additional capacity for excess storm runoff.

The storm runoff from building roofs and yards contains some suspended solids, but is generally not affected by plant operation activities. The suspended solids will eventually be settled out in the storm water basins and/or the overflow basin.

3.7.5 GASEOUS WASTES

Since St Lucie Unit 2 is a nuclear power plant, there is no continuous release of combustion products to the atmosphere during normal operation. There are, however, two kinds of gaseous wastes, as discussed below, released to the atmosphere intermittently.

3.7.5.1 Diesel Generator Gaseous Waste

Two diesel generator sets, each of which has the capability to supply power for a safe shutdown of St Lucie Unit 2 will be ocassionally operated. Each set consists of two engines, one with 12 cylinders and the other with 16 cylinders.

Emissions tests were performed by the diesel generator manufacturer. Operating at 100 percent load each engine set requires a maximum of 273 gallons of No. 2 diesel fuel oil per hour. The principal combustion products and effluent release rates for each diesel generator set are presented in Table 3.7-1. Since the diesel generator sets will be used only in the event of a loss of normal ac power, their frequency of service is limited to periodic testing of about one hour duration on a semi-monthly basis.

Combustion products from the two generator sets are discharged from vents located in the roof of the diesel generator building. Because of the infrequent operation of the generators, the amount of effluents released annually is insignificant.

3.7.5.2 Hypochlorite Generator Gaseous Waste

During the production of sodium hypochlorite by electrolysis of seawater, hydrogen gas is generated as a waste product. The hypochlorite generators operate approximately 12 hours per day. Approximately ten cfm of H_2 gas are produced by the generation of sodium hypochlorite solution, which is used to chlorinate the condensers of St Lucie Units 1 and 2 (Section 3.6).

The hydrogen produced during hypochlorite generation is diluted with ambient air to less than the combustible level. This diluted gas is discharged to the atmosphere through a vent equipped with a flame arrestor.

TABLE 3.7-1

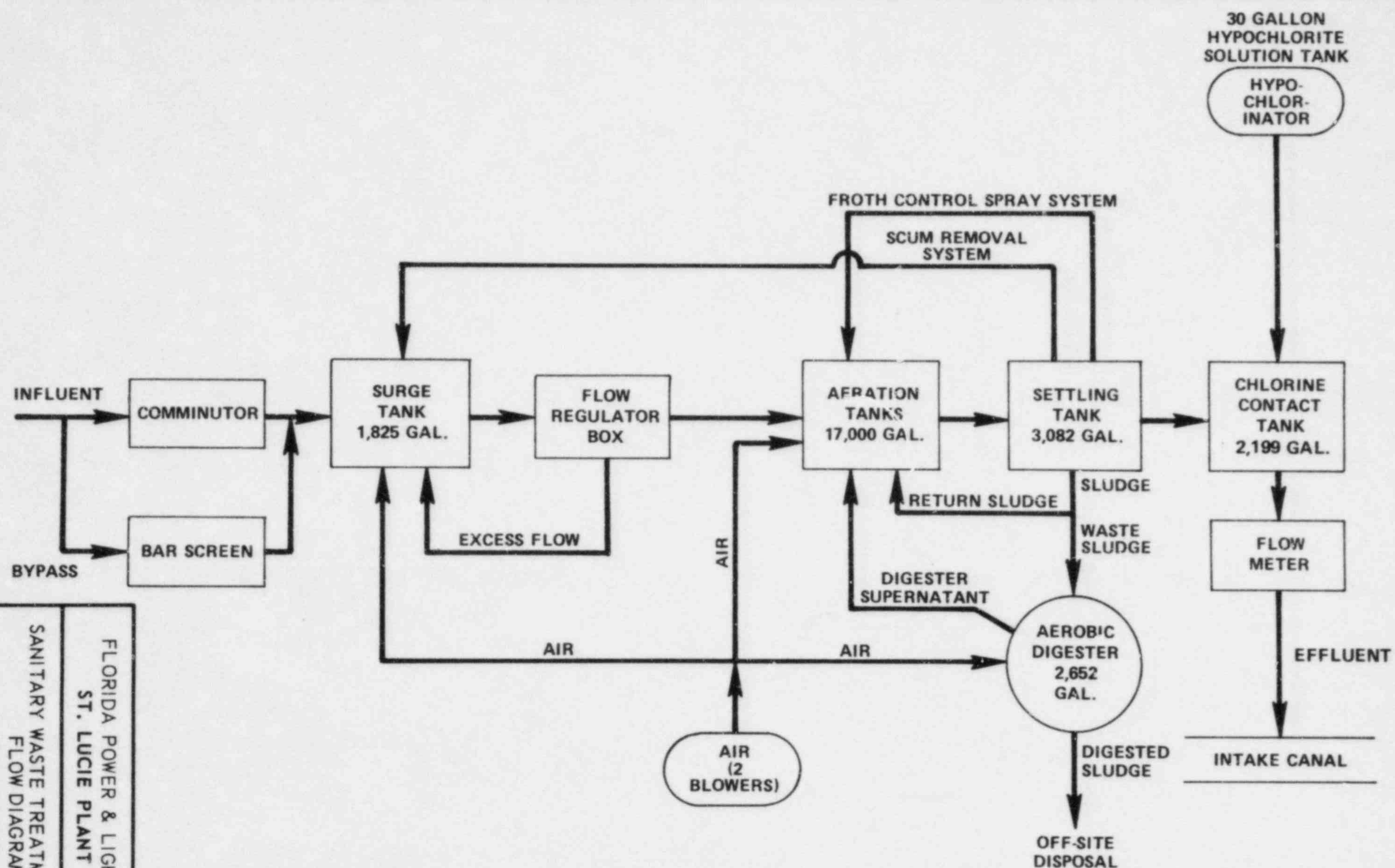
PRINCIPAL COMBUSTION PRODUCTS AND EFFLUENT RELEASE RATES OF A DIESEL GENERATOR SET

Combustion Product	Average Emission Factor ($lbs/10^3$ gal)	Emmissions per Generator Set (lbs/hr)
Particulates[(2)]	25	6.8
Sulfur oxides (as SO_2)[(1)]	64	17.5
Carbon monoxide	54	14.8
Hydrocarbons	14	3.9
Nitrogen oxides (as NO_2)	531	145.0
Aldehydes (as HCHO)[(2)]	5.5	1.5
Organic acids[(2)]	7	1.9

Source: Tests conducted on each generator set by manufacturer - Power Systems Division of Morrison-Knudsen Company, Inc. except otherwise noted.

(1) Based upon a 0.44 percent sulfur fuel oil.

(2) Taken from Table 3.2.2-1 of EPA's Publication AP-42, "Compilation of Air Pollutant Emission Factors," 1976.



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

SANITARY WASTE TREATMENT PLANT
FLOW DIAGRAM
FIGURE 3.7–1

3.8 REPORTING RADIOACTIVE MATERIAL MOVEMENT

The transportation of radioactive materials to and from St Lucie Unit 2 has been described in the St Lucie Unit 2 Environmental Report - Construction Permit and the Final Environmental Statement Related to Construction of St Lucie Unit 2.

3.9 TRANSMISSION FACILITIES

Florida Power & Light Company installed three 240 kV circuits for the transmission system during construction of St Lucie Unit 1, as described in the St Lucie Unit 2 Environmental Report - Construction Permit. Each of the three circuits is capable of carrying full load for one unit. Therefore, the construction and operation of St Lucie Unit 2 require no additional facilities for the transmission system.

EFFECTS OF CONSTRUCTION

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4.1 SITE PREPARATION AND PLANT CONSTRUCTION

The intent of this section is to address those areas where changes from the St Lucie Unit 2 Environmental Report - Construction Permit have occurred. These changes reflect differences in the St Lucie Unit 2 design and the availability of new information, as requested in USNRC Regulatory Guide 4.2, Revision 2.

4.1.1 CONSTRUCTION SCHEDULE

Major construction activities involving excavation, dredging, backfilling and disposal of spoil for St Lucie Unit 2 are scheduled to be completed by early 1981.

4.1.2 DESCRIPTION OF SITE PREPARATION AND CONSTRUCTION

The St Lucie site was initially conceived as a two unit site, and the majority of site excavation and dredging activities were completed during construction of St Lucie Unit 1, as discussed in the St Lucie Unit 2 Environmental Report - Construction Permit. The locations of various buildings and facilities are shown in Figure 4.1-1.

Table 4.1-1 indicates that 300 acres, or about 27 percent of the 1132 acre site, have been affected by plant construction activities. Some additional land is disturbed during construction of the St Lucie Unit 2 discharge pipeline and diffuser (Section 3.4 describes the discharge system). Approximately three acres of vegetation, primarily red mangrove, are removed at the eastern end of the discharge canal for excavation and installation of a headwall required for the St Lucie Unit 2 discharge pipeline. Figure 4.1-2 shows the location of this excavation. In addition, approximately 14 acres of ocean floor are excavated for installation of the discharge pipeline and diffuser. The impacts of these construction activities are discussed in Sections 4.1.3.2 and 4.1.3.3.

There is no intention on the part of any party or parties (including FP&L) to flood and drain this area for mosquito control, as stated in the St Lucie Unit 2 Environmental Report - Construction Permit. Mosquito control is the responsibility of the St Lucie County Mosquito Control District, and is performed by spraying.

4.1.3 EFFECTS OF SITE PREPARATION AND CONSTRUCTION

4.1.3.1 Impact of Construction Force

Impacts of construction worker immigration on the communities near the St Lucie site are expected to be low, for the following reasons:

- 85 percent of the construction work force is locally recruited, thus a relatively small percentage would move into the area.
- Many persons employed for St Lucie Unit 1 construction remained in the area to participate in St Lucie Unit 2 construction. This continuous construction program would have stabilizing effects on the economies and population in nearby communities.

- Calculations were made to estimate the actual number of persons who would move into the area for the construction period. These were compared to county data projected for the same period to determine an order-of-magnitude estimate of possible effects from an influx of construction workers.

- Peak construction year = 1980

- Estimate of construction workers required for peak period = 2025

- Estimated number of workers who would immigrate for peak period employment (15 percent of 2025) = 304

These 304 workers were then factored into groups by probable family size - e.g. single, man and wife, parents with one child, parents with two children, etc. After factoring was completed, it was estimated that the immigrant construction work force would contribute an additional 706 persons to the area.

The projected 1980 population for Martin County and St Lucie County is 142,100 persons. The estimated increase of 706 persons, because of St Lucie Unit 2 construction, represents less than one percent of that projected 1980 population. Table 4.1-2 presents the projected annual work force required for construction of St Lucie Unit 2.

4.1.3.2 Effects on Terrestrial Vegetation and Wildlife

Two St Lucie Unit 2 new construction activities requiring land not previously cleared during site preparation have been initiated. The existing canal is extended to accommodate a second headwall, and a second discharge pipeline is installed.

Extension of the existing discharge canal (Figure 4.1-2) preempts approximately three acres of red mangrove (Rhizophora mangle) swamp and less than an acre of saw palmetto (Serenoa repens) and Australian pine (Casuarina sp). This represents less than one percent of the mangrove swamp occurring within one mile of St Lucie Unit 2 (Figure 2.2-1), and less than ten percent of the mangroves between the intake and discharge canal.

The excavated area is dominated by red mangrove and white mangrove (Laguncularia racemosa), with few black mangrove (Avicennia germinans) present. The thin transition zone between mangrove swamp and scrub vegetation (saw palmetto and Australian pine) is similar to other swamp edges on site (Section 2.2.1). A single plant of Acrostichum aurium, a species included on the Florida Official List of Threatened Plants (effective July 1, 1978), was found in this area. However, this species was observed in similar habitat north of the discharge canal, east of State Route AlA. In addition, a few specimens were observed immediately south of Big Mud Creek, just west of State Route AlA. Two other plant species included on the Florida List which may inhabit mangrove swamps or swamp edge on Hutchinson Island, are Tillandsia fasciculata (endangered) and Annona glabra (threatened).

Verbena maritima grows in several clumps along the roadside edge of the saw palmetto stand to be cleared for headwall construction. This species is endemic to south Florida, and has been proposed by the U.S. Fish and Wildlife Service for status as threatened. Because of its widespread occurrence on site and apparent preference for disturbed, open habitat, such as roadside, loss of individual plants due to headwall construction should not significantly affect the local distribution and abundance of this species.

Many bird species derive food or cover from mangrove swamps, particularly when the latter are linked to upland watersheds and marine/estuarine systems. The most important species conceivably affected by discharge canal extension and ensuing habitat loss is the Wood Stork. Other species which may also utilize this habitat type on Hutchinson Island include wading birds such as the Great Egret, Louisiana Heron, White Ibis and Green Heron. No evidence (old nests and remnant eggshells) of on-site breeding activity of these species was observed.

The present mangrove stands are hydrologically isolated from marine systems due to trenching and diking employed in the past as mosquito control measures. Absence of tidal exchange essentially prevents nutrient export to marine communities and may decrease food resources for avifauna (Section 2.2.1). This factor, the small acreage requirements for canal extension, and apparent absence of bird nesting activity decrease the probability of vegetation removal, resulting in measurable changes of faunal richness of site locale.

In addition to vegetation clearing, canal excavation requires dewatering and earth removal. These activities may stress the adjacent remaining 45 acres of mangrove community through reducing productivity of swamp water biota, or smothering with sediments the upper portions of mangrove prop roots through which oxygen is absorbed. These effects are minimized through adoption of appropriate construction techniques. Temporary dikes or other means minimize drainage of water from adjacent areas, and restrict escape of sediment-carrying water into these areas. Dewatering effluent is discharged to the existing discharge canal. Slash and excavated material not utilized for diking are transported to the fill/borrow area west of State Route A1A.

Installation of the St Lucie Unit 2 discharge pipeline involves excavating a strip of dune vegetation and sand less than 100 feet wide. Vegetation in this area is characterized by extensive stands of saw palmetto and Spanish bayonet (Yucca aloifolia) (Table 2.2-3). Dune flora is important for its role in soil stabilization, and because it includes an assemblage of uncommon species of tropical affinity. Scaevola plumieri, a tropical species which may occur on beaches and dunes of Hutchinson Island, is listed as threatened by the state.

The same procedures utilized for construction of the St Lucie Unit 1 discharge pipeline through the dune are being implemented during installation of the St Lucie Unit 2 pipeline. A temporary berm is established, using material excavated for canal extension, to protect the 100 foot area during breaching of the dune. The temporary structure connects the natural dune at two points either side of the breached area, thus forming an arc around the latter. After pipeline installation is completed and contours have been restored to preconstruction conditions, areas cleared of vegetation will be replanted with native dune-stabilizing species.

As discussed during the SL-2 Environmental Report - Construction Permit stage, construction of the discharge pipeline affects turtle nesting patterns, egg development and hatchling movement during the period of beach activity.

Offshore, the highly motile turtles will probably avoid the immediate area of construction activity. Sampling areas 4 and 5 have had similar populations and nesting trends during all surveys except during 1975 (Figure 2.2-3) when area 4 had approximately one half the nests found in area 5 (See Section 2.2.1). Turtles that avoided area 4 due to construction activities have been considered to have nested elsewhere on the island. In the event these turtles did not nest elsewhere the estimated loss was about 58 percent (99 nests) of the projected nest potential for 1975[1]. This percentage reduction in nesting at area 4 might be expected during future construction. Nesting populations in areas 4 and 5 were about equal in 1977 indicating the construction effects on adult nesting patterns were temporary.

Beach surveillance and nest relocation to protected habitats will be instituted on those areas of beach potentially affected St Lucie Unit 2 construction activity. In 1975, a similar program was conducted with 12 nests removed from the dune construction area. During St Lucie Unit 2 construction, however, a larger area will be included in the relocation program in order to reduce the potential effects of compaction of nests and the influence of vibration and noise on turtle embryos (see also Section 6.1).

Coastal dunes and mangrove swamps provide storm protection to inland communities. In areas with a one percent chance of inundation in any one year, Executive Order 11988 (May 24, 1977) directs Federal agencies to consider possible effects of development on the capacity of a floodplain to endure and retard flooding impacts. The effects of discharge canal extension and pipeline installation on swamps and dunes of the St Lucie site have been avoided or minimized to the extent practicable. Efforts to minimize construction effects are cited above and include: temporary diking to prevent adverse changes in water quality and quantity in uncleared, adjacent swamps; disposal of slash and excavated material west of the State Route A1A; transport of dewatering effluent to the existing discharge canal; temporary berm construction where the dune is breached; re-construction of original dune contours; and establishment of native dune-stabilizing plant species. There are no practicable alternative locations for the discharge canal extension.

4.1.3.3 Effects On Marine Biota

The St Lucie Unit 2 discharge pipeline and diffuser extend approximately 3000 ft offshore of Hutchinson Island, parallel to and south of the St Lucie Unit 1 discharge pipeline (Section 3.4). The following method has been selected for construction of the St Lucie Unit 2 discharge pipeline.

Construction will rely on partial sheet piling. The first (near-shore) 1000 ft would be sheet piled and the remaining 2000 ft would be excavated as an open trench which, in cross section, resembles a trapezoid, 280 ft wide at the surface; 23 ft wide at the bottom; and 26 ft deep. The work area would be surrounded with silt screens to control suspended solids within the area and meet State of Florida turbidity limits (50 Jackson Turbidity Units above background). The total surface area disturbed by construction is approximately 56,692 m^2 (14 acres), or less than one percent of ocean bottom within the 30-ft contour between St Lucie and Fort Pierce inlets.

During the period of construction, motile organisms will leave the area due to increased activity, turbulence, and turbidity. This is a temporary phenomenon; motile epifauna may leave areas of increased activity, and fish may swim in and out of the area as activity around the dredging barges changes. Given the available data, the area affected cannot be quantified nor can the possible reduction in density of motile organisms in the construction zone be estimated. However, the construction zone is not necessarily devoid of motile organisms at any given time. Conversely, the infauna, consisting of nonmotile organisms are passively displaced with sediments. Losses of these organisms can be estimated from core sample data, assuming 100 percent mortality. Benthic losses were calculated from mean density and mean biomass estimates from three years of operational monitoring at Stations 1 and 2, respectively, (Table 4.1-3).

The benthic community of the beach terrace (Station 1) is of low density (717 organisms/m^2, 2.9 grams biomass/m^2) and low diversity as compared to offshore stations (Stations 2, 3, 4, and 5) (see Appendix Table 2.2A-21) Relative abundances derived from benthic core samples (see Appendix Table 2.2A-23) indicate that the benthic community is dominated by annelids and arthropods at this station. Juveniles of the shrimp, <u>Trachypenaeus constrictus</u> (occasionally found in catches of commercial bait shrimp), are also found at Station 1. No other commercially important species have been found in significant numbers. Mortalities associated with the first 1000 feet of construction are estimated at 3.3×10^6 individuals, or 14 kg biomass.

Station 2 is considered representative of the shellhash zone which is affected by the distal 2000 ft of pipeline construction. Shellhash stations (Stations 2, 4, and 5) showed highest densities and diversity of all stations sampled (see Appendix Table 2.2A-21). Mean density calculated from Station 2 core samples collected in 1976-1978 was 17,006 organisms/m^2. Mean biomass was estimated at 23.2 grams/m^2. The only commercially important species which has been collected in significant numbers in the trough zone is <u>Trachypenaeus constrictus</u>. Estimated losses for the open trench area are 8.9×10^8 individuals or 1207 kg biomass.

Table 4.1-3 presents estimates of total benthic losses, over the entire length of the pipeline. The total loss of infauna is estimated to be 8.9×10^8 individuals or 1221 kg.

Substrate stabilization and recolonization following construction of St Lucie Unit 1 discharge pipeline is the basis for prediction of recovery following St Lucie Unit 2 discharge pipeline installation. In constructing the discharge pipeline for St Lucie Unit 1, sheet piling was used for the entire length (1100 ft). The sheet piling was removed upon completion of construction in the fall of 1975. Subsequent changes observed in samples collected at Station 1, an area near the construction, were considered to reflect construction effects.

The mean grain size of substrate samples collected at Station 1 through the first three quarters of 1976 was slightly lower than that of samples collected during the baseline studies conducted in 1971-1973 (Figure 4.1-3). The sorting coefficients of the substrate samples remained within the same range as measured during the baseline period. However, winter quarter (December 1976) samples differed significantly from baseline. These differences included a reduction of mean grain size and the presence of large shell debris. The shells were discolored, suggesting that the material was recently unburied. These differences may have arisen from St Lucie Unit 1 pipeline construction. The delayed observation of construction-related effects probably resulted from substrate mobility which is common to high-energy beaches; substrate is moved onshore during the summer months, and deposited offshore with storm-induced turbulence during winter months. The substrate samples collected at Station 1 were comparable to that of baseline samples, indicating that substrate patterns had stabilized in the year following the completion of construction.

Recolonization of the sediments began immediately following completion of St Lucie Unit 1 pipeline construction (see Figure 2.2-9). Organism density and diversity increased through the first quarter of 1977. The rapid recolonization, which continued through the winter months, is partially explained by the spawning patterns of benthic organisms at the site. The St Lucie area is semitropical and is populated by both temperate and tropical organisms. Individual tropical species spawn at different times throughout the year and a pattern of more or less continuous recruitment of tropical species is super-imposed on seasonal recruitment of temperate species.

Subsequent to this first quarter of 1977 and continuing through 1978, density and diversity of benthos in samples collected at Station 1 decreased. However, the annual mean density and diversity calculated were greater than the same values derived from 1976 samples.

These observations indicate that substrate stabilization and recolonization in construction zone and adjacent areas were well established after one year following completion of construction of the St Lucie Unit 1 discharge pipeline. It is anticipated that substrate stabilization and recolonization, after St Lucie Unit 2 discharge pipeline construction, will follow a similar pattern because of the similarity of affected areas. The increased benthic diversity and density found at Station 2 could result in a more rapid recovery, particularly if post-construction surface substrates are returned to preconstruction conditions.

The use of silt screens during the construction of St Lucie Unit 2 discharge pipeline and the re-establishment of surface substrates to preconstruction condition during the backfill procedure mitigates impacts associated with construction. Based on evaluation of the effects of St Lucie Unit 1 pipeline construction, it is anticipated that the impacts associated with the construction of St Lucie Unit 2 discharge pipeline will be minimal and of a temporary nature.

SECTION 4.1: REFERENCES

1. Applied Biology, Inc., Ecological Monitoring at the Florida Power & Light Co., St Lucie Plant. Annual Report 1977, 1978.

TABLE 4.1-1

PLANT CONSTRUCTION LAND AREA REQUIREMENTS

Facility	Area in Acres
Plant Facilities (Units 1 & 2)	25
Switchyard (Units 1 & 2)	4
Transformers & Heat Exchangers	6
Cooling Water System Canals	
Intake (Units 1 & 2)	52
Discharge (Units 1 & 2)	20
Concrete; Storage & Fabrication	38
Fill Storage Area	16
Fill Borrow Area	80
Parking Facilities (Units 1 & 2)	15
Storm Drainage System (Units 1 & 2)	10
Road, Slopes and Dikes	34
Total	300

TABLE 4.1-2

ANNUAL AVERAGE WORK FORCE - ST LUCIE UNIT 2

Year	Number of Workers
1975	10
1976	175
1977	575
1978	1650
1979	1890
1980	2025
1981	1250
1982	750
1983	175

TABLE 4.1-3

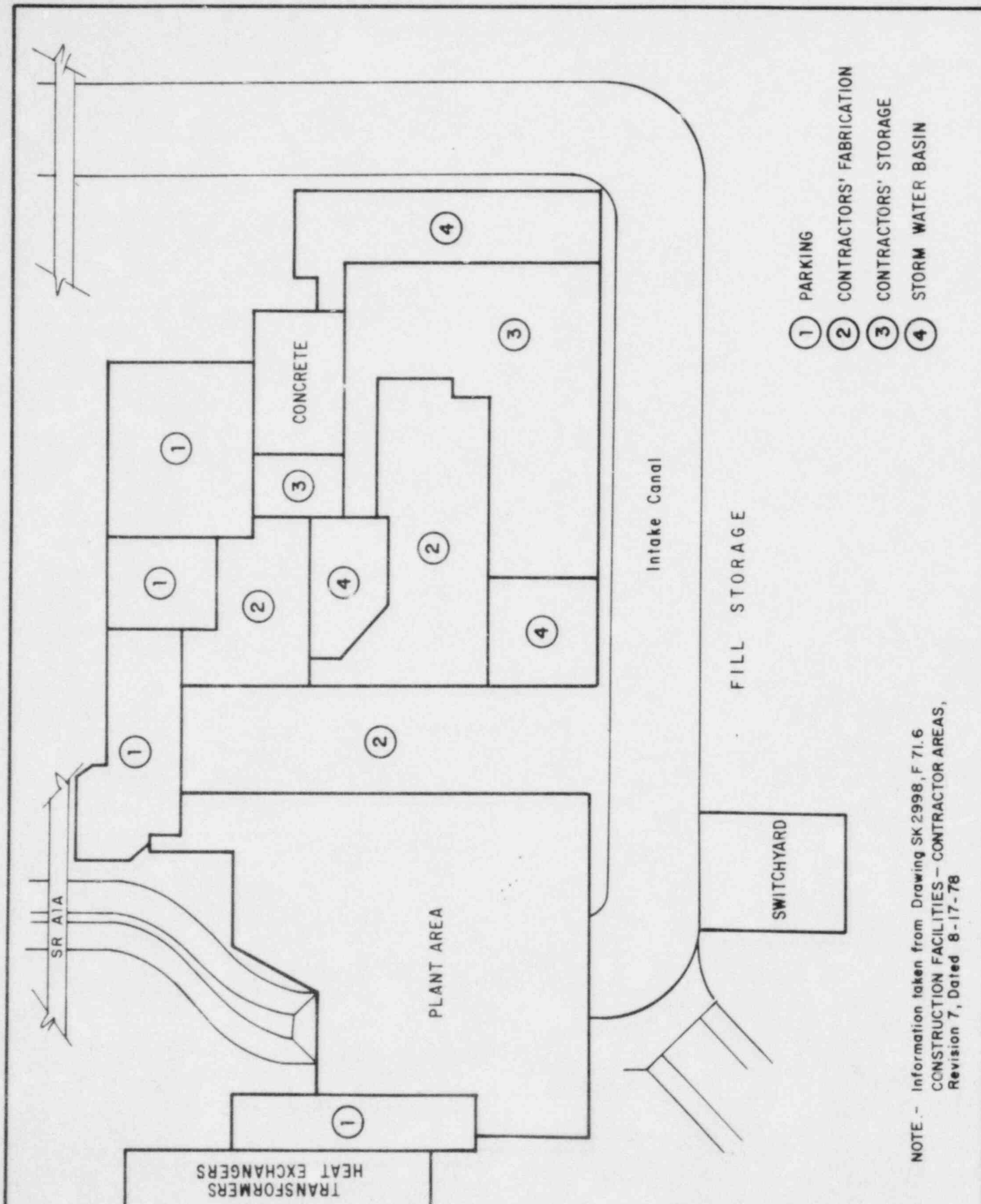
ESTIMATED LOSS OF BENTHIC FAUNA RESULTING FROM CONSTRUCTION OF ST LUCIE UNIT 2 DISCHARGE PIPELINE

	STATION 1	STATION 2
DENSITY OF BENTHIC ORGANISMS[1] (organisms/m^2)	717	17006
BIOMASS OF BENTHIC ORGANISMS[1] (g/m^2)	2.9	23.2

	SHORE TO 1000 FT (SHEET PILING)	1000 FT TO 3000 FT (OPEN TRENCH)	TOTAL EXCAVATION FOR ENTIRE PIPELINE
TOTAL AREA DISPLACED (m^2)	4647	52 045	56 692
TOTAL ORGANISMS DISPLACED[2]	3.3×10^6	8.9×10^8	8.9×10^8
TOTAL BIOMASS DISPLACED[2] (kg)	14	1207	1221

[1]Mean of 3-years' operational monitoring data (n=12)

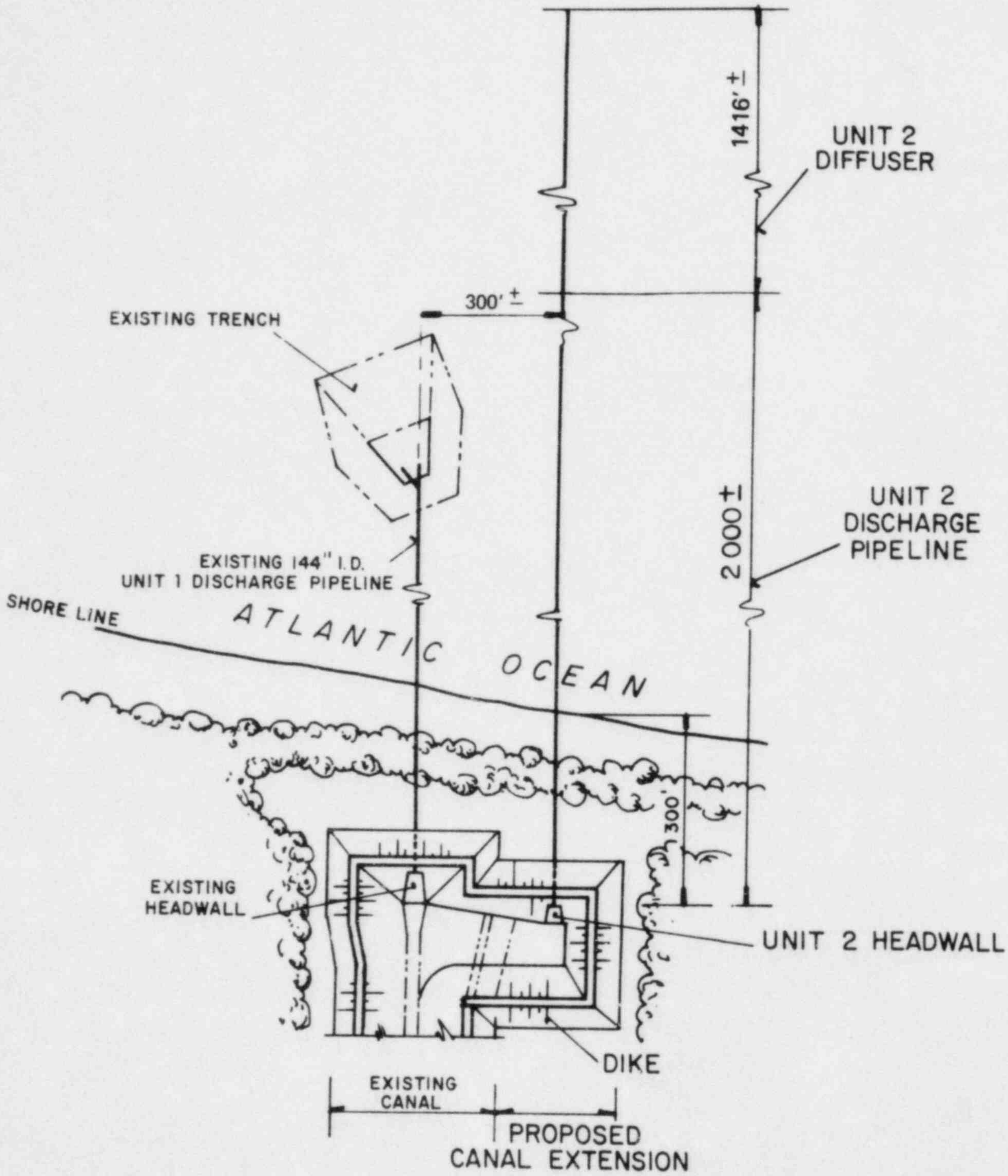
[2]Assumes 100% mortality of organisms in displaced substrate.



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

CONSTRUCTION FACILITIES

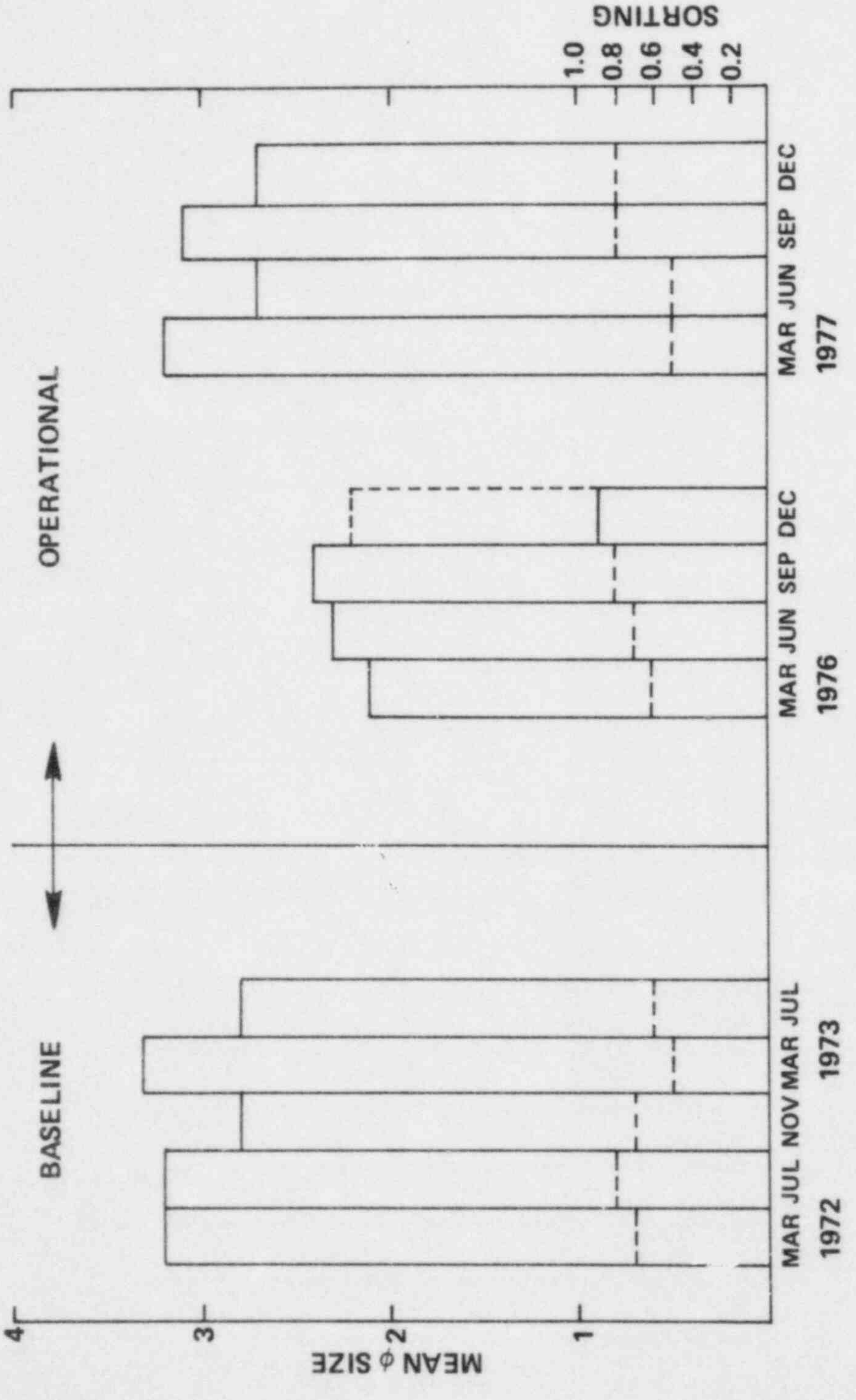
FIGURE 4.1-1



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

DISCHARGE CANAL EXTENSION

FIGURE 4.1-2



NOTE:
MEAN φ SIZES AND SORTING COEFFICIENTS OF PARTICLE-SIZE DISTRIBUTIONS FOR SEDIMENT SAMPLES TAKEN AT STATION 1 IN 1972-1973 AND 1976-1977, ST. LUCIE PLANT.

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

MEAN GRAIN SIZE OF
SUBTRATE SAMPLE
FIGURE 4.1-3

4.2 TRANSMISSION FACILITIES CONSTRUCTION

The switchyard and transmission facilities were designed and constructed to serve both St Lucie Units 1 and 2. As noted in the St Lucie Unit 2 Final Environmental Statement, Construction Permit Stage, "since there will be no additional transmission rights-of-way required for Unit 2, there will be no effect on agriculture or water producing savanna lands in the surrounding areas".

4.3 RESOURCES COMMITTED

Discussions of resources committed for the construction of St Lucie Unit 2 appear in Section 4.3 of the St Lucie Unit 2 Environmental Report - Construction Permit and Section 8.6 of the Final Environmental Statement. Additional resources committed for the extension of the discharge canal are identified in Section 4.1.3.2.

The use of three additional acres of land for extension of the discharge canal is not considered significant (see Section 4.1.3.2). The land committed for this use is irreversibly committed until such time as the plant is decommissioned, and the future use of the site has been determined.

4.4 RADIOACTIVITY

Section 12.4 of the FSAR provides an evaluation of the radiological dose to St Lucie Unit 2 construction workers from the operation of St Lucie Unit 1.

4.5 CONSTRUCTION IMPACT CONTROL PROGRAM

The major environmental effects of St Lucie Unit 2 site preparation and construction are described in Section 4.1.

Florida Power & Light Company's commitments to minimize the environmental impacts of construction are summarized in Section 4.5 of the St Lucie Unit 2 Final Environmental Statement, the St Lucie Unit 1 NPDES Permit[1], and are further detailed in the St Lucie Unit 2 Construction Permit. FP&L's Environmental Protection Control Program, effective June 16, 1977, is given in Appendix 4.5A.

Final plans for landscape restoration have not been completed. However, plants compatible with natural vegetation consisting largely of indigenous species will be installed.

SECTION 4.5: REFERENCES

1. Florida Power and Light Company, St Lucie Unit 1 NPDES Permit No. FLO 0002208, issued by U.S. Environmental Protection Agency, June 14, 1978.

APPENDIX 4.5A

FLORIDA POWER & LIGHT COMPANY	ST. LUCIE PROCEDURES MANUAL ST. LUCIE PLANT – UNIT II 800 MWe EXTENSION	No. SQP-15
		Rev. 0
	SITE QUALITY PROCEDURE ENVIRONMENTAL PROTECTION CONTROL	Date 1/17/79
		Page 1 of 9

1.0 PURPOSE

1.1 The Environmental Protection Control Procedure is established to define and implement construction practices that will assure minimal environmental impact on the St. Lucie Construction Site and adjacent areas.

2.0 SCOPE

2.1 The Procedure describes definitive areas of construction activities which may affect the environment, and addresses the particulars of surveillance. Specifically, it responds to the following control areas:

2.1.1 Land Clearing and Excavations.

2.1.2 Dredging and Placement of Spoil and Fill.

2.1.3 Site Dewatering

2.1.4 Area Surface Drainage

2.1.5 Chemical Waste

2.1.6 Sanitary Waste

2.1.7 Solid Waste

2.1.8 Vehicular Movements.

2.1.9 Fugitive Dust

2.1.10 Noise Control

2.1.11 Exterior Lighting

2.1.12 Surveillance and Reporting

2.1.13 Corrective Actions

2.1.14 Contract Requirements

2.1.15 Orientation and Training Program

3.0 REFERENCES

3.1 Florida Power & Light Company, St. Lucie Plant Unit #2 Environmental Report.

3.2 Florida Power & Light Company, St. Lucie Plant Unit #2 Preliminary Safety Analysis Report.

3.3 United States Atomic Energy Commission, Directorage of Licensing, Final Environmental Statement.

3.4 40 CFR Chapter 1, Subchapter N, Part 423 (Environmental Protection Agency).

3.5 Ebasco Dewatering Specification FLO-2998.472.

3.6 SQP-19, "Indoctrination and Training".

3.7 SQP-31, "General Instructions for Housekeeping During Construction".

3.8 SQP-24, "Excavation and Backfill".

3.9 29 CFR, Part 1926, "Occupational Safety and Health Standards for the Construction Industry".

3.10 SK-2998-F-71.6.

3.11 Construction Permit - St. Lucie Plant Unit #2 No. C PPR 144.

4.0 ATTACHMENTS

4.1 None

5.0 DEFINITION OF TERMS

5.1 None

6.0 PREREQUISITES

6.1 None

7.0 RESPONSIBILITY

7.1 The Senior Resident Engineer is responsible for assuring compliance with the Environmental Protection Control Program and will report monthly on the status of the program to the Site Manager and to the Manager of Florida Power & Light Environmental Engineering.

7.2 The Area Director has the general responsibility for performing all construction activities in accordance with the requirements of this Procedure.

7.3 The Environmental Control Engineer is responsible for monitoring and documenting all construction activities which directly or potentially may affect the environment of the Construction Site and adjacent areas. He shall report all environmental problems arising from construction activities to the Senior Resident Engineer, and document the data as well as the recommendations for resolution in a Daily Log.

8.0 PROCEDURE

8.1 Land Clearing and Excavations

8.1.1 Clearing of live foliage in Unit #2 areas was essentially completed during construction of Unit #1. No additional clearing is scheduled for Unit #2, but if any minimal clearing should be required, such activities shall be approved by the Senior Resident Engineer and the Environmental Control Engineer.

8.1.2 Excavations for Unit #2 structures will be performed inside cofferdams, or in such a manner that slope erosion is minimized.

8.1.3 Disposal of excavated soil shall be in conformance with SQP-34. The Environmental Control Engineer shall periodically survey the soils storage site for adequacy of contouring and compaction, to minimize erosion.

8.1.4 During excavation activities for Unit #2 Circulating Water Discharge Conduit, dune protection from the elements shall be retained continuously.

8.1.5 Excavation and backfilling activities west of the natural dune for the Circulating Water Discharge Conduit shall be completed prior to constructing the temporary protective dune preceeding penetration to the waterline. Upon completion of all installations the natural dune will be restored and revegetated with indigenous foliage. The Environmental Control Engineer shall assess the natural dune restoration and revegetation program under the direction of the Environmental Department's Life Scientist to ensure that adequate protective requirements are met.

8.1.6 If the turtle nesting and hatching season coincides with excavation and other construction activities for the Circulating Water Discharge Conduit, the Environmental Control Engineer shall survey the area and assess the impact of this, and recommend to the Life Scientist the required action to minimize the effect on nesting or hatching populations.

8.2 Dredging and Placement of Spoil and Fill

8.2.1 Dredging activities associated with Unit #2 construction shall meet minimum Federal and State Water Quality Requirements.

8.2.2 Spoil from dredging activities shall be disposed of or stored on shore sites above high water level. All liquids must be disposed of in accordance with State and Federal Water Quality Requirements.

8.2.3 The Environmental Control Engineer shall be responsible for monitoring dredge and fill activities for compliance with State and Federal Water Quality Regulations.

8.3 Site Dewatering

8.3.1 The Dewatering System shall consist of a main system of deep wells augmented by localized systems, to lower the water table to required levels for construction.

8.3.2 The effluent from the entire Dewatering System shall be discharged either to the Circulating Water Intake Canal, or temporarily to an on-site settling basin. Quality of effluent discharged into the canal system shall meet minimum Federal and State Standards for Quality of Discharge Into Receiving Waters.

8.3.3 The Environmental Control Engineer shall monitor the discharging of dewatering effluent.

8.4 Area Surface Drainage

8.4.1 Unit #2 Plant Site yard drainage shall be directed to on-site settling, evaporation/percolation basins.

8.4.2 Concrete Batch Plant yard drainage shall be directed to a dead mangrove swamp south of the plant for percolation/evaporation. Truck wash-out shall be performed in an area designated for future fill, and liquid waste shall be disposed of via percolation/evaporation.

8.4.3 The on-site settling basins shall have emergency provisions for overflowing to the dead mangrove area south of the plant, for percolation/evaporation.

8.4.4 The Environmental Control Engineer shall be responsible for monitoring compliance with the required dispositions of drainage effluents.

8.5 Chemical Waste

8.5.1 Waste liquid fuel and lubricants accumulated from construction activities shall be deposited into or routed to tanks or containers for salvage or subsequent removal to appropriate off-site disposal locations.

8.5.2 Spent chemicals used in cleaning stainless steel or carbon steel components, or otherwise produced by construction activities, shall be routed to the settling basins south of the plant. Any overflow from the settling basins shall be discharged in the dead mangrove area south of the plant, to eventually percolate and/or evaporate.

8.5.3 The Environmental Control Engineer shall make routine inspections during cleaning activities to verify that chemical wastes are treated in accordance with the above procedures.

8.5.4 Chemical waste disposals shall conform with the requirements outlined in SQP-31.

8.6 Sanitary Waste

8.6.1 Existing sanitary facilities utilized during Unit #1 construction shall be supplemented with additional portable equipment meeting the requirements of OSHA 29 CFR part 1926, as well as minimum State Sanitation Standards.

8.6.2 The supplementary portable sanitary facilities shall be serviced by Sub-Contractors who will remove the effluent and waste for off-site disposal.

8.6.3 The Environmental Control Engineer shall routinely inspect temporary sanitary facilities for conformances with State and Federal regulations.

8.7 Solid Waste

8.7.1 Construction scrap and debris shall be collected and deposited in designated on-site locations for salvage, incineration or burial, in accordance with SQP-31.

8.7.2 Waste paper, scrap wood, workmen's lunch leftovers and other non-toxic combustible materials shall be burned on-site. All burning will be conducted in compliance with State Open Burning Fire Regulations.

8.7.3 Ashes from incineration and other non-combustible solid waste shall be buried in the land fill area located on-site west of the plant.

8.7.4 Solid waste produced by concrete placement activities will be used as fill and covered with site grading materials.

8.7.5 The Environmental Control Engineer shall be responsible for monitoring the above procedures.

8.8 Vehicular Movement

8.8.1 Vehicular operations to and from the plant site shall be controlled by County Sheriff Deputies so as to minimize impact on local public roads in the vicinity of the Construction Site.

8.8.2 Traffic control measures shall be implemented and updated as required to control site vehicular traffic and assure safe operations in the vicinity of the Construction Site and minimize any effects it may have on the local environment.

8.8.3 Car pooling of construction employees will be encouraged continuously, to preserve fuel and minimize traffic loading on local public roads.

8.9 Fugitive Dust

8.9.1 The entrance roads, on-site roads, and parking lots, where practicable, shall be paved to reduce potential dust problems.

8.9.2 All non-paved, on-site roads shall be visually monitored daily by the Environmental Control Engineer. When warranted, excessive dust will be controlled by water spraying or other approved methods.

8.9.3 The Concrete Batch Plant shall be equipped with dust control systems as required by Regulatory Agencies.

8.9.4 Batch Plant cement shall be delivered by sealed tank trucks and unloaded by piping directly into totally enclosed storage bins.

8.9.5 Storage piles of sand and gravel shall be equipped with water spraying devices to minimize dust release.

8.9.6 The Environmental Control Engineer shall make visual observations daily of the Batch Plant during peak construction period to assure the above methods are being employed and to evaluate dust levels.

8.9.7 Dust levels shall be controlled by employing or upgrading the preceding methods.

8.10 Noise Control

8.10.1 Sound suppression devices shall be provided on all vehicles and machinery, and maintained in effective condition to meet minimum Local, State and Federal Requirements.

8.10.2 The Environmental Control Engineer shall monitor and document noise levels periodically at the Construction Site boundaries. During periods of peak noise-producing activities, these factors shall, when considered excessive, be brought to the attention of the Construction Superintendent, with recommendations for reducing the impact of high noise levels on the environment and its inhabitants.

8.11 Exterior Lighting

8.11.1 During the passages of storm fronts the Environmental Control Engineer shall monitor the daily weather forecasts, and be cognizant of prevailing weather patterns. He shall ascertain that elevated exterior lighting intensity is reduced to the minimum level required for safety and security, to protect disoriented wild-life inhabitants and transient fowl species during severe weather conditions.

8.11.2 Exterior elevated light fixtures shall be equipped with reflectors directed towards the ground, or with shields, to minimize the intensity of sky-glow, and thus reduce the possibility of disorientation of turtle hatchlings, or have other detrimental effects on local wild-life inhabitants.

8.11.3 During construction, the Environmental Control Engineer shall monitor the phenomenon of turtle egg hatching, and verify that necessary measures are taken to protect the natural evolution of the species at or adjacent to the Construction Site.

8.11.4 Existing foliage fringes on the Plant Site shall remain intact, and as soon as practical an Australian Pine or suitable indigenous plants "Light-Screen" shall be planted at the eastern limit of the site.

8.12 Surveillance and Reporting

8.12.1 Visual surveillance of all areas of active construction shall be conducted daily to assure compliance with this Procedure.

8.12.2 The Environmental Control Engineer shall provide or arrange for Field or Laboratory tests to document visual observations, when deemed necessary.

8.12.3 A Daily Log shall be maintained by, and on file with, the Environmental Control Engineer, documenting any construction activities which may influence the environment. The log shall contain data on final resolution of the problems encountered.

8.12.4 The Daily Log shall be available at any time to Management Personnel and such State or Federal Environmental Agencies as may be concerned. The log entries for preceding months shall be submitted to Quality Assurance Records on a periodic basis as determined by the Senior Resident Engineer.

8.12.5 The Environmental Control Engineer shall report all environmental matters to the Senior Resident Engineer and keep him up-to-date on any developments affecting the environment.

8.13 Corrective Actions

8.13.1 The Environmental Control Engineer shall be responsible for reporting to and coordinating and effecting acceptable solutions to environmental problems with the Senior Resident Engineer, the Area Directors and other supervisory personnel. Copies of correspondence and reports involving environmental problems will be submitted to the Site Manager, who in turn will submit copies to the Licensing and Environment Planning-Environmental Affairs (LEP-ENV Affairs) Department.

8.13.2 Methods utilized in the solution of environmental impact problems shall be adapted to meet minimum State and Federal Agency Requirements.

8.13.3 If an acceptable solution to the environmental problem cannot be found the Senior Resident Engineer shall notify the Site Manager and request an evaluation of the pertinent facts. The Site Manager shall contact the Licensing and Environment Planning-Environmental Affairs Departments, who may if required consult with the appropriate Local, State or Federal Agencies relative to the problem.

8.14 Orientation and Training

8.14.1 The Environmental Control Engineer shall establish environmental orientation criteria, and, in conjunction with the Training Coordinator, structure a suitable training program, in accordance with SQP-19.

9.0 INSPECTION

9.1 None

10.0 QUALITY ASSURANCE RECORDS

10.1 Upon completion, the following records shall be transmitted to the QA Record Center to be processed in accordance with QI 17 QAD 4.

RECORD NAME	TRANSMITTING RESPONSIBILITY
Daily Environmental Log Book Upon Completion of Each Volume	Environmental Engineer
Field or Laboratory Tests as Determined by the Senior Resident Engineer	Environmental Engineer

EFFECTS OF OPERATION

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5.1 EFFECTS OF OPERATION OF HEAT DISSIPATION SYSTEM

5.1.1 EFFLUENT LIMITATIONS AND WATER QUALITY STANDARDS

St Lucie Unit 2 is an existing unit pursuant to the Clean Water Act, because FP&L incurred substantial obligation and costs on or before March 4, 1974 for the purchase of facilities and/or equipment for St Lucie Unit 2. Federal thermal effluent limitations for existing electric generating facilities, as specified in 40CFR423, are currently being reviewed by EPA.

State of Florida rules and regulations pertaining to Water Quality Standards, Ch. 17-3 Florida Administrative Code (FAC), establish specific standards for thermal discharges into state waters (s. 17-3.05, Thermal Surface Water Criteria). Upon application on a case-by-case basis, the Florida Department of Pollution Control (now the Department of Environmental Regulation (DER) can establish a zone of mixing beyond the point of discharge to afford a reasonable opportunity for dilution and mixture of heated water discharges with the receiving water body.

The discharge from St Lucie Unit 2 will not affect the quality of the water of any other State.

5.1.2 PHYSICAL EFFECTS

5.1.2.1 Introduction

This section describes the characteristics of the St Lucie Unit 2 thermal plume, including the effects of the St Lucie Unit 1 thermal plume, when the two plumes interact. Thermal plume analyses for St Lucie Unit 2 were included in the St Lucie Unit 2 Environmental Report - Construction Permit. Since that document, the results of several studies have permitted optimization of diffuser design[1-7]. In addition, analyses of St Lucie Unit 1 discharge characteristics have been performed since 1973[8,9].

FP&L has also undertaken two bathymetric surveys: one by Continental Shelf Associates in 1972 and the other by Envirosphere in 1977 to define the bathymetry in the vicinity of St Lucie Units 1 and 2 discharges.

The original "alternating" St Lucie Unit 2 diffuser, details of which were presented in the St Lucie Unit 2 Environmental Report - Construction Permit, was optimized based on the thermal-hydraulic model studies[2-6]. The St Lucie Unit 2 diffuser is designed with 58 jet ports, each 16 inches in diameter. The length of the diffuser is 1368 ft, and the port spacing is 24 ft. The 16 ft diameter diffuser manifold was optimized with ports alternating on each side with each port oriented in an offshore direction at an angle of 25 degrees from the manifold centerline.

Results of recent studies at MIT[10], Alden Research laboratories[11], Acres Laboratory,[12] Argonne National Laboratory,[13] Caltech[14] and Iowa Institute of Hydraulic Research (II HR)[2] show that such "offshore angled" or "staged diffusers" are state-of-the-art and provide the most efficient means of dispersing heated water in semi-infinite coastal bodies of water. These studies show that such diffusers perform better under all current situations, unlike 90 degree "alternating" diffusers which show "good" performance only under high currents. Recent studies [10,13] also conclude that "offshore angled" or "staged" diffusers with net offshore momentum perform better than either alternating, coflowing, tee or oblique diffusers under different current situations. Table 5.1-1 summarizes the qualitative performance of various submerged diffusers in semi-infinite bodies of shallow water. St Lucie Units 1 and 2 discharge structures are described in Section 3.4.

5.1.2.2 Methodology

This section discusses the methodology used to select the appropriate modeling approach, describes the models utilized and presents predicted thermal plumes for St Lucie Unit 2 and the combined St Lucie Units 1 and 2 discharges.

5.1.2.2.1 Data Requirements

To predict thermal plume configurations resulting from the operation of St Lucie plant, both plant operating data and ambient oceanographic data are required.

5.1.2.2.1.1 Plant Operating Data

a) Plant Discharge Flow and Temperature Rise

The discharge flow consists primarily of condenser cooling water and intake cooling water flow. At 100 percent power output, the heat rejection rate of each unit is 6.4×10^9 Btu/hr; the rated discharge flow and condenser rise are 1160 cfs and 25^oF respectively.

However to ensure operating flexibility, discharge flows were computed assuming a heat rejection rate of 7×10^9 Btu/hr/unit for eight pump operation and discharge temperature rises of 32^oF and 28^oF. Plume computations were performed for seven different cases shown in Table 5.1-2 that envelope different flows, temperatures and heat discharge rates.

b) Discharge Canal Temperature

Discharge canal temperature, for the purpose of thermal plume evaluation, is obtained by adding the ambient ocean temperature to the temperature rise within the plant. In order to maximize the thermal plume characteristics (such that the impact can be assessed conservatively), the September maximum ocean temperature of 87^oF [15] was used in all cases. Resulting discharge canal temperature would either be 119^oF or 115^oF, reflecting a plant temperature rise of either 32^oF or 28^oF.

5.1.2.2.1.2 Oceanographic Data

a) Temperature and Salinity

Ocean temperature data were obtained from National Ocean Survey "Surface Water Temperature and Density" Publication 31-1, March 1973[15]. Monthly mean and maximum temperature data for the 1946-1962 period of record at Canova Beach, Florida, are used to represent ambient conditions at the St Lucie site. The monthly maximum temperature of 87°F for September is used for thermal plume analysis. Ocean salinity is specified as 35 ppt.

b) Ocean Bathymetry

For each case, an ocean depth corresponding to mean low water (MLW) was used for purposes of determining initial dilution. Based on the data available, an ocean depth of 23 ft at the St Lucie Unit 1 discharge and an average ocean depth of 35 ft at St Lucie Unit 2 discharge is used.

c) Currents

Current data used to determine surface plume temperatures and frequencies of occurrence of plume configurations are based on site specific measurements made during a 12 month period in 1974-1975[7]. These data were subsequently analyzed for joint-frequency distribution of current speed and direction as shown in Table 5.1-3.

Current measurements taken at the St Lucie site during 1974-1975[7] and 1977[8] demonstrate that nearshore currents generally flow parallel to the shoreline, with a prevailing northward direction and a secondary mode to the south (see Section 2.4). Based on an analysis of current measurements, plume computations are performed for stagnant ocean conditions and for most frequent current in northward (0.85 fps) and southward (0.85 fps) directions.

5.1.2.2.2 Predictive Techniques

Total cooling water flow from both units is discharged into the common discharge canal and carried into the ocean through two buried pipelines. The combined flow is distributed between the existing 12 ft diameter St Lucie Unit 1 ocean discharge pipeline and the 16 ft diameter St Lucie Unit 2 ocean discharge pipeline as noted in Table 5.1-2.

5.1.2.2.2.1 St Lucie Unit 2 Thermal Plume

Warm water discharged as a high velocity jet has both inertial and buoyant forces acting on it. Jet temperature, as the plume rises toward the surface, decreases steadily due to turbulent mixing and entrainment. This region of the jet, where conditions at the discharge point influence jet temperature distribution, is designated the near-field. Once the submerged jet reaches the surface, the jet "boils" up at the surface and spreads into a stable layer over the surface. The jet still has momentum when it reaches the surface and moves horizontally in a manner similar to a surface jet discharge. The plume spreads over the ocean surface and decreases in temperature due to turbulent mixing and other factors. The surface jet, as it travels away from the boil area, reaches a zone where temperature distribution is no longer influenced by the effects of discharge conditions. That zone, where ambient ocean conditions dominate temperature decay is called the far-field.

With the present "offshore angle" diffuser, diluting ocean water comes primarily from the plume sides and the bottom. For the ports located near the inshore end of the diffuser manifold, the diluent comes from around the individual jets, while for ports located near the offshore end, diluent water comes primarily from both sides of the diffuser. The offshore jets entrain part of the thermal plumes from jets located immediately inshore of them. As a result of this partial re-entrainment of warm water (for jets located towards the offshore end), the temperature near that end will be slightly higher than that at the inshore end. Thus, the net volume of ocean water entrained decreases towards the offshore end, resulting in a lesser temperature decrease. This difference, however, is compensated for by the increase of mixing depth with distance offshore.

a) Near-field (Subsurface) Thermal Plume Characteristics of St Lucie Unit 2 Discharge.

For modeling discharges from the "offshore angle" diffuser, a calibrated Koh-Fan mathematical model[16] was utilized to describe the near-field or submerged jet region. Koh-Fan model computer runs were made with known plant conditions as used in the physical model studies. The entrainment coefficient was varied until the predicted (from Koh-Fan model) and the maximum observed surface temperature rises (from physical model studies) matched. The resulting entrainment coefficients are respectively 0.028, 0.050 and 0.057 for stagnant, southward and northward currents conditions. The calibrated Koh-Fan model was utilized to establish near-field jet characteristics for all other discharge and ambient conditions.

Recently USNRC[17] utilized the Koh-Fan model to analyze the near-field performance of the "offshore angle" diffuser for a once-through cooling system (located near Block Island Sound in Charlestown, RI). NRC concluded that the results from Koh-Fan model were similar to those determined in the physical model studies.

b) Far-Field (Surface) Thermal Plume Characteristics of Unit 2 Discharges

The thermal plume from the St Lucie Unit 2 "offshore angle" diffuser, when it reaches the surface, interacts with ambient ocean and moves away from the diffuser due to residual momentum. The resulting thermal plume does not lend itself to exact analysis by available state-of-the-art models. For modeling surface plumes, the calibrated PDS model[18] was adopted. From the results of the calibrated near-field Koh-Fan model (Section 5.1.2.2.2.1a), maximum temperature rise at the surface and corresponding surface velocity was obtained for each case of interest. From the results of the physical model studies, the depth of the thermal layer was determined to be 15.4 feet. With these parameters known, the width of the surface layer was determined. The surface jet source was assumed to be located at the offshore end of the diffuser for stagnation conditions and along the diffuser for southward and northward currents.

For these known initial conditions, the PDS model was calibrated for the results of the physical model studies for stagnation, southward and northward currents. The values of Eo, (jet entrainment coefficient), XK_1 (spreading coefficient), E_H (horizontal turbulent diffusion/exchange coefficient) and R_F (function of local Richardson number) for stagnation case are respectively 0.05, 5.0, 0, and 0.05. Similar values for southward and northward current cases are respectively 0.05, 160, 0 and 0.001 and 0.05, 70, 0 and 0.001. The PDS model was utilized to obtain surface plume details for all cases of interest.

5.1.2.2.2.2 St Lucie Units 1 and 2 Thermal Plume Under Combined Operation

a) Near-Field (Subsurface) Thermal Plume Characteristics Under Combined St Lucie Units 1 and 2 Operation.

Results obtained from the physical model studies[2] indicate that the design and separation distance between the two discharge lines results in negligible interference between the thermal discharges from St Lucie Units 1 and 2. The results of near-field analysis for St Lucie Unit 1 and for St Lucie Unit 2 (Section 5.1.2.2.2.1a) individually are also appropriate for combined operation. The Koh-Fan model[16] is used to describe submerged near-field jet temperatures resulting from St Lucie Unit 1 discharges.

b) Far-Field (Surface) Thermal Plume Characteristics of St Lucie Unit 1 Discharges

For modeling surface plumes, the calibrated Prych - Davis - Shirazi (PDS)[20] model was adopted. From the results of the near-field Koh-Fan model (Section 5.1.2.2.2.1a) the jet velocity and temperature rise at the surface was obtained for each case. The results of the Koh-Fan model are used as one of the initial input conditions for the PDS model. From field measurements and St Lucie Unit 1 physical model studies, the location of the beginning of the surface layer and an initial surface layer depth of 12.5 feet is established[8]. With known values of the amount of heat discharged, surface temperature and velocity, depth of surface layer, the width of the surface layer is then established.

The PDS model is calibrated with results from the physical model studies[4]. The values of the calibration coefficients for stagnation conditions are; E_o (jet entrainment coefficients) =

0.05; E_H (horizontal turbulent diffusion/exchange coefficient)= 0.00004; XK_1 (spreading coefficient)= 45; R_F (a function of local Richardson Number) = 0.0031. Corresponding values for southward current conditions are 0.05, 0.0, 45 and 0.021. For northward current conditions, calibration values are 0.05, 0.00006, 45 amd 0.0031, respectively.

The calibrated PDS model also verifies St Lucie Unit 1 discharge results obtained during the March 1977 survey when St Lucie Unit 1 was operating at 99 percent power output. The PDS model predicted areas are 27 acres and 401 acres for 3 and 1.5°F, respectively. The corresponding prototype measurements are 18 acres and 278 acres, establishing the applicability of PDS model. The calibrated PDS model was utilized to obtain surface plume details for all test cases.

c) Far-Field (Surface) Thermal Plume Characteristics Under Combined St Lucie Units 1 and 2 Operation

When St Lucie Units 1 and 2 are in operation, the following procedure is used to estimate plume area. Details of the surface plume resulting from the St Lucie Unit 1 discharge, under stagnation conditions, were computed utilizing the calibrated PDS model. Plume computations were carried out to a distance where interaction with the St Lucie Unit 2 discharge occurs. At that point, a new source is formulated and its characteristics (such as width, velocity, temperature, depth) are determined by conserving or combining the total heat, volume and momentum flux of both discharges. With details of the new source known, the PDS model is again applied to determine the details of the combined plumes under stagnant conditions.

Based on tests conducted on St Lucie Unit 1 and on combined St Lucie Units 1 and 2 discharges, IIHR concluded that "there is almost no interference between Units 1 & 2."[(2)] Essentially this means that under both southward (0.85 fps) and northward currents (0.85 fps), even though the individual plumes from St Lucie Units 1 and 2 are oriented in the direction of the current, the areas of an isotherm (such as 2°F), under combined operation will equal the sum of the areas of isotherms from the individual units.

5.1.2.3 Results

In this section, results of the thermal plume analyses are discussed. Discharge plumes from St Lucie Unit 2 are discussed for stagnation, southward and northward currents. Discussion of plumes resulting from the combined operation of St Lucie Units 1 and 2 is restricted to only those (stagnant) cases where the individual plumes from both units (of 2°F) interfere.

The results described below are conservative, and reflect the assumed heat rejection rate of 7×10^9 Btu/hr/unit. Results presented herein for St Lucie Units 1 and 2 do not reflect normal operating conditions, due to the above assumption.

5.1.2.3.1 St Lucie Unit 2 Thermal Plume

5.1.2.3.1.1 Near-Field (Subsurface) Plume Characteristics

For St Lucie Unit 2 discharges, the resulting maximum surface temperatures are strongly dependent on ocean current conditions. Results of the St Lucie Unit 2 physical model studies [2] showed that surface temperatures are highest for stagnant situations and decrease as ambient current speed increases. This largely reflects the availability of additional ambient water for mixing and dilution, whenever there is a cross current.

The subsurface plume temperature distribution, volumes of isotherms and times of travel for St Lucie Unit 2 discharges are developed utilizing the Koh-Fan model. Table 5.1-4 presents the results of the analyses, and Figure 5.1-1 shows a typical example of the plume in the subsurface region. In this analysis, the jet centerline temperature rise at 5/6 the ocean depth over the nozzle is assumed to be the maximum surface temperature. Other investigators [19,20] of jets have shown that at this depth (i.e., the top 1/6 depth of the ocean), temperature decay is significantly less than that in the remainder of the water column. Further, this assumption adds conservatism to the analysis.

For seven pump operation with a ΔT_o of 32°F, the predicted ΔT_{max} is 4.9°F for a discharge flow of 836 cfs and 4.3°F for a discharge of 1090 cfs. However, for eight pump operation with a ΔT_o of 32°F, the predicted ΔT_{max} is 4.4°F for a flow of 1001.5 cfs and 4.6°F for a flow of 951 cfs. For the same eight pump operation, when ΔT_o is 28°F, the predicted ΔT_{max} is 3.6°F for a flow of 1075 cfs and 3.1°F when the flow is 1404 cfs.

The ΔT_{max} discussed above occur during stagnant or slack water ocean conditions. When other factors which influence temperature decay are held constant, the ambient current will increase mixing and dilution, resulting in a lower surface temperature rise. This is shown by a review of the results presented in Table 5.1-4. The ΔT_{max} varies from 1.9°F to 3.2°F, and surface temperature rises are about 50 to 30 percent lower than corresponding temperatures during stagnation conditions. Further, all the temperatures presented in Table 5.1-4 are the resulting temperature rises at the offshore end of the St Lucie Unit 2 "offshore angled" diffuser. As discussed in Section 5.1.2.2.2.1 and seen from the results of the physical model studies, ΔT_{max} values vary along the diffuser. At the inshore end, estimated ΔT_{max} values are one-half to one-third of those presented in Table 5.1-4. In this analysis, only characteristics of the offshore jet are considered, to provide conservative estimates of areas and volumes affected by elevated temperatures.

Predicted length of the jet trajectory (Table 5.1-4) varies between 81 and 130 ft, depending upon initial jet conditions. The predictions presented here are average lengths. However, under actual ocean conditions (ocean currents, stratification, etc) and from St Lucie Unit 1 operating experience and observations made during March 1977 field survey [8], it is expected that the trajectory length would be longer, by as much as 50 percent of the predicted values.

The jet surface velocity is predicted with the Koh-Fan model. Predicted velocities vary from 2.7 fps under stagnant conditions to 2.0 to 1.7 fps under southward or northward ocean currents.

Time of travel (Table 5.1-5) of a plume-entrained organism through the 20°F, 10°F and 5°F isotherms were predicted. From the discharge point, the maximum time required to traverse the 20°F, 10°F and 5°F isotherms are about 2 secs, 7 secs and 21 secs, respectively.

Volumes enclosed by 20°F, 10°F, 5°F and 2°F isotherms for all test cases are shown in Table 5.1-6. The largest volumes of 20°F, 10°F and 5°F are found to be respectively 0.02 ac-ft, 0.19 ac-ft and 1.51 ac-ft; this occurs when the discharge flow is 1090 cfs and ΔT_o is 32°F. Volume enveloped by each successive isotherm increases as the plume is diluted.

5.1.2.3.1.2 Far-Field (Surface) Plume Characteristics

The maximum surface temperature rise (ΔT_{max}), velocity, width and depth of the jet impingement zone form the primary input data for computation of the far-field or surface plume temperature distribution. Initial thermal layer depth at the offshore end of the diffuser is estimated to be 15.4 feet[2]. The width is calculated from the heat rejection rate, depth of the thermal layer and the near-field analysis. Predicted plume widths for September vary between approximately 140 and 760 feet, depending upon discharge temperature, discharge flow and ambient current conditions.

Utilizing the calibrated PDS Model (Section 5.1.2.2.2.1b), volumes, areas and travel times up to 2°F through the surface plume are computed for stagnation, southward and northward currents. The predicted results are presented in Tables 5.1-5 through 5.1-7. Figures 5.1-2 through 5.1-4 show examples of surface isotherms for a flow of 1001.5 cfs and ΔT_o of 32°F for stagnation, southward and northward currents, respectively. For stagnation conditions, the plume is oriented in the offshore direction while for other current conditions, surface plume orientation and shape is determined by ambient current direction and speed.

Table 5.1-7 and Figures 5.1-3 and 5.1-4 show that the isotherm shape for southward currents is similar and areas are of the same order of magnitude as that for northward currents. These similarities in the gross characteristics of the shape and size of the isotherms are explained by the approximate symmetry of the diffuser with respect to the currents. Differences in plume area are attributed to the nature of the shore. The plume in the southward direction is more likely to encounter shallow depths within a zone where comparatively smaller amounts of ocean water are available for dilution, while the reverse is true for a northward plume. This, in general, results in a diminished ability for the southward plume to entrain water, which results in slightly higher temperatures and larger areas of isotherms for southward currents.

Maximum surface areas generally occur with southward current conditions and minimum areas under either northward current or stagnation conditions. Maximum area of the 2°F isotherm is 963 acres, and results from a southward current when the discharge flow is 836 cfs and ΔT_o is

$32^{\circ}F$. Volume of the $2^{\circ}F$ isotherm (Table 5.1-6) under this condition is 629 ac-ft.

In one case (discharge flow of 1404 cfs, ΔT_o of $28^{\circ}F$), the ΔT_{max} will reach $1.9^{\circ}F$, therefore no $2^{\circ}F$ surface isotherms will occur. Average depth of the $2^{\circ}F$ isotherm varies between a maximum of about 2.5 ft under stagnation situations to almost zero under other current (discharge flow of 1404 cfs and ΔT_o of $28^{\circ}F$ with a northward current) situations.

Travel times of a surface plume entrained organism through $2^{\circ}F$ are presented in Table 5.1-5. Travel times vary from a maximum of 169.4 minutes (flow is 336 cfs and ΔT_o is $32^{\circ}F$) to a minimum of less than a minute (flow is 1404 cfs and ΔT_o is $28^{\circ}F$).

5.1.2.3.2 St Lucie Units 1 and 2 Thermal Plume Under Stagnant Ocean Conditions

5.1.2.3.2.1 Near-Field (Subsurface) Plume Characteristics

Table 5.1-8 presents subsurface jet characteristics for the St Lucie Unit 1 Y-nozzle discharge. Unlike the resulting maximum surface temperatures from St Lucie Unit 2, the physical model studies showed that the temperatures from St Lucie Unit 1 remain essentially unaltered under different ocean current conditions.[2] This is because of the high residual momentum of the St Lucie Unit 1 jets through the water column and at the surface in comparison to the momentum of the ocean currents. The plume would traverse an estimated horizontal distance of less than 150 feet, when it surfaces. Given that the separation distance between the St Lucie Unit 1 Y-nozzle and the St Lucie Unit 2 diffuser is about 450 feet; and the St Lucie Unit 2 diffuser ports are oriented offshore, for all practical purposes the St Lucie Unit 1 and St Lucie Unit 2 subsurface plumes do not influence each other in any way. Physical model studies[4] also show that the design and separation distance of the two discharge lines is such that the subsurface or near-field plumes from St Lucie Units 1 and 2 do not interact. Predicted travel times and volumes for stagnant ocean conditions are shown in Tables 5.1-9 and 5.1-10 respectively.

Results shown in Table 5.1-4 for St Lucie Unit 2 (Test Cases 1 through 7) and Table 5.1-8 for St Lucie Unit 1 (Test Cases 8 through 14), individually, would thus hold good for combined operation of St Lucie Units 1 and 2 (Test Cases 15 through 21) also. Thus, when the St Lucie plant is under seven pump operation, discharging a combined flow of 1770 cfs at a ΔT_o of $32^{\circ}F$, the resultant ΔT_{max} from the Y-nozzle is predicted to be $9.7^{\circ}F$ and ΔT_{max} from the diffuser will range between 2.6 and $4.9^{\circ}F$, depending upon plant and ambient current conditions. For eight pump operation, with a combined flow of 2003 cfs at a ΔT_o of $32^{\circ}F$, resulting ΔT_{max} from the Y-nozzle is predicted to be $8.1^{\circ}F$ and the ΔT_{max} from the diffuser between $2.7^{\circ}F$ and $4.6^{\circ}F$. However, under the same eight pump operation, with a combined flow of 2290 cfs at a ΔT_o of $28^{\circ}F$, predicted ΔT_{max} from the Y-nozzle is $7.3^{\circ}F$ and ΔT_{max} from the diffuser ranges between $1.9^{\circ}F$ and $3.6^{\circ}F$, depending upon plant and ambient current conditions.

Volumes enclosed by the $20^{o}F$ and $10^{o}F$ isotherms for combined plant operation under stagnant ocean conditions were obtained by adding the individual volumes for St Lucie Unit 1 (Table 5.1-10) and St Lucie Unit 2 (Table 5.1-6). Results are presented in Table 5.1-11. Maximum volumes of $20^{o}F$ and $10^{o}F$ isotherms are 0.14 ac-ft and 0.70 ac-ft respectively.

The volumes of $5^{o}F$ and $2^{o}F$ isotherms, under combined operation, require surface plume analysis and are discussed in Section 5.1.2.3.2.2. Other characteristics (such as jet trajectory length, times of travel, and velocity at the surface) of the Y-nozzle (Tables 5.1-8 and 5.1-9) and diffuser (Tables 5.1-4 and 5.1-5) that are presented individually, would hold good for combined operation also.

5.1.2.3.2.2 Far-Field (Surface) Plume Characteristics

Methodology for the computation of surface areas, volumes and times of travel, when both units are in operation and under stagnant ocean conditions is explained in Section 5.1.2.2.2.2c. The surface areas of $5^{o}F$ and $2^{o}F$ isotherms resulting from St Lucie Unit 1 discharges are presented in Table 5.1-12. Figure 5.1-5 shows the $2^{o}F$ and $5^{o}F$ surface isotherms when St Lucie Unit 1 is operating alone discharging 1001.5 cfs at a ΔT_o of $32^{o}F$.

Input data for the combined plume analyses was obtained from computations performed for St Lucie Unit 1 plume and St Lucie Unit 2 plume individually. Figure 5.1-6 shows the $2^{o}F$ and $5^{o}F$ surface isotherms when both units are operating, discharging 2003 cfs at a ΔT_o of $32^{o}F$.

Volumes of the $5^{o}F$ isotherms presented in Table 5.1-11 are primarily the result of St Lucie Unit 1 discharges. Maximum volume of the $5^{o}F$ isotherm is about 25 ac-ft and occurs when the plant is discharging 2003 cfs at a ΔT_o of $32^{o}F$.

Volumes of $2^{o}F$, however, reflect contributions from both St Lucie Units 1 and 2 discharges. The volume of $2^{o}F$, under combined unit operation is greater than the sum of the individual volumes of St Lucie Unit 1 and Unit 2. In some cases, the $2^{o}F$ volume under combined operation is almost 70 percent larger than the sum of the $2^{o}F$ volumes found when the units are operating individually. The maximum volume of $2^{o}F$ is 1889 ac-ft and occurs when plant discharge flow is 2003 cfs and ΔT_o is $32^{o}F$. The minimum volume of $2^{o}F$ is 873 ac-ft and occurs when flow is 2290 cfs and ΔT_o is $28^{o}F$. Average depths of $5^{o}F$ and $2^{o}F$ isotherms under combined operation are about 2 ft and 3 ft, respectively.

Surface areas of $5^{o}F$ isotherms presented in Table 5.1-13 are a result of St Lucie Unit 1 discharges. The maximum area of $5^{o}F$ is 18.3 acres and this results when plant flow is 1770 cfs and ΔT_o is $32^{o}F$. Under stagnant conditions the $2^{o}F$ isotherms from both units interfere and the areas in Table 5.1-13 are a result of the contribution of discharges from both units.

Combined or total areas of $2^{o}F$, similar to volumes, are greater than the sum of the individual areas generated by St Lucie Unit 1 and St Lucie Unit 2. In some cases (Table 5.1-13), the $2^{o}F$ isotherm areas from combined operation are almost 25 percent larger than sum of the areas found when the units are operating individually. The maximum surface area is 677 acres; this occurs when discharge flow is 1770 cfs and ΔT_o is 32°F. The minimum area of 2°F isotherm, 353 acres, results when flow is 2290 cfs and ΔT_o is 28°F.

Time of travel for an entrained organism to reach 5°F, presented in Table 5.1-14 result from St Lucie Unit 1 discharges. Maximum travel time is 9.5 minutes and occurs when the plant flow is 1770 cfs and ΔT_o is 32°F. A minimum travel time of 3.8 minutes occurs when the flow is 2290 cfs and ΔT_o is 28°F. Travel times to reach the 2°F isotherm, however, are the result of both St Lucie Unit 1 and 2 discharges. The travel time to reach 2°F isotherms under combined operations is greater than the sum of individual St Lucie Unit 1 and Unit 2 travel times. In some cases, the travel times under combined operation is almost 36 percent longer than the sum of the 2°F travel times found when the units are operating individually. The maximum travel time to reach 2°F isotherm is 193 minutes, this occurs when flow is 1770 cfs and the ΔT_o is 32°F. The minimum travel time is 95 minutes and this occurs when flow is 2290 cfs and ΔT_o is 28°F.

From the discussion presented above, for a stagnation case, the 2°F surface areas, volumes and travel times when both units are in operation are greater than for either individual unit. This reflects the following phenomenon; when individual plumes interfere, they form a single plume with reduced periphery and therefore a diminished ability to entrain surrounding water. The combined plume will traverse a greater distance, covering a greater area to entrain sufficient water to reduce plume temperature to 2°F above ambient.

The discussion presented above refers to stagnant ocean conditions, when St Lucie Unit 1 and 2 plumes interfere. During both southward and northward ocean current conditions, when the ocean current speed is 0.85 fps, the individual discharge plumes of 2°F do not interfere[2]. Therefore, it is concluded that the thermal effects (of 2°F) contributed by St Lucie Unit 2 when both units are in operation, will be the same as the thermal effects obtained when St Lucie Unit 2 alone is operating, when ambient northward or southward currents (0.85 fps) occur.

5.1.2.3.3 Recirculation

Estimates of surface temperatures at the intake, under St Lucie Unit 2 or combined unit operation are complicated, since the systems dealt with do not lend themselves to exact mathematical analyses. Consequently, recirculation estimates are based on the results of IIHR physical model study[2] and the calibrated PDS model.

Physical model studies have shown that there is no recirculation of St Lucie thermal plumes for either individual or joint unit operation under stagnation and northward current conditions. The recirculation temperatures discussed below refer to southward currents.

Physical model studies showed that the St Lucie Unit 2 plume would be diluted at least 260 times with a flow of 1150 cfs and ΔT_o of 26°F. For Test Cases 1 through 7, the calibrated PDS model shows that maximum temperature rise near the intake would be about 0.5°F at the surface and almost ambient at the bottom. This should produce a recirculation temperature of no higher than 0.2°F.

Under combined operation, with ΔT_o of 26°F and discharge flow of 1150 cfs from each unit, the physical model studies showed that near the intake the surface temperature rise would be about 2°F and near the bottom it would be about 0.2°F. This results in a recirculation temperature of about 0.8°F or a minimum dilution of about 32. The calibrated PDS model shows surface and bottom temperatures of 0.8°F and 0.1°F respectively. This should result in a recirculation temperature of no higher than 1.2°F.

The recirculation temperatures presented here, 0.2°F due to St Lucie Unit 2, and 1.2°F from combined unit operation, are based on conservative assumptions. These temperature rises are small compared to natural ambient temperature variation and should not pose significant problems for plant operation.

5.1.2.3.4 Plume Frequency Analysis

Beyond the region of high jet velocity, plume orientation and shape is determined by ambient current direction and speed. Since the plume is controlled by nearshore flow, the frequency of occurrence of plume orientation will be the same as that of the local current. Figure 2.4-5 presents a current rose.

For the nearshore region at St Lucie, frequency distribution of current direction is bimodal, with the primary mode in the northward direction. Within this 300-030 degree quadrant, the frequency of current direction and plume orientation is 49 percent. For the opposite quadrant (120-210 degrees) it decreases to 34 percent. Longshore flow within both quadrants accounts for plume orientation 83 percent of the time.

An onshore current within 210-300 degrees occurs at a frequency of almost nine percent, which is slightly greater than the six percent occurrence in the offshore direction. The lower frequency of onshore plume orientation in comparison to longshore directions is due to the deformation of onshore flows by the shoreline boundary.

Median longshore current speed is between 0.8 and 0.9 feet per second (fps) in either direction; ten percent of the flow is less than 0.5 fps. At high current speed, ten percent of northward flow occurs at 1.4 fps and 1.1 fps for southward flow. At low current speeds, plume shape will tend to spread more uniformly in the slack flow, whereas at high current speeds, the plume will tend to stream with the current.

5.1.3 BIOLOGICAL EFFECTS OF ST LUCIE UNIT 2 OPERATION

5.1.3.1 Intake Effects

The flow through the St Lucie intake lines from the Atlantic Ocean will be approximately 2,320 cfs when St Lucie Unit 2 goes on-line. This represents a doubling of the present capacity (St Lucie Unit 1) and will result in a doubling of velocities through the system. This increased flow will increase the rate that biota are removed from the offshore environment. Whether this increase will result in a doubling in the number of plankton and fish entrained through the system is unknown. However, such an assumption is an appropriate boundary condition for the following discussion.

The planktonic community, comprised of phytoplankton, zooplankton and ichthyoplankton, is passively conducted through the circulating water system with the flow of water and returned to the ocean. In contrast, fish entrained from the ocean into the intake canal are removed from the offshore environment and not returned to the ocean. However, not all fish in a given volume of water are entrained into the intake pipeline, because they exhibit species and/or size-specific susceptibility to such entrainment. Estimates of possible entrainment and impingement impacts by St Lucie Unit 2 are discussed below.

5.1.3.1.1 Planktonic Organisms

Plantonic organisms should be entrained into the St Lucie Unit 2 circulating water system in a nonselective manner. The impact of entrainment on the waterbody is then computed on the basis of intake water flow relative to the source water volume (and planktonic community) available to entrainment over a reasonable amount of time.

Applied Biology Inc. (ABI) has previously computed entrainment rates for St Lucie Unit 1 based on a mathematical model and a source water volume defined as that circumscribed by the array of sampling stations. Their results indicated that entrainment would be 1.8 percent of this near-field community based on the assumption of 100 percent mortality of organisms through the system, and stagnant (worst case) ocean conditions (Table 5.1-15).

St Lucie Unit 2 will double the flow, or entrainment rate at the station. Using the source water volume computed by ABI[21,22,23], this results in a doubling of the estimated portion of the near-field plankton community affected. A worst case entrainment rate of 3.6 percent of the near-field plankton community present offshore of St Lucie Unit 2 should not constitute a significant impact.

5.1.3.1.2 Active Swimmers

Impingment data collected during the three years of operational monitoring at St Lucie Unit 1 are summarized in Table 5.1-16. Figures 5.1-7 through 5.1-14 represent time series of total numbers and weight of finfish and shellfish impinged on the traveling sceens over that period.

The dominant species impinged at St Lucie are: anchovy, grunt, jack, croaker and mojarra (numerically) and jack, mojarra and grunt (gravimetrically). The length distribution of impinged organisms collected in 1978 indicates that samples are dominated by small organisms. Over 80 percent of the impinged fish were less than or equal to 8 cm in length, and almost 100 percent of the impinged shrimp were 4 cm in length or less. The number of impinged species which are commercially important is low (Table 5.1-16). Although the fish impinged are primarily forage species or species of minor commercial importance, comparison of St Lucie plant annual impingement with the commercial catch illustrates the insignificance of impingement at this station. The total weight of fish impinged in any year (conservatively assuming 365 days operation of St Lucie Unit 1) is less tan 0.04 percent of the commercial landings docked in either St. Lucie or Martin counties. The shrimps and blue crabs impinged represent organisms of commercial value; however, the biomass of impinged shellfish is less than 0.005 percent of commercial shellfish landed in either St Lucie or Martin Counties.

Current impingement rates, assuming plant operation during 365 days per year ranged from approximately 34,000 (1978) to 131,000 (1976) finfish and from 26,000 (1976) to 37,000 (1978) shellfish.

Addition of St Lucie Unit 2 capacity to the total station circulating cooling water capacity is expected to increase the impingement rate at the station. When a fish or group of fish encounters the intake, as velocity increases, the probability of impingement should also increase. However, most species will have a finite probability of encountering the intake and of those, some of the more important species appear capable of avoiding entrainment (e.g., Spanish mackerel, bluefish). As an upper (conservative) boundary, impingement at St Lucie Units 1 and 2 is estimated at approximately 160,000 fish per year and 60,000 shellfish per year. These numbers represent twice the mean annual impingement estimates calculated from three years of St Lucie Unit 1 impingement data. These are relatively low impingement rates for a power plant, and should not produce significant ecological impacts.

5.1.3.1.3 Marine Turtles

Marine turtles presently enter the intake canal through the intake pipeline. Current research is examining whether turtles are being drawn into the intake pipe as they move through the area or if they actively swim into the structure in search of food or shelter. The increase in volume of water from 1160 cfs to 2320 cfs when St Lucie Unit 2 becomes operational will increase water velocity at the perimeter of the velocity cap from 0.5 to 1.0 fps. This increase will not appreciably enlarge the area from which turtles are unable to escape the intake velocity. Hence, no increase in the number of turtles entering the intake canal is expected due to velocity.

Even if current research demonstrates that turtles are deliberately entering the intake pipeline, no increase in the number of turtles in the intake canal is expected since the offshore configuration of the intake structure will not be changed.

Water in the intake pipelines will travel at a speed of 10 ft per second. This velocity will carry turtles from the intake structure to the intake canal in less than two minutes. There is no evidence that this activity is harmful to the animals. Turtles entering the canal are generally restricted from access to the entire canal by a block net at the A1A bridge. Turtles are captured and removed from the canal by netting and are released into the ocean. Additional studies on the behavior of turtles, physical characteristics of captured turtles and tagging and recapture studies are being conducted in cooperation with federal and state agencies.

5.1.3.2 Discharge Effects

An ABI report entitled "Effects of Increased Water Temperature on the Marine Biota of the St Lucie Plant Area"(24) addressed the impact of the St Lucie Unit 1 wye-port diffuser and a 32°F plant temperature rise on Atlantic Ocean biota. This report incorporated results of thermal plume modeling conducted by Envirosphere Company, ecological monitoring performed by ABI and results of thermal bioassays reported in the literature. Because the St Lucie Unit 2 multiport diffuser will provide greater dilution of the thermal plume than does the St Lucie Unit 1 wye-port diffuser, ABI's conclusions are considered conservative as applied to St Lucie Unit 2 impacts.

A summary of thermal bioassay, preference, and avoidance work applicable to St Lucie Unit 2 impact assessment is given in Table 5.1-17. Thermal tests conducted in laboratory facilities establish specific organism temperature tolerances. However, these tests generally record tolerance to increased temperatures for extended periods (e.g. 24, 48, or 96 hour exposure) and, generally, preclude avoidance behavior. As such, these reported temperature tolerances do not reflect exposure regimes that entrained organisms would encounter in the St Lucie Unit 2 plume.

In the case of St Lucie Unit 2, physical modeling indicates that an organism entrained into the thermal plume during September (worst case conditions) at the point of discharge would be exposed to a cumulative exposure of two seconds at 107°F; 7 seconds at 97°F; 21 seconds at 92°F and 85 minutes at 89°F (travel time along the plume center line, Table 5.1-5) before reaching water ambient ocean temperatures (87°F). Therefore exposure to potentially stressful temperatures lasts for less than one minute. Similarly, exposure duration along the plume centerlines from St Lucie Unit 1 through Unit 2, to the 2°F isotherm, would be 188 minutes (from Table 5.1-14, 6 seconds at 107°F; 15 seconds at 97°F; 8.5 minutes at 92°F). Thus, thermal bioassay data may overestimate impact. Also, exposure to water 2°F above average ambient temperature is within the realm of natural temperature variation offshore of Hutchinson Island.(25)

5.1.3.2.1 Effects on Benthos, Plankton and Fish

The thermal plume from St Lucie Unit 2 rises rapidly from the discharge diffuser, resulting in little plume contact or scouring of the benthic substrate (Figure 5.1-4). Therefore, it is assumed that the plume will not affect the benthic biota.

Thermal tolerances of plankton species resident in the St Lucie area which are available in the literature (Table 5.1-17) suggest that the brief exposures (less than 8 minutes) to increased temperatures will result in negligible effects. The temperatures inducing optimum growth and abundance for phytoplankton species indigenous to the St Lucie area range from 77°F to 95°F [26,28,30,31,33,34] coinciding with temperatures which occur during periods of observed maximum cell density and productivity (Table 2.2-7). Work by Ukeles [35] indicates that temperatures exceeding 102°F completely inhibit growth of marine diatoms. Saks and Lee [32] found that chronic exposure to temperatures of 102°F resulted in zero percent survival of 12 species of salt marsh epiphytes. Recorded upper lethal temperatures for several diatoms were: 94.2°F (Chaetoceros laciniosus) [27]; 93.2 [27] and 98.6°F [29] (Skeletonema costatum); and 95°F (Nitzscia acicularis) [33]. No instantaneous thermal maxima are available for phytoplankton species found in the St Lucie area. However results for other tropical species, exposure duration models for St Lucie plumes, and empircal results suggest that impact on phytoplankton should be insignificant.

Studies conducted at utility sites in Florida suggest that zooplankton are comparatively tolerant to thermal stress resulting from plume entrainment. Reeve and Casper [37] showed that at ambient temperatures of 85°F Acartia tonsa exhibited less than 25 percent mortality following a six hour exposure to 96.8°F. Adlen [38] noted that mortality of virtually all species tested from the Crystal River Estuary increased significantly at temperatures in excess of 95°F. Thermal tolerance data for some shrimp species which have meroplanktonic (larval) life stages (Penaeus aztecus and P. setiferus) also indicate that brief exposure to temperatures above 95°F should not cause significant mortality. For example, 24 hour LT50's for P. aztecus post larvae ranged from 97.3 to 100.9°F, depending on acclimation temperature in studies conducted by Wiesepape [39].

Observed thermal tolerance ranges from ichthyoplankton found off Hutchinson Island are quite variable (Table 5.1-17). Also, due to seasonal spawning and developmental patterns, some ichthyoplankton species will not encounter worst case conditions in which ambient ocean temperatures of 37°F and maximum plume temperature of 105°F occur.

Temperature ranges of ichthyoplankton observed empirically at St Lucie range from 32°F (menhaden larvae) to 95°F (silverside prejunveniles). The lowest 96 hour LT50 reported for a St Lucie area species was 79.5°F (mullet embryo). The highest thermal tolerance reported for a 96 hour LT50 was 97.2°F (pompano juveniles). Very short-term thermal maxima data which would be applicable to plume entrainment exposure durations at St Lucie are apparently not available for the species concerned. Some ichthyoplankton mortality will occur as a result of this additional stress in the fishes early life history, but it is unlikely that this stress will be significant in relation to other sources of mortality.

Operation of St Lucie Unit 2 should not have a significant impact on fish. A number of studies have suggested that adult fish actively avoid areas where water temperatures reach lethal temperatures [63,75,78-79,82]. Gallaway and Strawn, [78,79] observed avoidance behavior of gulf menhaden and bay anchovy within a temperature range of 86 to 91°F. It is expected that most of the fish offshore St Lucie would avoid the plume during the warmest months of the year. For the situation studied in this report, some 25.5 acre-feet could be so affected by the interaction of St Lucie Units 1 and 2 plumes if fish avoid temperatures exceeding 92°F (sum of volumes at 20°F, 10°F, and 5°F on line 4 of Table 5.1-11). Attraction of fish during other seasons should not present a potential for cold shock if both generating units shut down (unlikely), nor should the area affected by the plumes be considered to represent a significant influence with respect to fish behavior or life functions dependent on such behavior.

5.1.3.2.2 Effects on Marine Turtles

Variations in ambient water temperatures have been associated with changes in the timing of sea turtle nesting activity and nesting rates. During all four study years, the nesting season began when maximum ocean temperatures ranged between 71.6 and 76.1°F (Figure 5.1-17). A positive relationship between rising water temperatures and increased nesting activity was observed at the onset of each nesting season at Hutchinson Island (Figure 5.1-17). Nesting and nesting crawl activity levels increased until June or July and then declined, despite generally rising water temperatures, through the remainder of the nesting season. In 1973, cooler ocean temperatures may have partially inhibited nesting until July, when the waters warmed and a great influx of nesting females was observed. In contrast, increased nesting activity was observed during the early nesting season periods of 1975 and 1977, when ambient ocean temperatures were warmer than those in the other years of observation.

While the peak period of nesting appears to be related to temperature, there is no evidence that higher temperatures caused by the operation of St Lucie Unit 1 has caused premature nesting. Many reptiles require interaction between photoperiod and temperature which may preclude nesting until minimal requirements of both factors are present.

The volume of St Lucie Unit 1 and Unit 2 discharge plumes that will exceed 2°F in March and April immediately prior to normal nesting will not exceed 1900 acre-ft. This water mass will be located primarily in the water column immediately above the point of discharge and will have a velocity of about 14 ft/sec coming from the multiport diffusers. These conditions are not expected to influence the onset of turtle nesting or nesting behavior. Turtles encountering the thermal plume would move to waters of ambient temperatures for feeding. Hatchling turtles leaving the beach in the vicinity of the thermal plume may be exposed to elevated temperatures but the combination of currents and swimming activity should enable them to leave the plume area without excessive stress.

The discharge pipe will be buried below the sea floor, and will not impede turtle movement since they will be able to swim between the vertical risers and discharge jets.

5.1.4 OTHER EFFECTS OF HEAT DISSIPATION SYSTEM

Re-evaluation of potential fogging over the St Lucie Plant discharge canal, based on a condenser rise of 32°F, site specific meteorological data (Dec 1976 to Nov 1977) and actual intake water temperatures (Dec 1976 to Nov 1977), has shown a low occurrence of fogging for all months (33). However, the probability of St Lucie Unit 2 operation at 32°F during these months is extremely low.

Ten hours of fog, which produced visibility of less than 50 m, were predicted for the entire year. Seven hours were predicted for January 1977 and three hours were predicted for December 1976. No cases of natural fog were predicted during these occasions.

Because of the low incidence of fog predicted over the discharge canal, the occurrence of fog in the Atlantic Ocean, resulting from the operation of St Lucie Unit 2, is considered to be very low. This reflects the much lower surface water temperatures produced by discharge from the St Lucie Unit 2 multiport diffuser.

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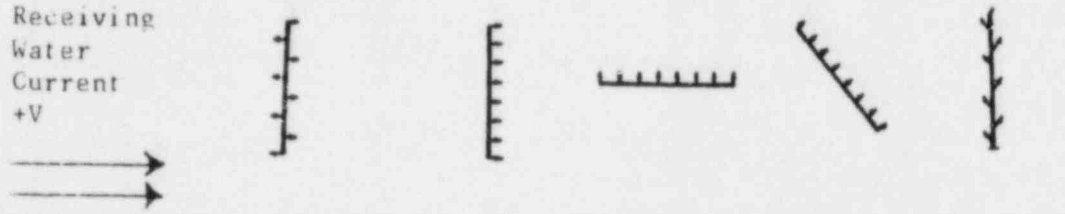
TABLE 5.1-1

QUALITATIVE PERFORMANCE OF SUBMERGED DIFFUSERS IN SEMI-INFINITE SHALLOW WATER*

TYPE OF DIFFUSER		(a) ALTERNATING	(b) COFLOWING	(c) TEE	(d) OBLIQUE	(e) STAGED**
Receiving Water Current +V						
Net Offshore Momentum		No	No	Yes	Yes	Yes
Performance in Receiving Water Currents: Unidirectional	Low Speed	Poor	Good	Good	Good	Fair
	Moderate Speed	Poor	Good	Fair	Good	Good
	High Speed	Fair	Good	Poor	Fair	Good
Performance in Receiving Water Currents: Bidirectional	Low Speed	Poor	Fair	Good	Fair	Fair
	Moderate Speed	Poor	Poor	Fair	Poor	Good
	High Speed	Fair	Poor	Poor	Poor	Good

* From Reference 10.

** Staged or off-shore angled diffuser.

TABLE 5.1-2

OCEAN DISCHARGE PIPELINE FLOW DISTRIBUTION

Discharge Flow (cfs)	Discharge Temp Rise (°F)	Heat Discharge Rate ($Btu/_{hr} X10^9$)	Unit 1* Discharge Flow (cfs)	Unit 1* Velocity (fps)	Unit 1* Friction factor	Unit 2** Discharge Flow (cfs)	Unit 2** Velocity (fps)	Unit 2** Friction factor	Head++ (ft)	Flow## Variation (percent)
2003	32	14	941	10.65	0.015	1062	13.11	0.015	4.4	18.9 to 8.4
2003	32	14	836	9.46	0.030	1167	14.40	0.015	5.1	27.9 to 0.6
2003	32	14	766	8.67	0.045	1237	15.27	0.015	5.7	34 to 6.6
2003+	32	14	1001.5	11.33	0.015	1001.5	12.36	0.030	5.0	13.7
2003+	32	14	1052	11.90	0.015	951	11.74	0.045	5.5	9.3 to 18
1770#	32	12.25	830	9.39	0.015	940	11.60	0.015	5.5	9.3 to 18
1770#	32	12.25	745	8.43	0.030	1025	12.65	0.015	4.0	35.8 to 11.6
1770#+	32	12.25	680	7.7	0.045	1090	13.45	0.015	4.5	41.4 to 6.0
1770#	32	12.25	880	9.96	0.015	890	10.99	0.030	3.8	24.1 to 23.2
1770#+	32	12.25	934	10.57	0.015	836	10.32	0.045	4.3 *	19.5 to 27.9
2290	28	14	1065	12.05	0.015	1225	15.12	0.015	5.7	8.2 to 5.6
2290	28	14	956	10.82	0.030	1334	16.47	0.015	6.7	17.6 to 15
2290+	28	14	886	10.02	0.045	1404	17.33	0.015	7.5	23.6 to 21.0
2290+	28	14	1145	12.95	0.015	1145	14.13	0.030	6.6	1.3
2290+	28	14	1215	13.75	0.015	1075	13.27	0.045	7.3	4.7 to 7.3

* 12' Diameter

** 16' Diameter

\# Refers to 7-pump operation (one waterbox out of service).

\## With respect to a base flow of 1160 cfs per unit.

\+ Test cases for plume evaluation.

\++ Elevation difference between ocean and discharge canal.

TABLE 5.1-3

FREQUENCY DISTRIBUTION OF LONGSHORE CURRENT
SPEED AND DIRECTION AT THE ST LUCIE SITE

Current Speed Group (ft/sec)	Southward Frequency (%)	Quadrant Cumulative	Northward Frequency (%)	Quadrant Cumulative
0.0 - 0.1	0.06	0.06	0.44	0.44
0.1 - 0.2	0.33	0.39	0.52	0.96
0.2 - 0.3	0.76	1.15	0.82	1.78
0.3 - 0.4	0.97	2.12	0.97	2.75
0.4 - 0.5	3.27	5.39	3.92	6.67
0.5 - 0.6	3.25	8.64	3.68	10.35
0.6 - 0.7	4.11	12.75	5.57	15.92
0.7 - 0.8	4.28	17.03	6.49	22.41
0.8 - 0.9	5.65	22.68	8.65	31.06
0.9 - 1.0	3.27	25.95	5.61	36.67
1.0 - 1.1	3.66	29.61	4.99	41.66
1.1 - 1.2	2.22	31.83	3.48	45.14
1.2 - 1.3	1.19	33.02	1.69	46.83
1.3 - 1.4	0.58	33.60	1.05	47.88
1.4 - 1.5	0.36	33.96	0.48	48.36
1.5 - 1.6	0.20	34.16	0.27	48.63
1.6 - 1.7	0.12	34.28	0.24	48.87
1.7 - 1.8	0.17	34.45	0.20	49.07
1.8 - 1.9	0.03	34.48	0.14	49.21
1.9 - 2.0	0.08	34.56	0.19	49.40

TABLE 5.1-4

ST LUCIE UNIT 2: SUBSURFACE JET CHARACTERISTICS

Test No.	Discharge Flow (cfs)	Discharge Temp Rise (°F)	Max Surface Temp Rise (°F) Stagnant	Max Surface Temp Rise (°F) Southward Current	Max Surface Temp Rise (°F) Northward Current	Ave Distance to Reach 17°F Above Ambient (ft)+ Stagnant	Ave Distance to Reach 17°F Above Ambient (ft)+ Southward Current	Ave Distance to Reach 17°F Above Ambient (ft)+ Northward Current	Jet Trajectory Length (ft) Stagnant	Jet Trajectory Length (ft) Southward Current	Jet Trajectory Length (ft) Northward Current	Jet Velocity at the Surface (fps) Stagnant	Jet Velocity at the Surface (fps) Southward Current	Jet Velocity at the Surface (fps) Northward Current
1	1001.5	32	4.4	[illegible]	2.7	15.6	13.4	13.2	101	91	87	2.7	1.9	1.8
2	951	32	4.6	3.0	2.7	15.6	13.4	13.2	98	88	86	2.6	1.9	1.8
3	1090	32	4.3	[illegible]	2.6	15.6	13.4	13.2	106	95	93	2.7	2.0	1.8
4	836	32	4.9	3.2	2.9	15.6	13.4	13.2	91	83	81	2.6	1.9	1.8
5	1145	28	3.5	2.3	2.1	13.5	12.0	12.0	114	100	96	2.6	1.9	1.7
6	1404	28	3.1	2.1	1.9	13.5	12.0	12.0	130	109	105	2.7	1.9	1.8
7	1075	28	3.6	2.4	2.2	13.5	12.0	12.0	110	98	93	2.5	1.8	1.7

Note:

(1) Ambient ocean temperature = 87°F.

(2) Jet characteristics shown are for the offshore port only.

\+ Distance computed along centerline of discharge, which is oriented 25° from the diffuser centerline. To determine the distance to the 17°F isotherm normal to the diffuser centerline, multiply the distance given by sin 25°.

TABLE 5.1-5

ST LUCIE UNIT 2: TRAVEL TIME ALONG PLUME CENTER LINE

			Plume Travel Time											
			Stagnant				Southward Current				Northward Current			
Test No.	Discharge Flow (cfs)	Discharge Temp Rise (°F)	Up to 20°F (sec)	Up to 10°F (sec)	Up to 5°F (sec)	Up to 2°F (min)	Up to 20°F (sec)	Up to 10°F (sec)	Up to 5°F (sec)	Up to 2°F (min)	Up to 20°F (sec)	Up to 10°F (sec)	Up to 5°F (sec)	Up to 2°F (min)
1	1001.5	32	2	6	19	70.5	2	4	12	1263	2	4	11	137.8
2	951	32	2	6	20	74.1	2	4	13	132.8	2	4	11	149.3
3	1090	32	2	5	18	66.2	2	4	11	115.3	1	3	10	118.0
4	836	32	2	7	21	85.1	2	4	14	147.5	2	4	13	169.4
5	1145	28	1	4	14	42.0	1	3	9	55.5	1	3	8	28.1
6	1404	28	1	3	12	32.5	1	2	7	18.4	1	2	6	0.5
7	1075	28	1	4	15	43.0	1	3	9	66.9	1	3	8	40.8

TABLE 5.1-6

ST LUCIE UNIT 2: VOLUME ENCLOSED BY ISOTHERMS

Test No.	Discharge Flow (cfs)	Discharge Temp Rise (°F)	Volume (acre-ft) Enclosed by Isotherms, and Max Temp Rises: Stagnant ΔT* Max	Stagnant 20°F	Stagnant 10°F	Stagnant 5°F	Stagnant 2°F	Southward Current ΔT* Max	Southward Current 20°F	Southward Current 10°F	Southward Current 5°F	Southward Current 2°F	Northward Current ΔT* Max	Northward Current 20°F	Northward Current 10°F	Northward Current 5°F	Northward Current 2°F
1	1001.5	32	4.4	0.02	0.19	1.48	584	2.9	0.02	0.12	0.88	599	2.7	0.02	0.10	0.78	500
2	951	32	4.6	0.02	0.19	1.47	536	3.0	0.02	0.12	0.88	621	2.7	0.02	0.10	0.78	534
3	1090	32	4.3	0.02	0.19	1.51	590	2.8	0.02	0.12	0.89	567	2.6	0.02	0.10	0.79	435
4	836	32	4.9	0.02	0.19	1.41	588	3.2	0.02	0.12	0.86	629	2.9	0.02	0.10	0.77	582
5	1145	28	3.5	0.02	0.12	1.04	314	2.3	0.02	0.08	0.60	170	2.1	0.02	0.07	0.53	85
6	1404	28	3.1	0.02	0.12	1.05	290	2.1	0.02	0.08	0.61	86	1.9	0.02	0.07	0.53	8
7	1075	28	3.6	0.02	0.12	1.03	250	2.4	0.02	0.08	0.60	201	2.2	0.02	0.07	0.53	100

*Maximum surface temperature rise.

TABLE 5.1-7

ST LUCIE UNIT 2: AREA OF ISOTHERMS

Test No.	Discharge Flow (cfs)	Discharge Temp Rise (^oF)	Area (acres) Enclosed by 2^oF Isotherms and Max Surface Temp Rises					
			Stagnant		Southward Current		Northward Current	
			ΔT* Max	Area	ΔT* Max	Area	ΔT* Max	Area
1	1001.5	32	4.4	273	2.9	825	2.7	528
2	951	32	4.6	285	3.0	872	2.7	589
3	1090	32	4.3	258	2.8	739	2.6	427
4	836	32	4.9	294	3.2	963	2.9	720
5	1145	28	3.5	172	2.3	175	2.1	28
6	1404	28	3.1	133	2.1	21	1.9	0
7	1075	28	3.6	192	2.4	226	2.2	53

*Maximum surface temperature rise.

TABLE 5.1-8

ST LUCIE UNIT 1: SUBSURFACE JET CHARACTERISTICS

Test No.	Discharge Flow (cfs)	Discharge Temp Rise (°F)	Max Surface Temp Rise (°F)	Jet Trajectory Length (ft)	Jet Velocity at the Surface (fps)
8	1001.5	32	8.1	130	3.9
9	1052	32	7.9	134	4.0
10	680	32	9.7	110	3.5
11	934	32	8.4	126	3.8
12	1145	28	6.4	144	3.9
13	886	28	7.3	127	3.6
14	1215	28	6.2	149	3.9

Notes: (1) Ambient ocean temperature = 87°F.

(2) Subsurface jet characteristics remain essentially unaltered under stagnant, southward and northward ocean current conditions.

TABLE 5.1-9

ST LUCIE UNIT 1: TRAVEL TIME ALONG PLUME CENTERLINE UNDER STAGNANT OCEAN CONDITIONS

Test No.	Discharge Flow (cfs)	Discharge Temp Rise (°F)	Max Surface Temp Rise (°F)	Plume Travel Time: Up to 20°F (sec)	Plume Travel Time: Up to 10°F (sec)	Plume Travel Time: Up to 5°F (min)	Plume Travel Time: Up to 2°F (min)
8	1001.5	32	8.1	6	14	7.3	58.2
9	1052	32	7.9	6	13	7.0	56.2
10	680	32	9.7	8	19	9.5	75.9
11	934	32	8.4	6	15	7.7	61.5
12	1145	28	6.4	5	10	4.2	39.1
13	886	28	7.3	6	11	5.8	48.1
14	1215	28	6.2	4	10	3.8	37.3

TABLE 5.1-10

ST LUCIE UNIT 1: VOLUME ENCLOSED BY ISOTHERMS UNDER STAGNANT OCEAN CONDITIONS

Test No.	Discharge Flow (cfs)	Discharge Temp Rise (°F)	Max Surface Temp Rise (°F)	Volume (acre-ft) Enclosed by Isotherms			
				20°F	10°F	5°F	2°F
8	1001.5	32	8.1	0.12	0.51	23.1	542
9	1052	32	7.9	0.12	0.51	22.8	550
10	680	32	9.7	0.12	0.49	22.6	469
11	934	32	8.4	0.12	0.51	23.3	531
12	1145	28	6.4	0.09	0.37	10.9	369
13	886	28	7.3	0.09	0.37	13.0	348
14	1215	28	6.2	0.09	0.37	10.2	372

TABLE 5.1-11

ST LUCIE UNITS 1 and 2: VOLUME ENCLOSED BY ISOTHERMS UNDER STAGNANT OCEAN CONDITIONS

Test No.	Discharge Flow (cfs)	Discharge Temp Rise (^oF)	Volume (acre-ft) Enclosed by Isotherms 20^oF	10^oF	5^oF	2^oF
15	2003	32	0.14	0.70	24.6	1701
16	2003	32	0.14	0.70	24.3	1889
17	1770	32	0.14	0.68	24.1	1673
18	1770	32	0.14	0.70	24.7	1721
19	2290	28	0.11	0.50	11.9	963
20	2290	28	0.11	0.50	14.1	873
21	2290	28	0.11	0.50	11.2	932

TABLE 5.1-12

ST LUCIE UNIT 1: AREA OF ISOTHERMS UNDER STAGNANT OCEAN CONDITIONS

Test No.	Discharge Flow (cfs)	Discharge Temp Rise (°F)	Max Surface Temp Rise (°F)	Area (acres) Enclosed by Isotherms	
				5°F	2°F
8	1001.5	32	8.1	14.6	270
9	1052	32	7.9	14.0	268
10	680	32	9.7	18.3	284
11	934	32	8.4	15.8	274
12	1145	28	6.4	4.9	173
13	886	28	7.3	8.2	188
14	1215	28	6.2	4.1	171

TABLE 5.1-13

ST LUCIE UNITS 1 and 2: AREA OF ISOTHERMS UNDER STAGNANT OCEAN CONDITIONS

Test No.	Discharge Flow (cfs)	Discharge Temp Rise (^oF)	Areas (acres) Enclosed by Isotherms 5^oF	2^oF
15	2003	32	14.6	644
16	2003	32	14.0	605
17	1770	32	18.3	677
18	1770	32	15.6	660
19	2290	28	4.9	405
20	2290	28	8.2	353
21	2290	28	4.1	422

TABLE 5.1-14

ST LUCIE UNITS 1 AND 2: TRAVEL TIME ALONG THE PLUME CENTER LINES UNDER STAGNANT OCEAN CONDITIONS

Test No.	Discharge Flow (cfs)	Discharge Temp Rise (^{o}F)	Travel Time Up to $20^{o}F$ (sec)	Travel Time Up to $10^{o}F$ (sec)	Travel Time Up to $5^{o}F$ (min)	Travel Time Up to $2^{o}F$ (min)
15	2003	32	6	14	7.3	165
16	2003	32	6	13	7.0	172
17	1770	32	8	19	9.5	193
18	1770	32	6	15	7.7	188
19	2290	28	5	10	4.2	104
20	2290	28	6	13	5.8	98
21	2290	28	4	10	3.8	95

TABLE 5.1-15

PERCENTAGE LOSS ESTIMATES OF FISH LARVAL ENTRAINMENT BASED ON PLANT OPERATING AND ICHTHYOPLANKTON SAMPLING STATISTICS ST LUCIE PLANT 1976, 1977 AND 1978

Year	Category	Variables[a] C_r	C_p	Q_r	Q_p	m	Percentage loss (mean depth-9.2m) $\frac{mC_p}{C_r} \neq 1$	$\frac{mC_p}{C_r} = 1$	Percentage loss (mean depth-3.0m) $\frac{mC_p}{C_r} \neq 1$	$\frac{mC_p}{C_r} = 1$
1976	eggs	3.848	1.259	5474[1785]	32.36	1.0	0.19	0.59	0.59	1.81
	larvae	0.205	0.041	5474[1785]	32.36	1.0	1.07	0.59	3.29	1.81
1977	eggs	0.429	0.366	5474[1785]	32.36	1.0	0.50	0.59	1.55	1.81
	larvae	1.345	0.028	5474[1785]	32.36	1.0	0.01	0.59	0.04	1.81
1978[b]	eggs	2.709	1.503	5474[1785]	32.36	1.0	0.40	0.59	1.23	1.81
	larvae	0.421	0.087	5474[1785]	32.36	1.0	0.15	0.59	0.47	1.81

[a] C_r = Geometric mean concentration of organisms per m^3 (based on surface tows only) in offshore areas (Stations 0 through 5).

C_p = Geometric mean concentration of organisms per m^3 in the intake water (Station 11).

Q_r = Flow in m^3 per second past the plant, based on a cross-sectional area of 32,200m^2; numbers in brackets are based on a cross-sectional area of 10,500m^2.

Q_p = Water flow in m^3 per second through the plant intake, based on maximum recorded daily value.

m = Mortality rate of entrained organisms (assumed to be 100%, making m = 1.0).

b = Mean numbers of eggs or larvae per m^3 are calculated from data collected from 14 December 1977 through 28 November 1978.

TABLE 5.1-16

SUMMARY OF ST LUCIE UNIT 1 IMPINGEMENT SAMPLING (MARCH 1976 - DECEMBER 1978)[1]

	1976	1977	1978
Days Sampled/Days on-line (%)	45/192 (23.4%)	97/339 (28.6%)	84/297 (28.3%)
FINFISH			
Mean Number Impinged/24 hours[2]	351	223	92
Mean Weight (kg) Impinged/ 24 hours[2]	1.2	2.7	1.2
Species' Relative Abundance (%)	Anchovy: 54.4 Jack: 30.8 Remaining: <2.8*	Grunt: 50.3 Anchovy: 28.0 Mojarra: 6.7 Jack: 4.7 Remaining: <2.9	Anchovy: 18.2 Jack: 15.0 Croaker: 14.5 Mojarra: 12.5 Herring: 9.9 Grunt: 7.2 Remaining: <3.8
Species' Representative Weight (%)	Anchovy: 22.9 Jack: 12.2 Grunt: 10.7 Remaining: <5.8	Jack: 40.9 Grunt: 31.1 Mojarra: 3.7 Croaker: 3.6 Filefish: 3.4 Anchovy: 3.1 Remaining: <1.5	Jack: 20.7 Mojarra: 9.0 Herring: 6.1 Croaker: 5.0 Anchovy: 1.7 Remaining: <4.8
Peak Sampling Period	October	August	December
Number Commercially-Important Organisms Impinged (Annual Total)	10	76	37
SHELLFISH			
Mean Number Impinged/24 hours[2]	72	72	101
Mean Weight (kg) Impinged/ 24 hours[2]	0.8	0.3	0.5
Species' Relative Abundance (%)	Shrimp: 78.2 Blue Crab: 21.4 Remaining: <0.4	Shrimp: 88.7 Blue Crab: 10.1 Remaining: 0.8	Shrimp: 84.1 Blue Crab: 15.6 Remaining: 0.2
Species' Representative Weight (%)	Blue Crab 75.3 Shrimp: 23.9 Remaining: <0.7	Blue Crab 54.9 Shrimp: 42.1 Remaining: <2.3	Shrimp: 53.3 Blue Crab: 44.8 Remaining: <1.7

TABLE 5.1-16

	1976	1977	1978
Peak Sampling Period	November	August	December

(1) Summarized from Annual Monitoring Reports, Applied Biology, Inc, 1977-1979.
(2) Means for 1976/1977 data are arithmetic means; 1978 means are geometric.

*Each remaining taxon comprised no more of the sample than the percentage shown.

TABLE 5.1-17

THERMAL TOLERANCE DATA: ORGANISMS INDIGENOUS TO HUTCHINSON ISLAND OFFSHORE ENVIRONMENT

Organism	Physiological Response	Temperature (°F)	Reference
PHYTOPLANKTON			
Nitzschia sigma	Optimal growth	77	26
Chaetoceros laciniosus	Upper lethal	84.2	27
Skeletonema costatum	Upper lethal (68°F acclimation)	93.2	27
Rhizosolenia delicatula	Optimal growth	55.4	28
Skeletonema costatum	Upper lethal	98.6	29
Nitzschia filiformis	Optimal growth	78	30
various marine diatoms	Optimal abundance	87.8 - 95.0	31
12 spp salt marsh epiphytes	Chronic exposure: 0% survival	102.2	32
Nitzschia acicularis	Optimal growth Depressed growth Upper lethal	77 91.4 95	33
Gymnodinium simplex	Optimal growth	73.4 - 82.4	34
Prorocentrum	Optimal growth	77	34
various marine diatoms	No growth	>102	35
ZOOPLANKTON			
Acartia tonsa	Normal nauplii development	41 - 77	36
Acartia tonsa	<25% mortality	96.8 (6 hours)	37

TABLE 5.1-17 Sheet 2 of 5

Organism	Physiological Response	Temperature (°F)	Reference
Crystal River estuary spp	Increased mortality	95	38
Penaeus aztecus	LT50 (10,000 minutes)	95 - 96.8	39
	LT50 (24 hour acclimation T = 75.2, 84.2, 93.2°F)	97.3, 99.5, 100.9	
P. setiferus	LT50 (10,000 minutes; acclimation T=84.2, 93.2°F)	96.8, 98.6	39
	LT50 (24 hour;acclimation T=84.2, 93.2°F)	100.9, 102.2	
P. setiferus	Good growth	89.6	40
P. aztecus	No growth	95	40
MACROINVERTEBRATES			
Puerto Rico benthic fauna	Decreased species diversity Decreased biomass	95	41
Tampa Bay fauna	Restrictive to benthic fauna	89.6-91.4	42
Biscayne Bay fauna	Optimal temperature	78.8-82.4	43
	50% reduction in representative species	95-102.2	43
Phragmatopoma lapidosa	Optimal larval development (to age 48 hrs)	75.2-78.8	44
	LT50 (48 hr exposure from fertilization)	85.1	
	No embryonic development	95	
Biscayne Bay ophiuroids	Upper instantaneous lethal temperatures	99.5-104.9	45
ICHTHYOPLANKTON			
Frog fish embryo, larvae	Observed temperature range	70-81	46
Silverside prejuvinels	Thermal tolerance range	46-95	47,48
Silverside embryos, larvae	Incipient lethal (upper)	82.4	49,50

TABLE 5.1-17

Organism	Physiological Response	Temperature (^oF)	Reference
Jacks embryo larvae	Observed range	82.4	51
Menhaden larvae	Observed range	32-77	52
Sardine larvae	Thermal tolerance range	79-92	53
Sheepshead minnow juvenile	Observed range	109.4	54
Tarpon larvae	Observed range	68-90	55,56
Bay anchovy larvae, embryo	Incipient lethal	82	53
Striped anchovy embryo	Incipient lethal	69.8	57
Clingfish embryo	Optimal temperature	75	58
Neon goby embryo	Observed range	82.4	59
Code goby embryo	Observed range	59.9-87.8	60
Striped mullet embryo, larvae	Thermal range	45.9-87.1	61
Striped mullet larvae	Incipient lethal	89.6	57
Speckled worm eel larvae	Observed range	64.4-75.2	62
French grunt juveniles	Critical thermal max	96.8-100.4	63
Spot post larvae-juveniles	Critical thermal max	88	64
Pinfish post larvae juveniles	Critical thermal max	87.8	64

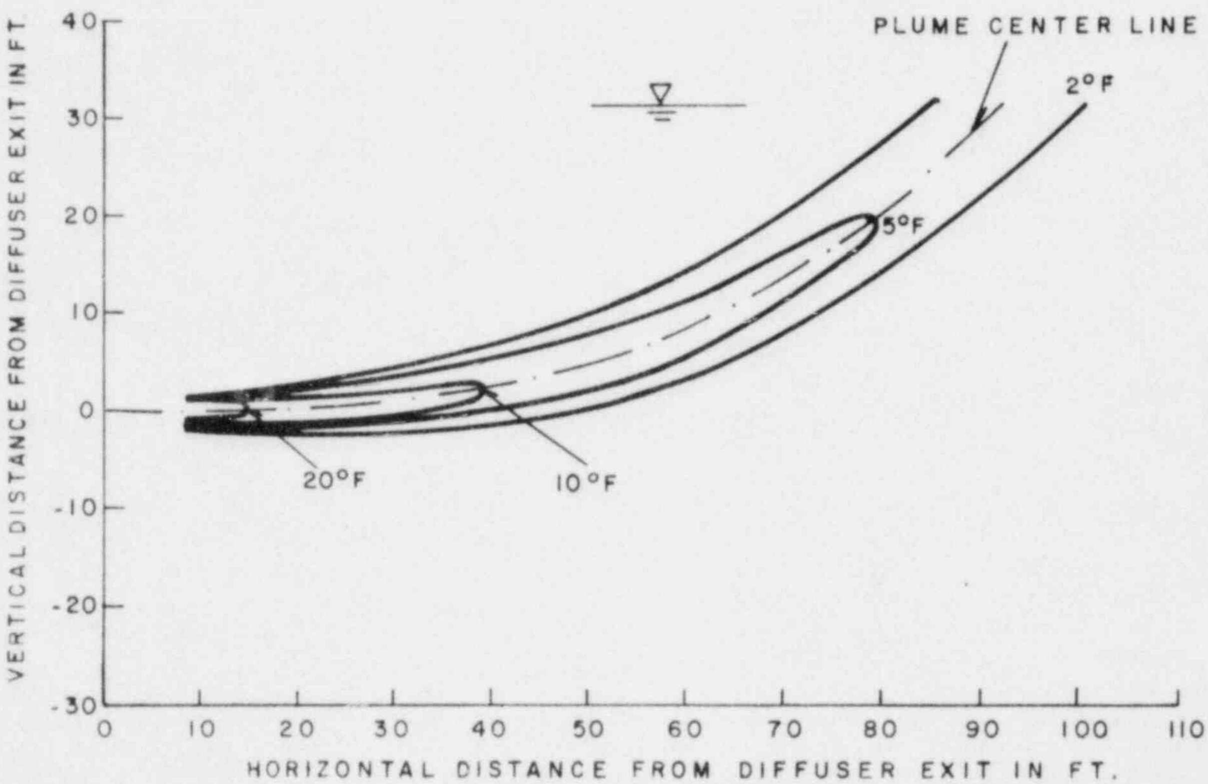
TABLE 5.1-17

Organism	Physiological Response	Temperature (^oF)	Reference
Drum larvae	Optimal larval develop-	76	65
	24-hour LT50	82-90	
Menhaden	Critical thermal maximum	85	66
Spot	Critical thermal maximum	88	
Pinfish	Critical thermal maximum	88	
FISH - SHELLFISH			
Gray snapper	Lower tolerance limit	52-57	67
Spot	Observed range	34-96	68
Atlantic croaker	Observed range	32-96	
Mummichog	Upper lethal (10,000 minutes)	97.4	69
	Incipient lethal	99.5	70
Mullet	96 hour TL50	98	71
Pompano	96 hour TL50	97	71
Blue crab	96 hour TL50	98	
Menhaden	Incipient lethal	91.4	72
Bay anchovy	Observed ranged	47-91	73
Clingfish	Incipient lethal	88	58
Crested goby	Observed range	81-82	74
Atlantic mackerel Bluefish Tautog	61-190% increase in swim speed	increases over ambient	75
Tropical marine fishes	Observed range	88-90	57
	Maximum survival temperature	95	
Boney fishes	Upper lethal	100	76
Sharks/rays	Upper lethal	86	
Marine fishes	No large or diverse populations	>95	77
Galveston Bay fishes	Observed range	91-95	78,79
	Decreased spp diversity	>95	

TABLE 5.1-17 Sheet 5 of 5

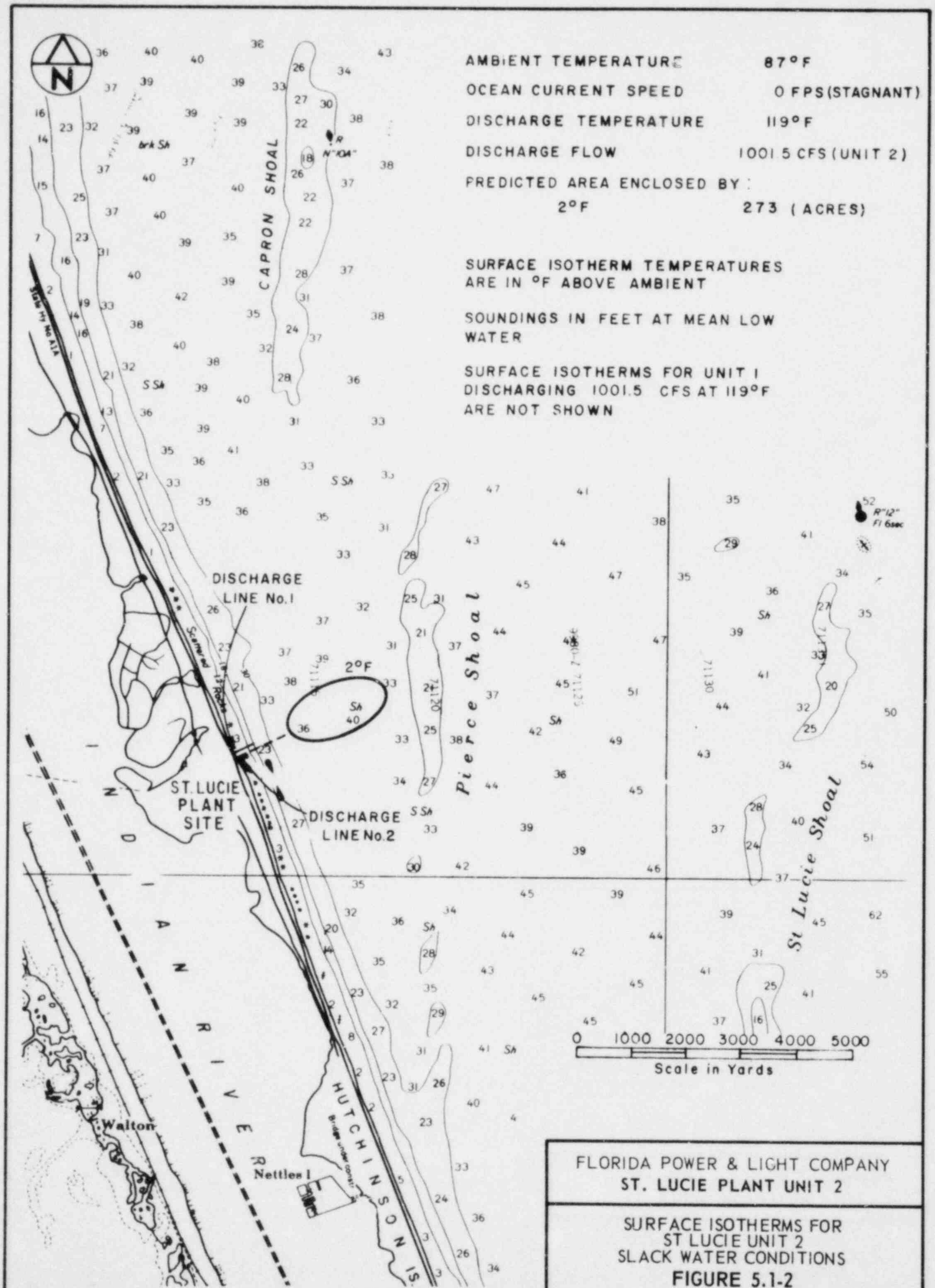
Organism	Physiological Response	Temperature (^{o}F)	Reference
Atlantic croaker, Sea catfish	Occurrence	99	
Striped mullet	Occurrence	104	78,79
Gulf menhaden, Bay anchovy	Avoidance behavior	86-91	78,79
Sea catfish Gulf menhaden	Occasional mortality		78,79
King mackerel	Minimum of range	68	80
Spanish mackerel	Ripening of gonads Spawning	72 78	81
Bluefish	Preferred thermal range Increased swimming speed	66-72 $>$85	82

DISCHARGE EXIT VELOCITY 12.4 FPS
DISCHARGE FLOW RATE AT DIFFUSER OUTLET 1001.5 CFS
DISCHARGE EXIT TEMPERATURE 119.0°F
AMBIENT TEMPERATURE 87.0°F
OCEAN CURRENT SPEED 0 FPS
DETENTION TIME TO REACH SURFACE 26 SECS



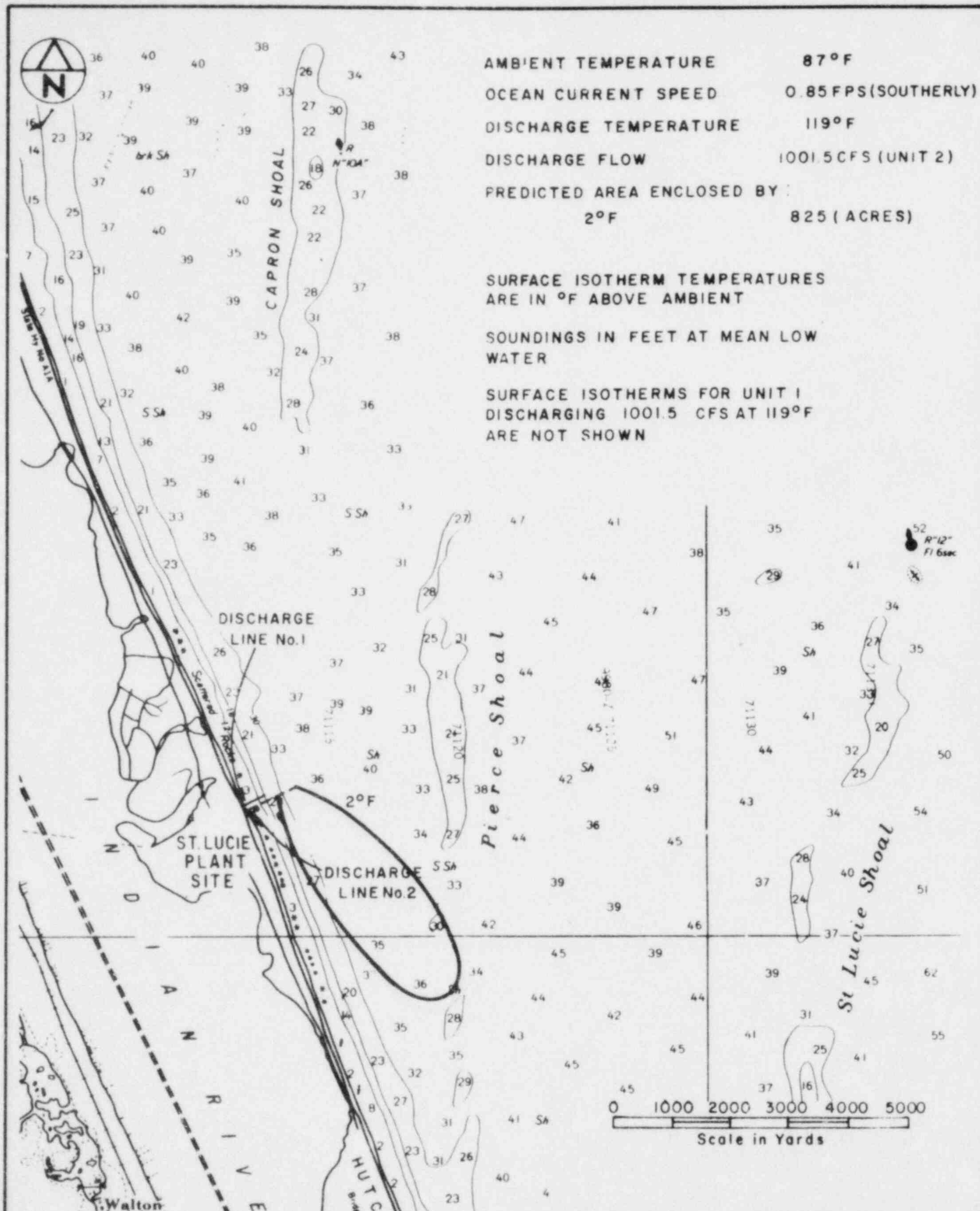
FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

SUBSURFACE ISOTHERMS FOR
ST LUCIE UNIT 2
SLACK WATER CONDITIONS
FIGURE 5.1-1



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

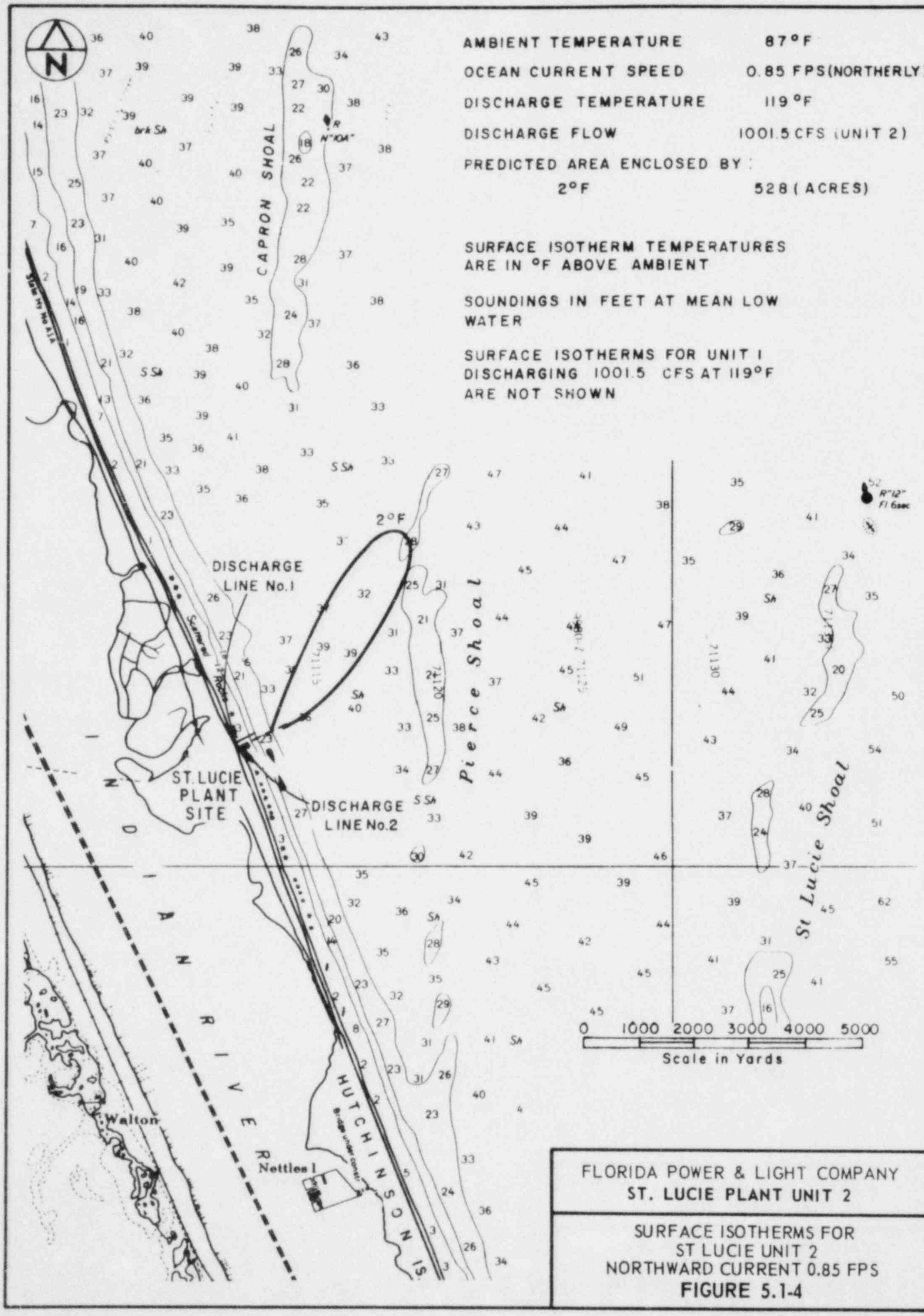
SURFACE ISOTHERMS FOR ST LUCIE UNIT 2 SLACK WATER CONDITIONS
FIGURE 5.1-2



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

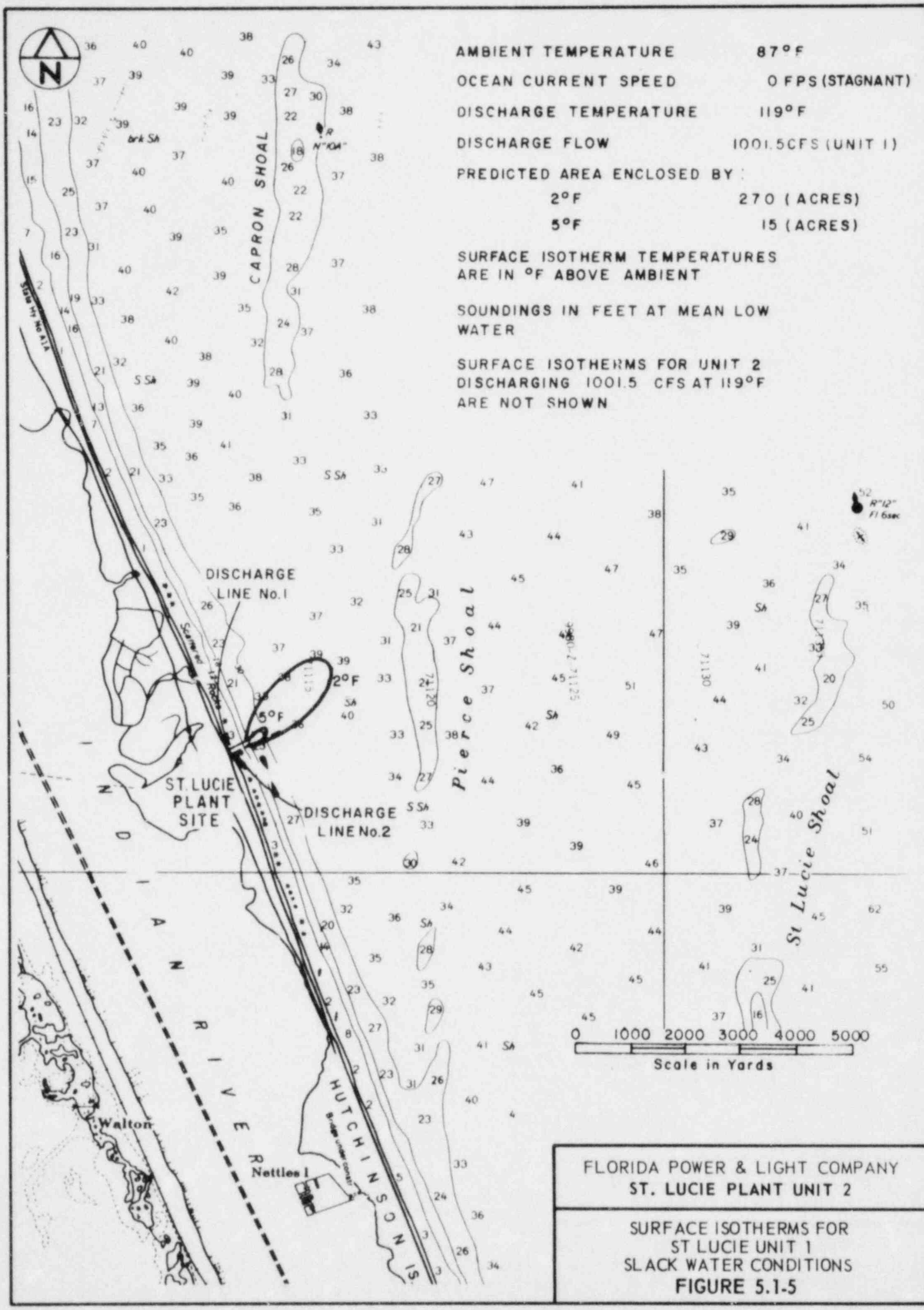
SURFACE ISOTHERMS FOR ST LUCIE UNIT 2 SOUTHWARD CURRENT 0.85 FPS

FIGURE 5.1-3



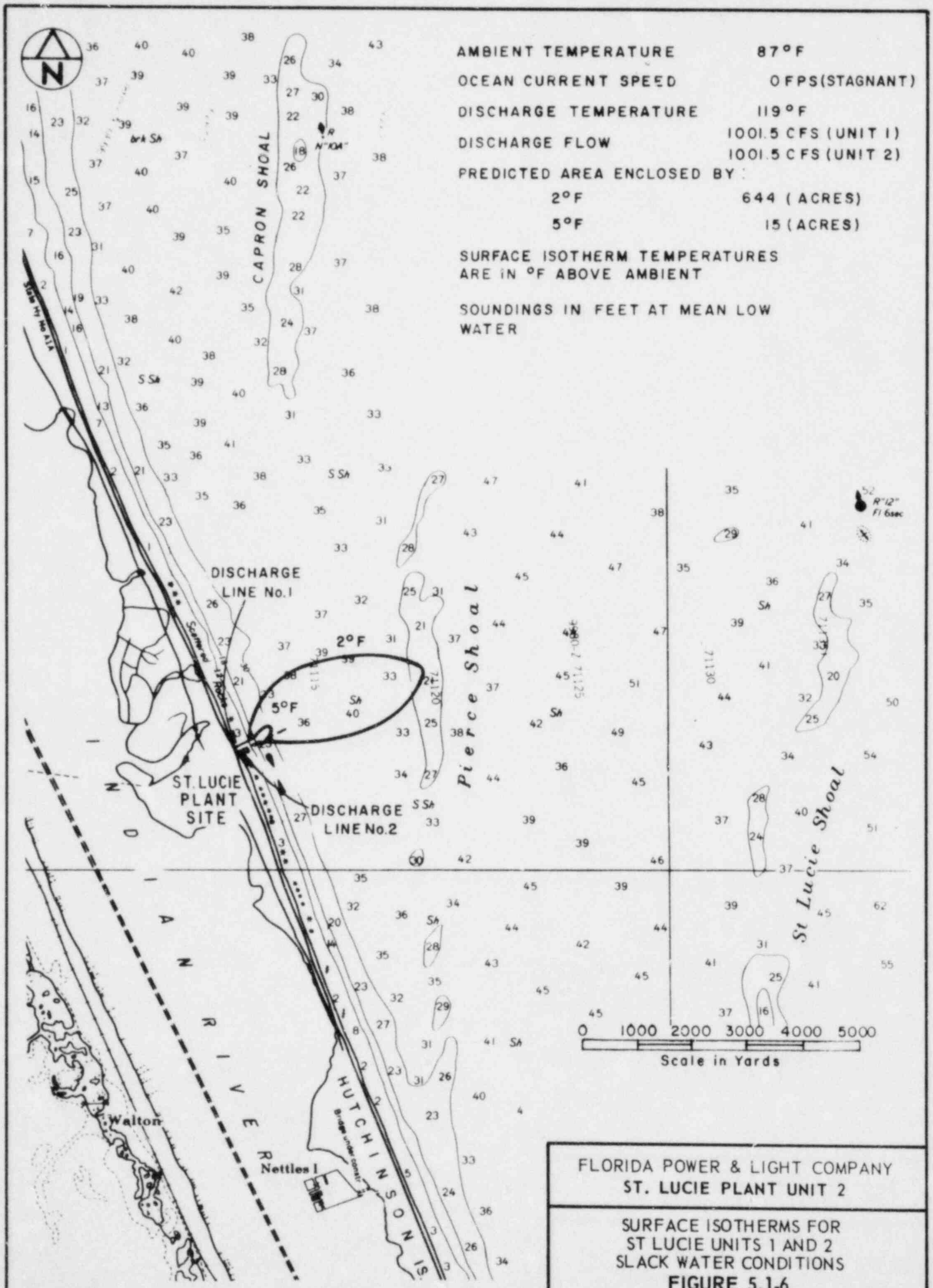
FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

SURFACE ISOTHERMS FOR
ST LUCIE UNIT 2
NORTHWARD CURRENT 0.85 FPS
FIGURE 5.1-4



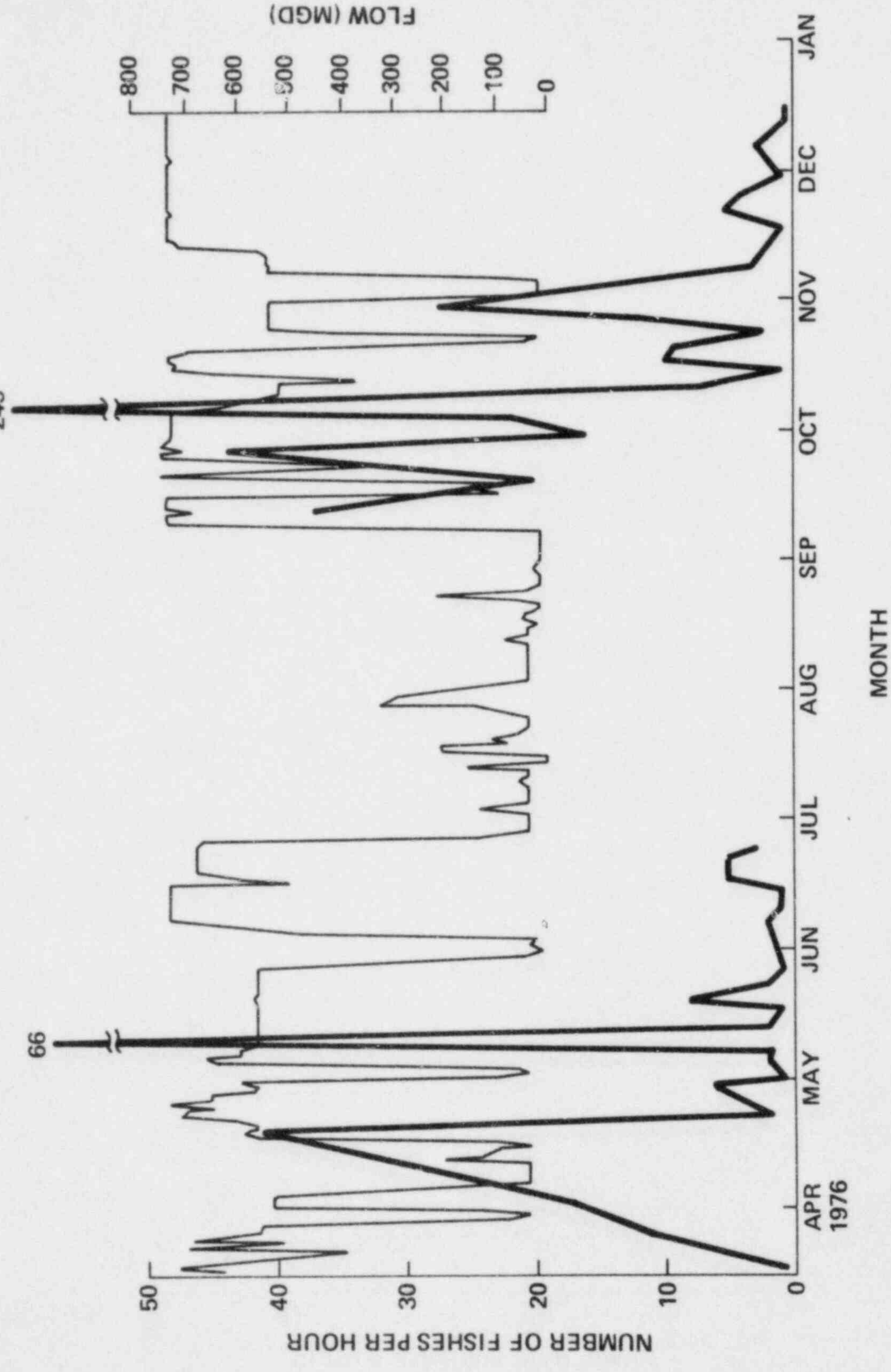
FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

SURFACE ISOTHERMS FOR
ST LUCIE UNIT 1
SLACK WATER CONDITIONS
FIGURE 5.1-5



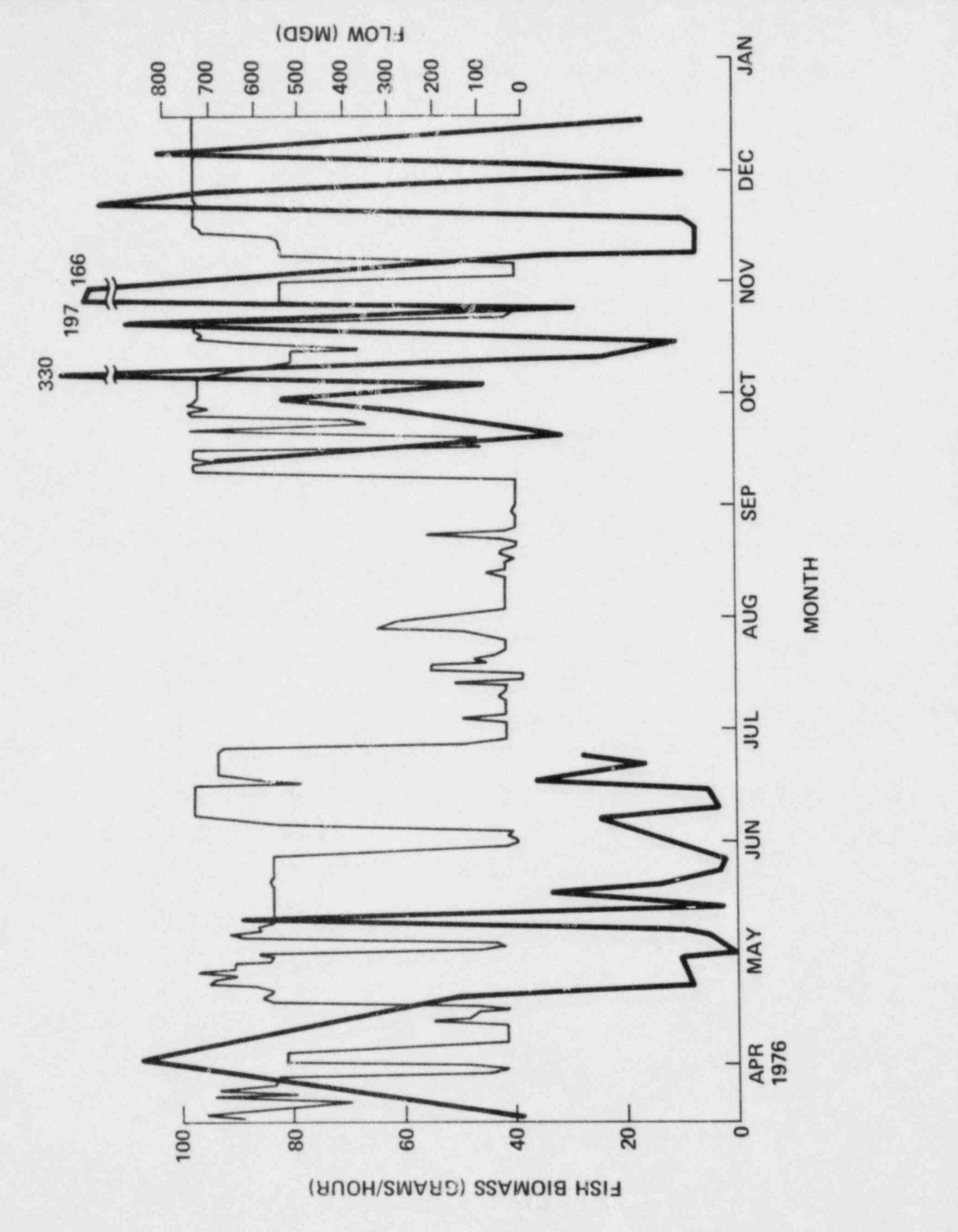
FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

SURFACE ISOTHERMS FOR
ST LUCIE UNITS 1 AND 2
SLACK WATER CONDITIONS
FIGURE 5.1-6



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

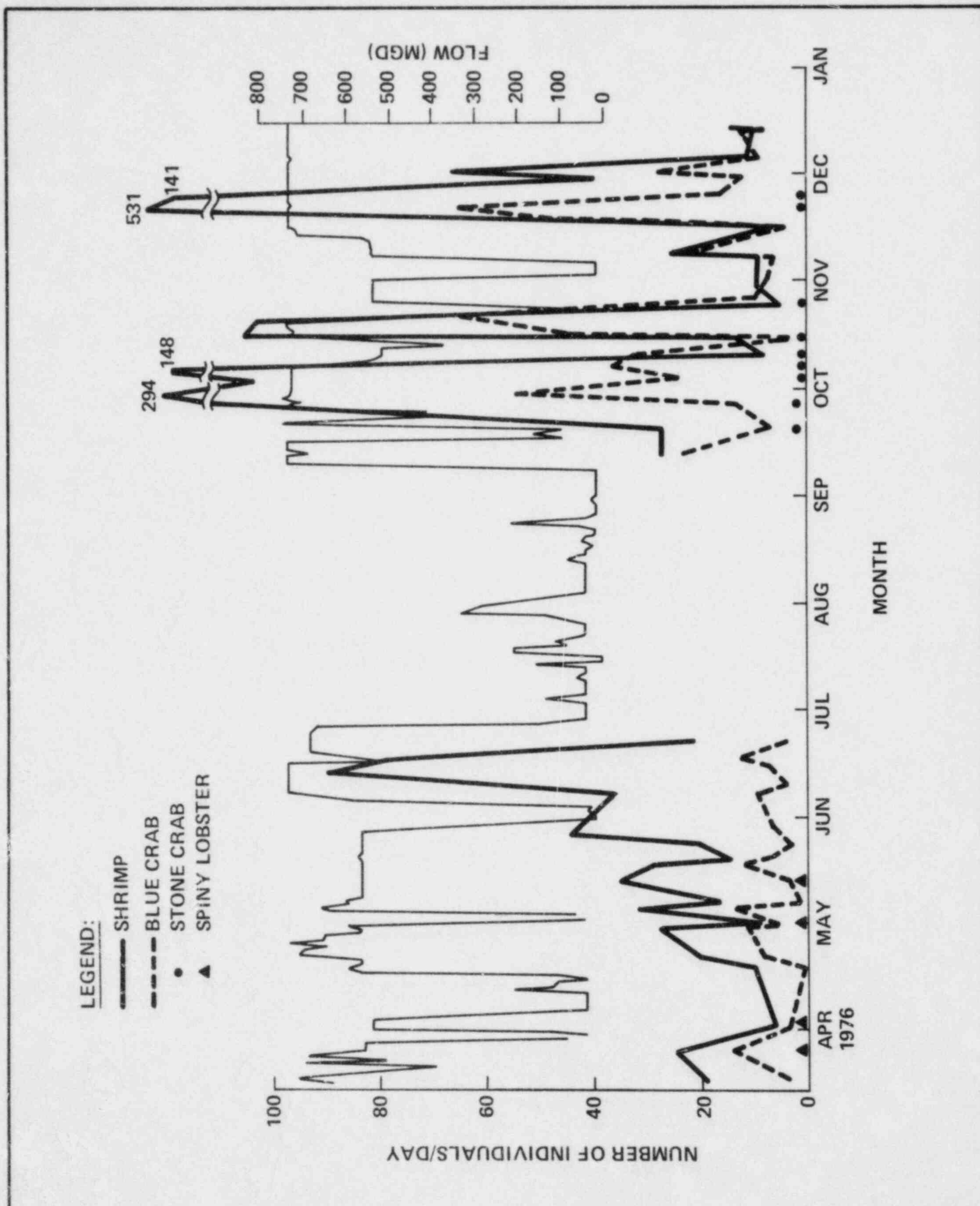
NUMBER OF FISH IMPINGED
VS. PLANT FLOW IN 1976
FIGURE 5.1-7



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

FISH BIOMASS COLLECTED VS.
PLANT FLOW IN 1976

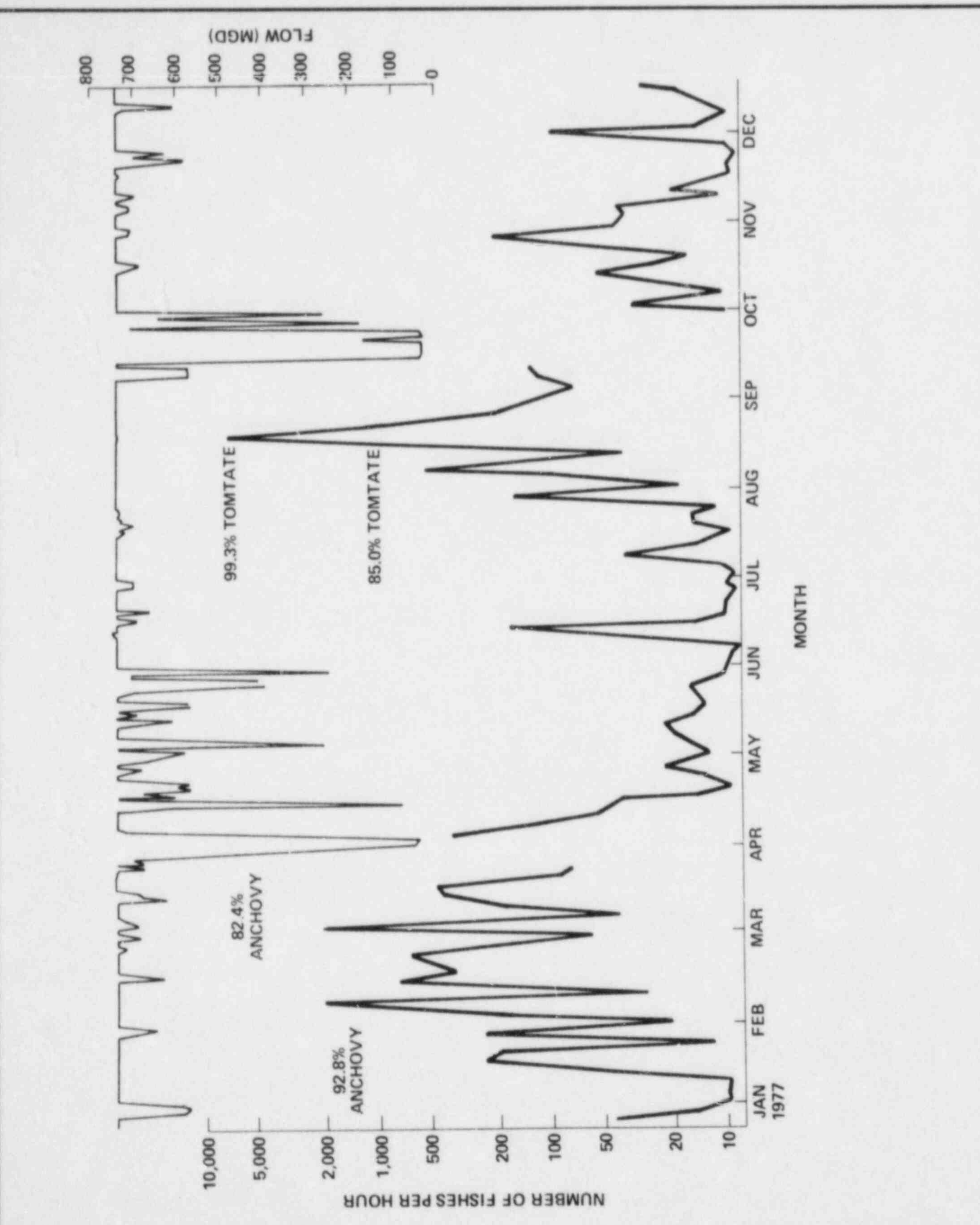
FIGURE 5.1-8



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

NUMBER OF SHELLFISHES IMPINGED VS. PLANT FLOW IN 1976

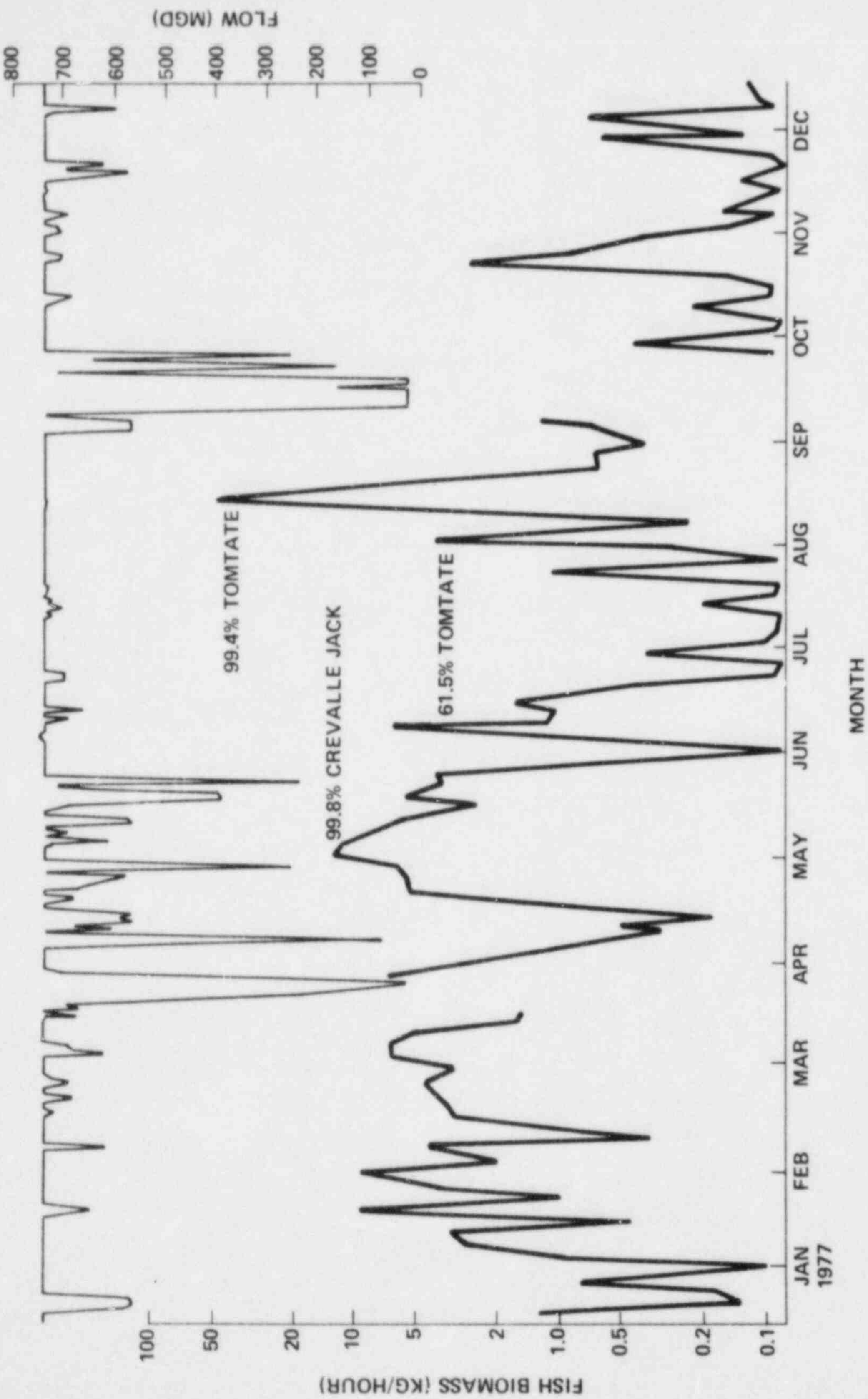
FIGURE 5.1-9



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

NUMBER OF FISHES IMPINGED VS. PLANT FLOW IN 1977

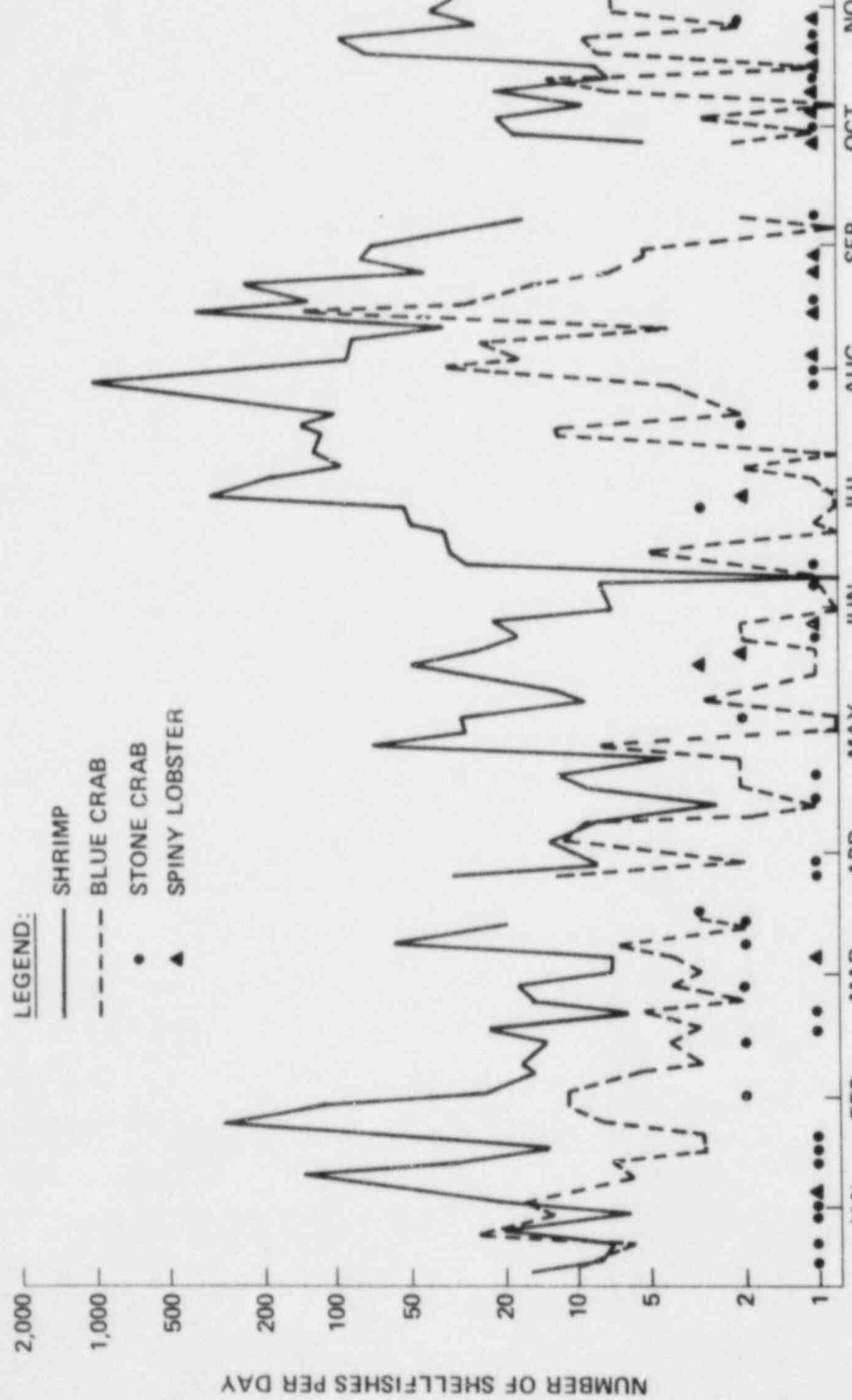
FIGURE 5.1-10



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

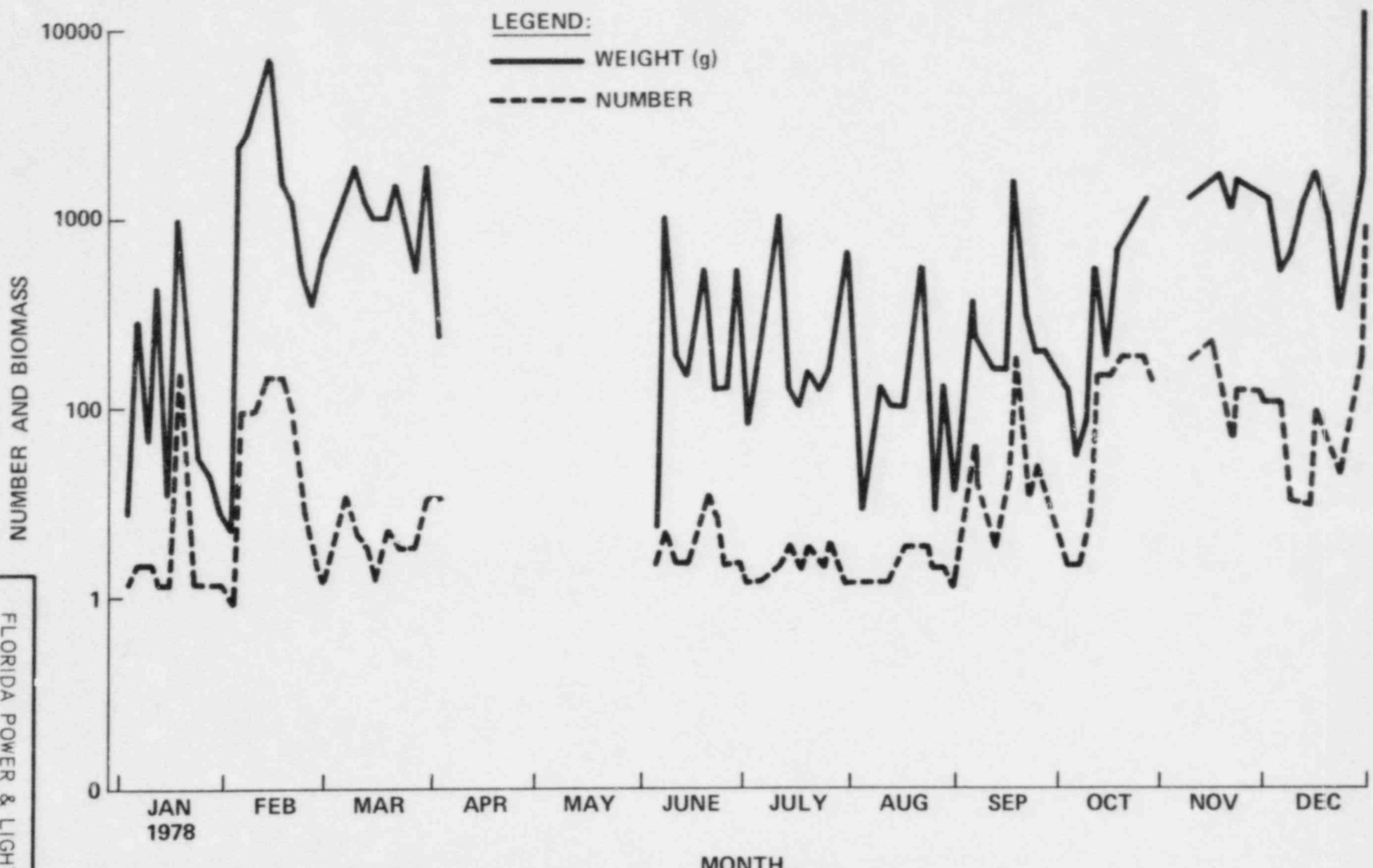
FISH BIOMASS COLLECTED VS.
PLANT FLOW IN 1977

FIGURE 5.1-11



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

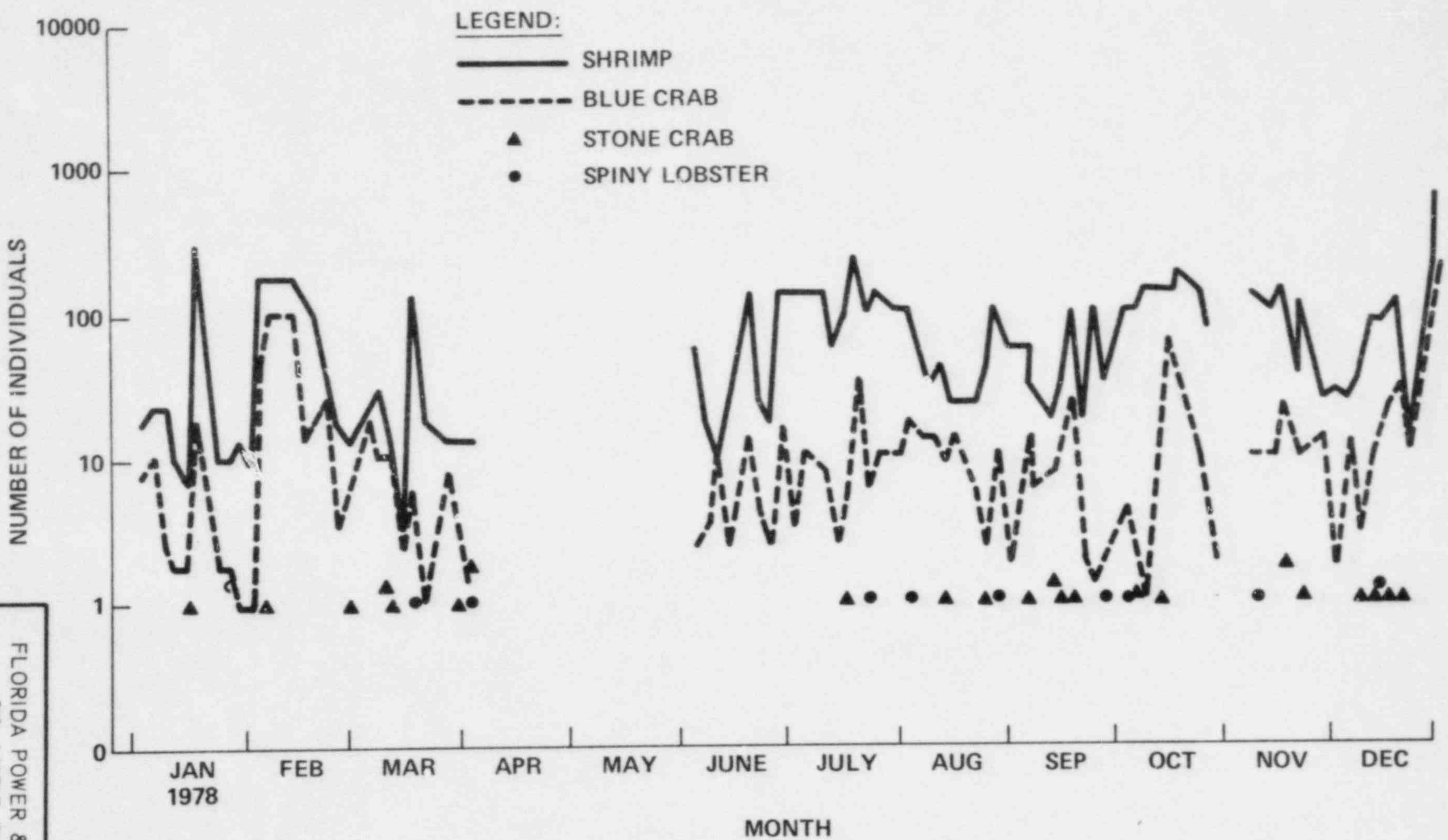
NUMBER OF SHELLFISHES IMPINGED PER DAY IN 1977
FIGURE 5.1-12



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

NUMBER OF INDIVIDUALS & BIOMASS OF FISHES IMPINGED PER 24-HOUR SAMPLING PERIOD IN 1978

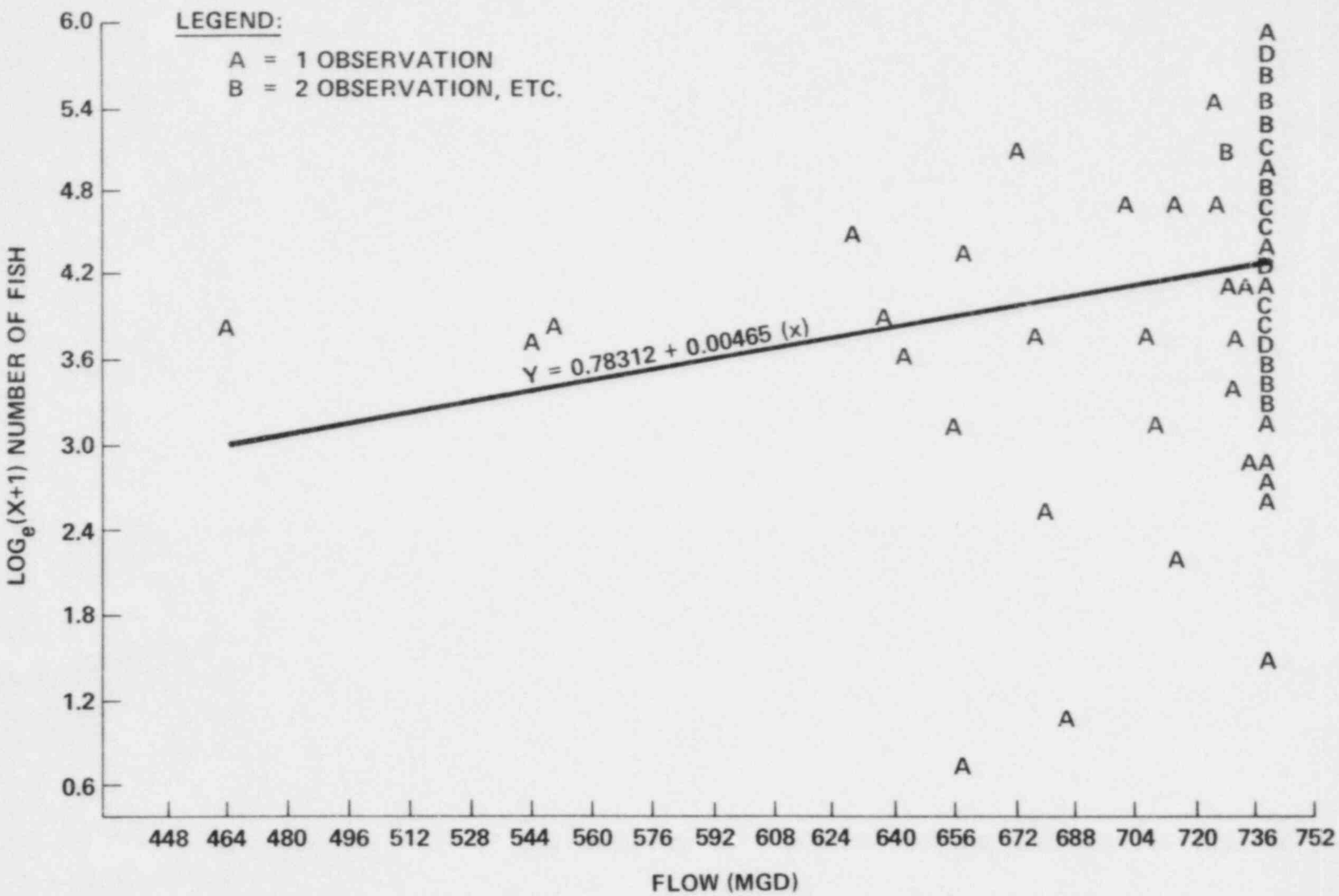
FIGURE 5.1-13



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

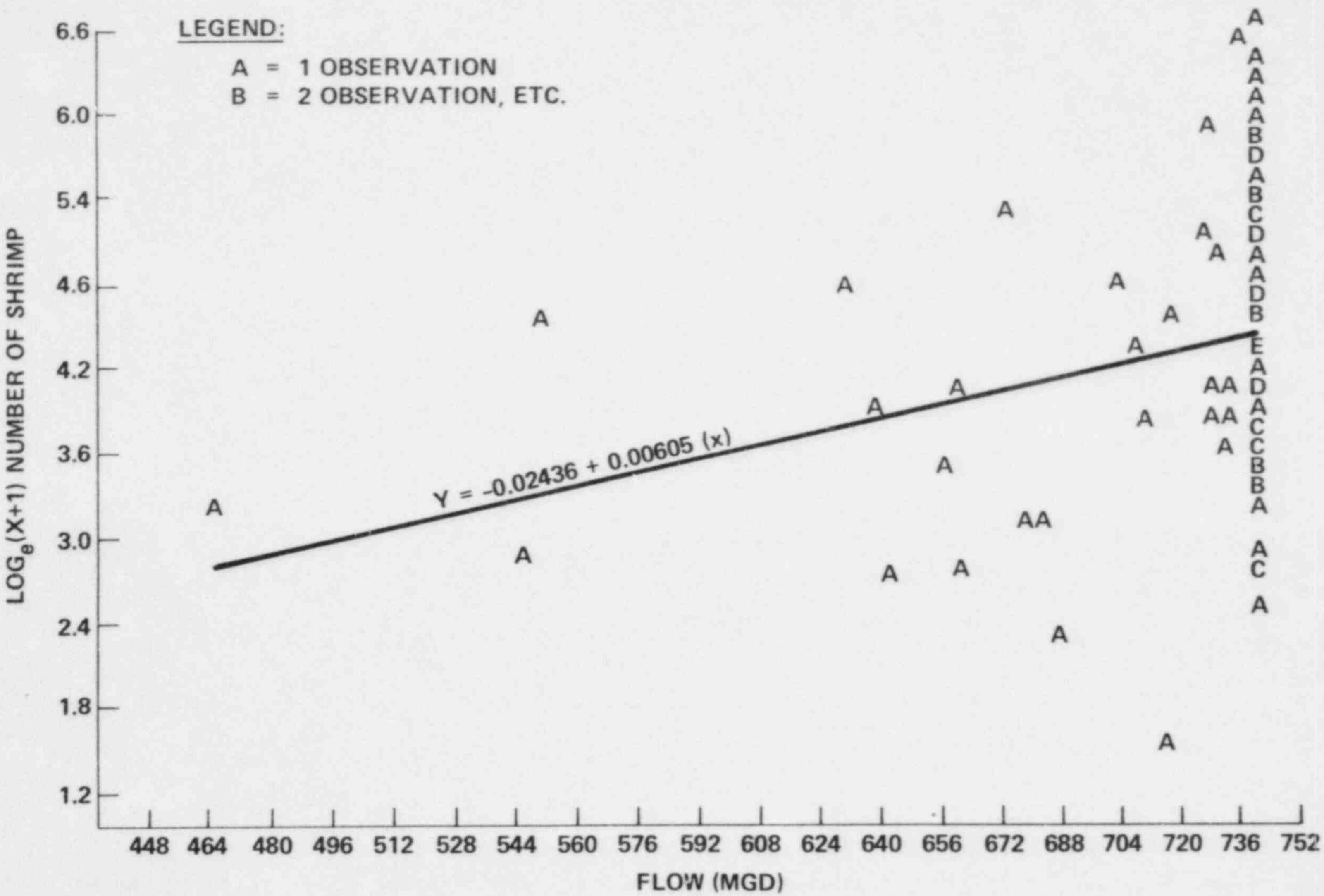
NUMBER OF SHELLFISHES IMPINGED PER 24-HOUR SAMPLING PERIOD IN 1978

FIGURE 5.1-14



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

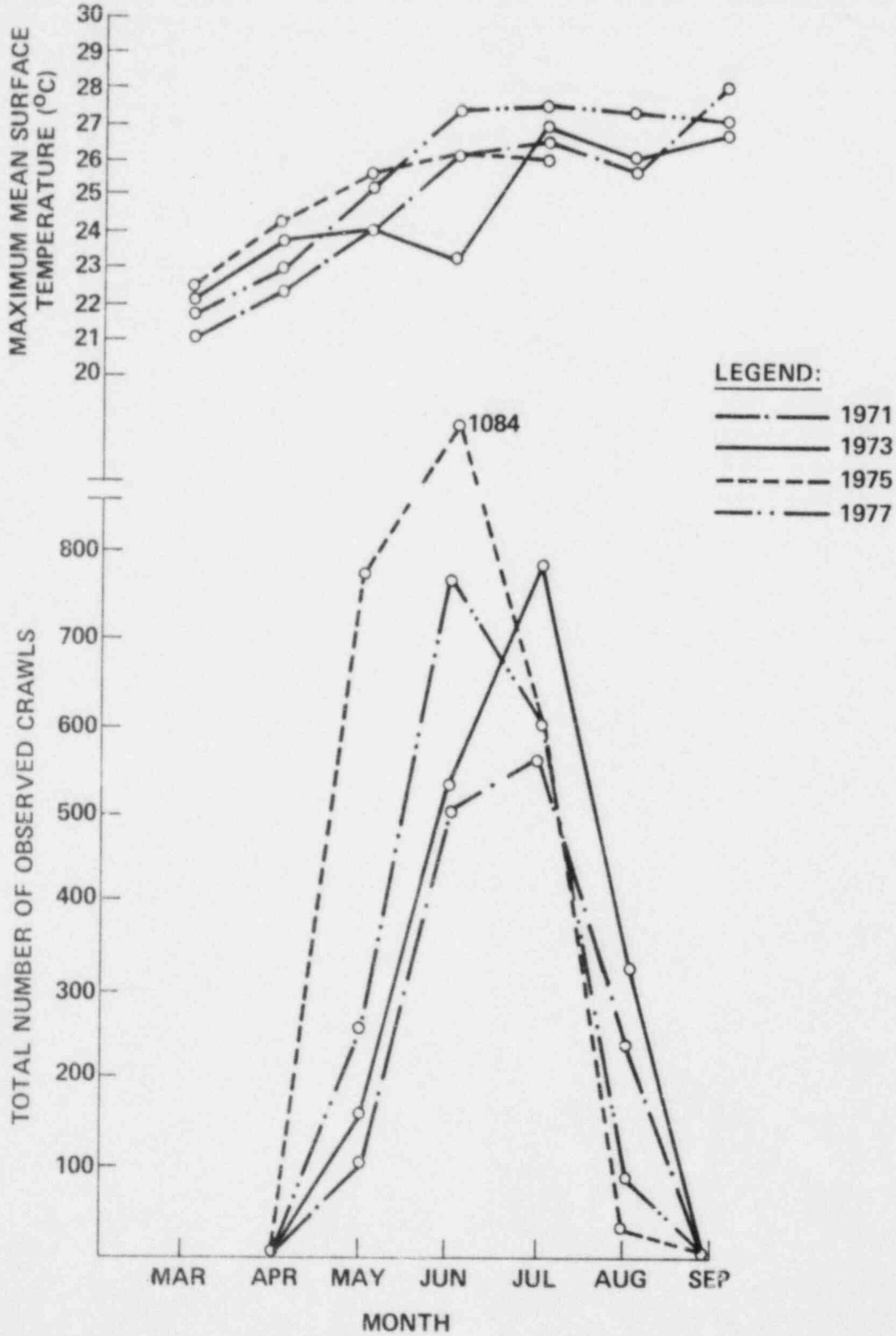
FISH IMPINGEMENT VS. PLANT FLOW,
3 JANUARY – 14 NOVEMBER 1978
FIGURE 5.1-15



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

SHRIMP IMPINGEMENT VS. PLANT FLOW,
3 JANUARY – 14 NOVEMBER 1978

FIGURE 5.1-16



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

COMPARISON OF MARINE TURTLE NESTING ACTIVITY TO OCEAN WATER TEMPS. BY MO. & YR, HUTCHINSON ISLAND

FIGURE 5.1-17

5.2 RADIOLOGICAL IMPACT FROM ROUTINE OPERATION

As discussed in Section 3.5, small quantities of radioactive materials will be released to the environment during normal operation. These materials will be dispersed in the air and water in the vicinity of the site and will present a source of radiation exposure in the area. It is expected that this will result in radiological impacts that are a small fraction of those from naturally occurring radiation.

The fundamental equation which is used to calculate the radiological impact of plant releases is:

$$R_{ipr} = C_{ip} U_p D_{ipr}$$

where:

R_{ipr} = the dose rate to organism r from nuclide i via pathway p.
C_{ip} = the concentration of nuclide i in the medium of pathway p.
U_p = usage, i.e., the exposure time or intake rate associated with pathway p.
D_{ipr} = the dose factor for organism r from nuclide i via pathway p.

The above equation may be tailored to calculate the dose rate from intake of, as well as exposure to, radionuclides for each organism. The specific models that have been used are those presented in NRC Technical Report WASH-1258 for biota other than man and in NRC Regulatory Guide 1.109 Rev 1 (1977) for man.

5.2.1 EXPOSURE PATHWAYS

5.2.1.1 Organisms Other Than Man

Aquatic biota will be exposed to external radiation from radionuclides in the water and sediment and to internal radiation from the assimilation of these radionuclides. In addition to uptake via the ingestion of food organisms, fish and invertebrates can acquire radionuclides through direct absorption from the water and can at least partially assimilate radioactivity from ingested sediment. Figure 5.2-1 is a flow chart representing the transfer of radionuclides through the aquatic ecosystem.

In the aquatic environment, the first trophic level consists predominantly of diatoms, dinoflagellates and bluegreen algae (Section 2.2.2). The second trophic level is predominantly zooplankton of the order Copepoda. These organisms feed on phytoplankton and serve as the link in the food chain between the first and higher trophic levels. A benthic population feeds on phytoplankton, zooplankton and organic detritus.

Section 2.2.2 presents a list of the local and migratory fish observed offshore of Hutchinson Island. The fish of greatest importance to the St Lucie County fin fishery are the migratory fish; king mackerel (Scomberomorus cavalla), Spanish mackerel (Scomberomorus maculatus) and bluefish (Pomatomus saltatrix). These fish feed upon smaller fish, which in turn feed upon organisms of lower trophic levels.

The sea turtles Caretta caretta and Chelonia mydas are listed, respectively, as threatened and endangered by the US Fish and Wildlife Service (Section 2.2.1). These turtles nest in the sand along the shore of Hutchinson Island and feed in the sea offshore. Caretta is generally carnivorous while Chelonia is generally herbivorous.

Figure 5.2-2 presents the pathways by which terrestrial biota in the vicinity of Hutchinson Island are exposed to radionuclides released in the gaseous effluent of St Lucie Unit 2. The specific wildlife species involved in this food web are numerous and are listed in Section 2.2.1.

5.2.1.2 Man

Figure 5.2-3 presents the various potential pathways to man. These potential pathways may be divided into two categories: those pathways resulting in a radiation dose via internal exposure, and those pathways resulting in a dose via external exposure. External exposure occurs if an individual is immersed in a cloud containing radioactive gaseous effluents, or, if while swimming or engaged in some similar activity, comes in direct contact with water containing radioactive liquid effluents. Internal exposures result from radioactivity contained in various foods and by inhalation.

5.2.1.2.1 Internal Exposure

Liquid effluents are discharged into the Atlantic Ocean. As a result, there are several potential pathways of internal exposure which are of interest to those assessing the radiological impact of the two units. The marine food chains will be monitored during pre-operational and operational stages in order to accurately assess the radiological impact of the liquid effluents and to verify the accuracy of pre-operational estimates.

The general public receives some small internal dose as a result of the ingestion of locally harvested seafood. The critical radionuclides for fin fish are Cs-134 and Cs-137 which are reconcentrated in the edible flesh of the fish.

The existence of commercial dairy and crop farms in St Lucie and surrounding counties suggests two more possible routes of internal exposure. These routes result from the discharge of radioactive gaseous wastes into the atmosphere. The first is the air-grass-milk-child route, and the second is the air-soil-foodcrop-man route. I-131 is the critical radionuclide for the milk pathway, but Cs-134 and Cs-137 may also contribute. The nearest dairy herd, supplying milk to the St Lucie plant area is located about 14 miles west of the site.

I-131, Cs-134 and Cs-137, which concentrate in the green leafy portions of plants, are the critical radionuclides for the food crop pathway. They enter the chain by direct foliar contamination and root uptake.

There is some beef production west of the plant in an area principally outside of the ten mile radius where the atmospheric dilution factor is of the order of 10^{-7} sec/m^3. It is therefore readily apparent that this does not constitute a significant internal exposure pathway.

The drinking water pathway will not be affected by liquid effluents.

5.2.1.2.2 External Exposure Pathways

People living in the vicinity of or frequenting the plant site will be subject to low level external exposures due to plant liquid and gaseous effluent releases. The principle external exposure from plant liquid effluents would be a result of direct contact with ocean or discharge water while swimming, boating or fishing. The principle external exposure from plant gaseous releases will be the result of immersion in a cloud containing radioactive gaseous effluents.

Large recreational areas are located at least five miles from the plant. The largest is the Savannahs Recreational Area which is located five miles WNW of the plant and features boating, picnicking, swimming, fishing, etc. Other recreational areas include Douglas Memorial Park which is more than five miles north of the plant; a public beach seven miles south of the plant; and camp grounds five miles north of the plant. There are also numerous beach access points near the facility.

5.2.2 RADIOACTIVITY IN THE ENVIRONMENT

In Section 3.5, the radionuclides discharged in the liquid and gaseous effluents are identified. This section discusses the distribution of these effluents in the environment surrounding the St Lucie site. Specifically, estimates have been made for the radionuclide concentration: a) in the water and sediment in the vicinity of St Lucie Units 1 and 2; b) in the atmosphere around the site; and c) on land areas and vegetation surrounding the plant.

The models and assumptions used to determine annual average air concentration (X/Q), depleted concentration, and deposition (D/Q) are described in Section 6.1.3. The meteorological data used in these models is described in Section 2.3. The concentrations were calculated at points within a radial grid of sixteen 22.5 degree sectors centered at true north and extending to a distance of 50 miles from the station. The data points are located in each sector at 0.5, 1.5, 2.5, 3.5, 4.5, 7.5, 15, 25, 35, and 45 miles. In addition, calculations were made at the critical receptors in each sector within five miles of the site. These distances and directions are presented in Table 5.2-1. The terrain/recirculation factors described in Section 6.1.3 are presented in Tables 5.2-2 and 5.2-3. The results of the X/Q, depleted X/Q and D/Q computations are presented in Tables 5.2-4 to 5.2-15.

The highest ground concentrations in the vicinity of the site due to gaseous releases have been calculated using these meteorological data and the source terms presented in Table 3.5-7. The concentrations are presented in Table 5.2-16. The concentrations of radionuclides on the ground and in vegetation are controlled by the deposition of gaseous effluents since irrigation of cropland is not a potential pathway of exposure.

5.2.2.1 Surface Water Models

A simplified approach has been used to predict the transport of liquid radioactive effluents. This approach is conservative in that it will overestimate the radiological impact of the normal operation of St Lucie Unit 2. Discussions of the basic hydrologic and water use data of the area are provided in the St Lucie Unit 2 Environmental Report - Construction Permit.

5.2.2.1.1 Transport Models

Liquid radioactive wastes will be diluted by the circulating water system flow prior to being released to the ocean. Assuming discharge flow rate of 510,000 gpm (corresponding to four pump operation) and the release quantities from Section 3.5, the expected annual average discharge concentrations of radionuclides are presented in Table 5.2-17. Since releases from the various plant processing systems will be on a batch or intermittent basis, peak concentrations have also been calculated and are included in Table 5.2-17. Upon discharge, effluents will be further diluted in the ocean, and an estimate of these diluted concentrations has also been included in Table 5.2-17. A dilution factor of ten has been calculated using the models described in Section 5.1.2. To calculate the maximum radiological impact, it was assumed that the critical biota, including man, are exposed to discharge concentrations, while the diluted concentrations were used to calculate the integrated population doses.

5.2.2.1.2 Sediment Uptake Models

An estimate of the concentrations of radionuclides in the ocean sediment was made using the "effective" surface model presented in the Nuclear Regulatory Commission Regulatory Guide 1.109 Rev 1 (1977). Column 4 of Table 5.2-17 presents the expected activity of the sediment.

Although radionuclide concentrations in the ocean sediment have been calculated, no credit has been taken for concentration reductions of radionuclides in the surface water resulting from sediment uptake.

5.2.2.1.3 Water Use Models

Since the discharge of any liquid wastes will be to the ocean, there will be no exposure via the ingestion of water.

5.2.2.2 Groundwater Models

Plant liquid effluents will be released to the ocean. In addition, because there is no utilization of shallow groundwater from wells, the radiological impact from groundwater is negligible.

5.2.3 DOSE RATE ESTIMATES FOR BIOTA OTHER THAN MAN

Using the models outlined in NRC Technical Report WASH-1258, annual average radiation doses were estimated for terrestrial and aquatic organisms assumed to be living in the vicinity of St Lucie Unit 2. These are the organisms which are expected to receive the greatest exposures.

Table 5.2-18 lists doses to biota associated with the aquatic environment. It can be seen that all doses to organisms directly associated with the aquatic environment are small. Animals not directly associated with the aquatic environment would receive an external dose of less than 0.1 mrad/yr when continuously occupying areas close to the plant boundary. A slight additional thyroid dose may be received by animals feeding close to the plant from the deposition of radioiodines released in the plant's gaseous effluent.

Numerous investigations have been made on the effects of radioactivity on biota. No effects have been observed at dose rates as low as those associated with the plant effluents. Investigations of chironomid larvae, (bloodworms), living in bottom sediments near Oak Ridge, Tennessee, where they were irradiated at the rate of about 230 to 240 rad/yr for more than 130 generations, have shown no decrease in abundance, even though a slightly increased number of chromosome aberrations have occurred[1].

Studies on the Columbia River, Washington, have shown that irradiation of salmon eggs and larvae at a rate of 500 mrad/day did not affect the number of adult fish returning from the ocean or their ability to spawn[2]. Other studies were made on the effect of released radionuclides on spawning salmon in the Columbia River. These studies have shown that when all reactors at the Hanford facility were operating, salmon have not been affected by dose rates in the range of 100 to 200 mrads/wk[3].

Accordingly, there should be no perceptible effect on biota from the radioactive material released by St Lucie Unit 2, since these releases will be many times less than those observed in these studies.

The green turtle, Chelonia mydas, nests in the sand along the ocean shore above the mean high water level and feeds on marine plants in the ocean. Accordingly, they are exposed externally to radioactivity in the air, water, and on the ground, and internally, from radioactivity associated with ingested marine plants. The dose to Chelonia mydas from the various exposure pathways are presented in Table 5.2-18.

The total dose to Chelonia from all pathways is 2.0 mrem/year. The doses from submersion in water, submersion in air, contaminated ground and ingestion of marine plants were analyzed. The ingestion of marine plants growing in the effluent is almost totally responsible for this dose and tritium is the critical radionuclide.

The exposure rate to Chelonia mydas of 2.0 mrem/year reflects the most conservative dose estimate for terrestrial biota. The dose to terrestrial biota from the ingestion of food will be no greater, and usually appreciably lower, than that calculated from Chelonia mydas because Chelonia feeds on marine plants which are expected to have a relatively high radionuclide concentration as compared to terrestrial organisms.

This exposure rate is considered negligible because it has been generally agreed (ICRP-26) that if the dose to biota other than man is comparable to the guidelines for man, there will be no detrimental effects to the biota from this exposure. Templeton et al[2] and the 1972 UNSCEAR Report[4] indicate that at the above doses, no adverse effects to aquatic biota are expected.

5.2.4 DOSE RATE ESTIMATES FOR MAN

A comprehensive evaluation of the individual and population dose rates at the St Lucie site has been performed for the purpose of demonstrating compliance with Appendix I to 10CFR50. The results of this evaluation were originally submitted to the NRC as Amendments 7 and 8 to the St Lucie Unit 2 Environmental Report - Construction Permit.

A complete reevaluation of the offsite exposures and compliance with Appendix I to 10CFR50 was not performed. However, a review of plant design changes and site characteristics has been performed in order to determine if there have been any significant changes since submittal of Amendments 7 and 8 which could alter their conclusions.

The review included the annual site monitoring reports prepared for St Lucie Unit 1, updated meteorological data, and the design of the gaseous and liquid radwaste systems, and building ventilation systems. This review revealed no significant changes which affect offsite doses.

A reanalysis of the source term using the GALE code revealed that the source term is virtually unchanged. Accordingly, the exposures and conclusions provided in Amendments 7 and 8 remain valid. Table 3.5-7 presents the revised source terms.

5.2.4.1 Liquid Pathways

The calculated maximum individual doses from all aquatic pathways of exposure are based on radionuclide concentrations calculated to occur in the circulating water system discharge. These doses are presented in Table 5.2-20. It should be noted that these are doses to a hypothetical individual and that the maximum dose to a real individual will be less. The usage factors and dose calculational models were taken from NRC Regulatory Guide 1.109 Rev 1 (1977).

5.2.4.2 Gaseous Pathways

The calculated maximum individual doses from gaseous pathways of exposure are based on the atmospheric dispersion and deposition rate factors presented in Tables 5.2-13 to 15. The resultant doses are presented in Table 5.2-20. The usage factors and dose calculational models were taken from NRC Regulatory Guide 1.109 Rev 1 (1977).

5.2.4.3 Direct Radiation from Facility

Since the area surrounding the plant to a distance of 0.97 miles (the exclusion area) will be unoccupied, it is not expected that any member of the general public will be close to the plant site long enough to receive any measurable radiation from this pathway. In addition, all radioactive material within Units St Lucie 1 and 2 will be shielded such that the radiation level in all unrestricted areas will be kept below 0.25 mrem/hr. At the nearest residence, this will result in an annual dose from this pathway of less than 0.01 mrem.

5.2.4.4 Annual Population Doses

The radiological impact on the general population will depend not only on the release of radiological material, but also upon the land and water use of the region surrounding the site. Amendments 7 and 8 to the St Lucie Unit 2 Environmental Report - Construction Permit provide a discussion of land and water use near the St Lucie plant site and associated population exposures. Using updated land use information (Section 2.1.3) and source terms (Section 3.5), conservative estimates of general population exposure to radiation have been made. Current food production rates and the estimated population for the year 2000 were used in these calculations. The resultant dose estimates are shown in Table 5.2-19. The major assumptions used in these calculations appear in Table 5.2-22.

5.2.5 SUMMARY OF ANNUAL RADIATION DOSES

Table 5.2-19 summarizes the estimated annual radiation dose to the regional population (during commercial operation of St Lucie Unit 2) from all station-related sources. This tabulation includes, out to a distance of 50 miles from the site: a) the total of the whole-body doses to the population from all water related pathways; b) the total of the whole-body doses to the population attributed to gaseous effluents; and c) the total of the thyroid doses to the population from radioiodine and particulates. Table 5.2-20 compares the calculated individual doses to the design objectives of Appendix I to 10CFR50. The results reveal that the calculated exposures are within the design objective guidelines of Appendix I to 10CFR50 and are a very small fraction of naturally occurring background exposures.

St Lucie Unit 2 is designed to keep radioactive releases as low as is reasonably achievable. Dose calculations based upon the liquid and gaseous release source terms of Section 3.5 show that the normal operation of St Lucie Unit 2 will result in additional whole body doses of less than 0.1 mrem/year to the most exposed individual in the vicinity of the plant, 10^{-3} mrem/year to the average individual within 50 miles of the site, and less than 20 man-rem/year to the population within a 50 mile radius of the site. On the other hand, natural background radiation and medical radiation exposures are likely to result in doses in excess of 60,000 man-rems to the population during the same period. The predicted dose to the most exposed individual is 20 percent of the limits defined in 10CFR50 Appendix I.

Table 5.2-21 shows comparative radiation exposure to the general public. From this table it is evident that the radiation exposures to an individual living as close as possible to St Lucie Units 1 and 2 are insignificant even when compared to naturally occurring variations in background radiation. Variations in natural background radiation, as indicated in this table, have not produced any observable harmful effects.

SECTION 5.2: REFERENCES

1. Blaylock, B G, 1979. Cytogenetic study of a natural population of Chironomus inhabiting an area contaminated by radioactive waste. in: Disposal of Radioactive Wastes into Seas, Oceans and Rivers pp. 835-845.

2. Templeton, W L, R E Nakatani and E E Held, 1971. Radiation Effects. in: Radioactivity in the Marine Environment, Committee on Oceanography, National Research Council, National Academy of Sciences, pp 223-239.

3. Watson D G, and W L Templeton, 1971. Thermal Luminescent Dosimetry of Aquatic Organisms. Third National Symposium of Radioecology, Oak Ridge, TN.

4. Ionizing Radiation: Levels and Effects, A Report of the United National Scientific Committee on the Effects of Atomic Radiation to the General Assembly, with Annexes. Volume II: Effects, United Nations, New York, 1972.

5. Branch Technical Position CSB 6-4, Rev 1, Containment Purging During Normal Plant Operations.

TABLE 5.2-1

ST LUCIE UNIT 2

CRITICAL DISTANCES USED IN ANALYSES (miles)

SECTOR	EXCLUSION ZONE	MILK COW	MEAT ANIMAL	MILK GOAT	RESIDENCE	VEGETABLE GARDEN
NNE	0.97	5.00	5.00	5.00	5.00	5.00
NE	0.97	5.00	5.00	5.00	5.00	5.00
ENE	0.97	5.00	5.00	5.00	5.00	5.00
E	0.97	5.00	5.00	5.00	5.00	5.00
ESE	0.97	5.00	5.00	5.00	5.00	5.00
SE	0.97	5.00	5.00	5.00	5.00	5.00
SSE	0.97	5.00	5.00	5.00	5.00	5.00
S	0.97	5.00	5.00	5.00	4.10	5.00
SSW	0.97	5.00	5.00	5.00	2.30	2.30
SW	0.97	5.00	5.00	2.20	2.00	2.00
WSW	0.97	5.00	5.00	5.00	1.90	1.90
W	0.97	5.00	3.20	5.00	2.10	3.50
WNW	0.97	5.00	4.50	5.00	2.80	3.00
NW	0.97	5.00	5.00	5.00	4.80	5.00
NNW	0.97	5.00	5.00	5.00	5.00	5.00
N	0.97	5.00	5.00	5.00	5.00	5.00

TABLE 5.2-2

FLORIDA POWER & LIGHT COMPANY
ST LUCIE UNIT 2
HUTCHINSON ISLAND, FLORIDA
PERIOD OF RECORD: 8/29/77 TO 8/31/78

TERRAIN CORRECTION FACTORS (PUFF/STRAIGHT LINE)

BASE DISTANCE IN MILES/KILOMETERS

AFTD SEC	DESIGN DIST MI	.50 .80	1.50 2.41	2.50 4.02	3.50 5.63	4.50 7.24	7.50 12.07	15.00 24.13	25.00 40.22	35.00 56.32	45.00 72.40
NNE	0.	1.7E+00	1.4E+00	1.4E+00	1.3E+00	1.4E+00	1.3E+00	1.0E+00	6.6E-01	4.0E-01	2.3E-01
NE	0.	1.7E+00	1.4E+00	1.3E+00	1.2E+00	1.1E+00	1.0E+00	7.8E-01	3.8E-01	2.2E-01	1.3E-01
ENE	0.	1.3E+00	1.1E+00	1.0E+00	9.7E-01	8.9E-01	9.1E-01	5.8E-01	3.1E-01	1.8E-01	1.0E-01
E	0.	1.[illegible]E+00	1.2E+00	1.1E+00	1.1E+00	1.1E+00	1.0E+00	6.9E-01	3.8E-01	1.6E-01	5.6E-02
ESE	0.	1 [illegible].+00	1.3E+00	1.2E+00	1.1E+00	9.6E-01	1.0E+00	5.7E-01	3.0E-01	1.6E-01	8.6E-02
SE	0.	1.7E+00	1.4E+00	1.4E+00	1.3E+00	1.3E+00	1.1E+00	1.0E+00	7.0E-01	4.0E-01	2.2E-01
SSE	0.	1.8E+00	1.3E+00	1.3E+00	1.2E+00	1.2E+00	1.1E+00	8.9E-01	5.7E-01	3.7E-01	2.3E-01
S	0.	1.5E+00	1.1E+00	1.1E+00	1.1E+00	1.0E+00	9.0E-01	6.5E-01	3.9E-01	2.1E-01	1.0E-01
SSW	0.	1.4E+00	1.2E+00	1.2E+00	1.1E+00	1.1E+00	9.4E-01	7.1E-01	4.2E-01	2.8E-01	1.8E-01
SW	0.	1.6E+00	1.2E+00	1.2E+00	1.1E+00	1.2E+00	1.1E+00	8.9E-01	4.5E-01	2.1E-01	9.1E-02
WSW	0.	1.4E+00	1.2E+00	1.1E+00	1.1E+00	1.0E+00	9.0E+01	7.1E-01	5.4E-01	3.6E-01	2.4E-01
W	0.	1.5E+00	1.2E+00	1.1E+00	1.1E+00	1.1E+00	9.9E-01	7.6E-01	3.8E-01	2.0E-01	9.9E-02
WNW	0.	1.6E+00	1.2E+00	1.1E+00	1.1E+00	1.0E+00	1.0E+00	8.7E-01	5.4E-01	3.0E-01	1.6E-01
NW	0.	1.5E+00	1.2E+00	1.1E+00	1.0E+00	9.8E-01	9.3E-01	7.2E-01	5.4E-01	3.5E-01	2.0E-01
NNW	0.	1.7E+00	1.3E+00	1.2E+00	1.1E+00	1.1E+00	9.8E-01	7.7E-01	4.5E-01	1.9E-01	6.9E-02
N	0.	1.7E+00	1.3E+00	1.3E+00	1.3E+00	1.2E+00	1.2E+00	1.1E+00	7.9E-01	4.2E-01	1.8E-01

TABLE 5.2-3

ST LUCIE UNIT 2

CRITICAL DISTANCE TERRAIN CORRECTION FACTORS (dimensionless)

SECTOR	EXCLUSION ZONE	MILK COW	MEAT ANIMAL	MILK GOAT	RESIDENCE	VEGETABLE GARDEN
NNE	1.533	1.334	1.334	1.334	1.334	1.334
NE	1.512	1.111	1.111	1.111	1.111	1.111
ENE	1.181	0.897	0.897	0.897	0.897	0.897
E	1.362	1.116	1.116	1.116	1.116	1.116
ESE	1.389	0.972	0.972	0.972	0.972	0.972
SE	1.558	1.221	1.221	1.221	1.221	1.221
SSE	1.491	1.135	1.135	1.135	1.135	1.135
S	1.221	1.016	1.016	1.016	1.010	1.016
SSW	1.369	1.038	1.038	1.038	1.193	1.193
SW	1.407	1.172	1.172	1.050	1.250	1.250
WSW	1.262	1.004	1.004	1.004	1.104	1.004
W	1.335	1.075	1.084	1.075	1.133	1.013
WNW	1.394	1.044	0.991	1.044	1.082	1.095
NW	1.313	0.983	0.983	0.983	0.933	0.983
NNW	1.408	1.103	1.103	1.103	1.103	1.103
N	1.431	1.203	1.203	1.203	1.203	1.203

TABLE 5.2-4

TERRAIN/RECIRCULATION ADJUSTED
FLORIDA POWER & LIGHT COMPANY
ST LUCIE UNIT 2
HUTCHINSON ISLAND, FLORIDA
PERIOD OF RECORD: 9/1/76 TO 8/31/77

AVERAGE ANNUAL RELATIVE DEPOSITION RATE (square meter -1)

BASE DISTANCE IN MILES/KILOMETERS

AFTD SECT	DESIGN DIST MI	.50 .80	1.50 2.41	2.50 4.02	3.50 5.63	4.50 7.24	7.50 12.07	15.00 24.13	25.00 40.22	35.00 56.32	45.00 72.40
NNE	0.	1.9E-08	2.5E-09	1.0E-09	5.6E-10	3.8E-10	1.4E-10	3.4E-11	8.6E-12	2.8E-12	9.8E-13
NE	0.	2.1E-08	2.7E-[illegible]	1.1E-09	5.4E-10	3.4E-10	1.2E-10	2.7E-11	5.3E-12	1.6E-12	6.1E-13
ENE	0.	1.1E-08	1.5E-09	5.9E-10	3.1E-10	1.9E-10	7.7E-11	1.4E-11	3.0E-12	9.1E-13	3.3E-13
E	0.	8.2E-09	1.1E-09	4.3E-10	2.3E-10	1.6E-10	5.9E-11	1.1E-11	2.4E-12	5.4E-13	1.2E-13
ESE	0.	1.1E-08	1.5E-09	6.0E-10	3.0E-10	1.7E-10	7.4E-11	1.2E-11	2.5E-12	7.2E-13	2.4E-13
SE	0.	1.9E-08	2.7E-09	1.1E-09	5.7E-10	3.7E-10	1.4E-10	3.5E-11	9.1E-12	2.8E-12	9.8E-13
SSE	0.	2.3E-08	2.7E-09	1.1E-09	6.1E-10	3.8E-10	1.4E-10	3.4E-11	8.6E-12	3.0E-12	1.1E-12
S	0.	1.8E-08	2.2E-09	9.2E-10	5.0E-10	3.1E-10	1.1E-10	2.4E-11	5.5E-12	1.6E-12	4.7E-13
SSW	0.	9.5E-09	1.3E-09	5.5E-10	3.0E-10	1.8E-10	6.5E-11	1.4E-11	3.2E-12	1.1E-12	4.8E-13
SW	0.	1.2E-08	1.5E-09	6.2E-10	3.3E-10	2.3E-10	8.2E-11	1.9E-11	3.9E-12	9.9E-13	2.6E-13
WSW	0.	1.4E-08	2.0E-09	8.1E-10	4.4E-10	2.8E-10	9.9E-11	2.2E-11	6.4E-12	2.4E-12	9.7E-13
W	0.	1.5E-08	2.1E-09	8.1E-10	4.3E-10	3.0E-10	1.1E-10	2.4E-11	4.6E-12	1.3E-12	4.1E-13
WNW	0.	3.0E-08	3.8E-09	1.4E-09	7.9E-10	4.9E-10	2.1E-10	4.9E-11	1.2E-11	3.6E-12	1.1E-12
NW	0.	2.5E-08	3.4E-09	1.3E-09	7.0E-10	4.2E-10	1.7E-10	3.7E-11	1.1E-11	3.9E-12	1.3E-12
NNW	0.	2.7E-08	3.3E-09	1.3E-09	7.1E-10	4.5E-10	1.7E-10	3.7E-11	8.5E-12	1.9E-12	4.3E-13
N	0.	1.3E-08	1.9E-09	7.2E-10	4.1E-10	2.6E-10	1.0E-10	2.6E-11	7.6E-12	2.1E-12	5.6E-13

NUMBER OF VALID OBSERVATIONS = 8459
NUMBER OF INVALID OBSERVATIONS = 301
NUMBER OF CALMS LOWER LEVEL = 46
NUMBER OF CALMS UPPER LEVEL = 0

TABLE 5.2-5

TERRAIN/RECIRCULATION ADJUSTED
FLORIDA POWER & LIGHT COMPANY
ST LUCIE UNIT 2
HUTCHINSON ISLAND, FLORIDA
PERIOD OF RECORD: 9/1/76 TO 8/31/77

AVERAGE ANNUAL RELATIVE CONCENTRATION DEPLETED (sec/cubic meter)

BASE DISTANCE IN MILES/KILOMETERS

AFTD SECT	DESIGN DIST MI	.50 .80	1.50 2.41	2.50 4.02	3.50 5.63	4.50 7.24	7.50 12.07	15.00 24.13	25.00 40.22	35.00 56.32	45.00 72.40
NNE	0.	3.0E-06	4.5E-07	1.9E-07	1.1E-07	7.9E-08	3.3E-08	9.0E-09	2.7E-09	9.7E-10	3.7E-10
NE	0.	3.4E-06	5.4E-07	2.2E-07	1.2E-07	7.9E-08	3.2E-08	8.6E-09	1.8E-09	6.3E-10	2.5E-10
ENE	0.	2.5E-06	4.0E-07	1.8E-07	9.7E-08	6.2E-08	2.8E-08	6.3E-09	1.5E-09	5.2E-10	2.0E-10
E	0.	2.7E-06	4.4E-07	1.8E-07	1.1E-07	7.6E-08	3.1E-08	6.9E-09	1.8E-09	4.5E-10	1.1E-10
ESE	0.	3.5E-06	5.3E-07	2.3E-07	1.3E-07	7.6E-08	3.6E-08	7.5E-09	1.7E-09	5.6E-10	2.1E-10
SE	0.	4.0E-06	6.1E-07	2.8E-07	1.6E-07	1.0E-07	4.1E-08	1.4E-08	4.1E-09	1.4E-09	5.1E-10
SSE	0.	3.9E-06	5.3E-07	2.4E-07	1.3E-07	8.7E-08	3.6E-08	1.1E-08	3.1E-09	1.2E-09	5.0E-10
S	0.	1.9E-06	2.7E-07	1.2E-07	7.0E-08	4.7E-08	1.8E-08	4.4E-09	1.2E-09	4.0E-10	1.3E-10
SSW	0.	1.4E-06	2.3E-07	1.0E-07	5.8E-08	3.6E-08	1.4E-08	3.8E-09	1.0E-09	3.9E-10	1.8E-10
SW	0.	1.5E-06	2.2E-07	9.4E-08	5.4E-08	3.7E-08	1.5E-08	4.2E-09	9.3E-10	2.7E-10	7.8E-11
WSW	0.	1.7E-06	2.6E-07	1.1E-07	6.2E-08	4.0E-08	1.5E-08	4.1E-09	1.4E-09	5.5E-10	2.4E-10
W	0.	2.1E-06	3.4E-07	1.3E-07	7.4E-08	5.2E-08	2.1E-08	5.4E-09	1.2E-09	3.7E-10	1.3E-10
WNW	0.	3.9E-06	5.9E-07	2.5E-07	1.4E-07	8.8E-08	4.0E-08	1.1E-08	3.2E-09	1.0E-09	3.7E-10
NW	0.	4.0E-06	6.4E-07	2.6E-07	1.5E-07	9.4E-08	4.0E-08	1.0E-08	3.5E-09	1.4E-09	5.1E-10
NNW	0.	3.9E-06	5.6E-07	2.3E-07	1.4E-07	8.8E-08	3.5E-08	9.2E-09	2.5E-09	6.5E-10	1.6E-10
N	0.	2.5E-06	3.8E-07	1.6E-07	9.9E-08	6.3E-08	2.8E-08	8.7E-09	2.9E-09	8.8E-10	2.5E-10

NUMBER OF VALID OBSERVATIONS = 8459
NUMBER OF INVALID OBSERVATIONS = 301
NUMBER OF CALMS LOWER LEVEL = 46
NUMBER OF CALMS UPPER LEVEL = 0

TABLE 5.2-6

TERRAIN/RECIRCULATION ADJUSTED
FLORIDA POWER & LIGHT COMPANY
ST LUCIE UNIT 2
HUTCHINSON ISLAND, FLORIDA
PERIOD OF RECORD: 9/1/76 TO 8/31/77

AVERAGE ANNUAL RELATIVE CONCENTRATION (sec/cubic meter)

BASE DISTANCE IN MILES/KILOMETERS

AFTD SEC	DESIGN DIST MI	.50 / .80	1.50 / 2.41	2.50 / 4.02	3.50 / 5.63	4.50 / 7.24	7.50 / 12.07	15.00 / 24.13	25.00 / 40.22	35.00 / 56.32	45.00 / 72.40
NNE	0.	3.1E-06	5.4E-07	2.4E-07	1.4E-07	1.0E-07	4.7E-08	1.4E-08	4.8E-09	1.9E-09	7.8E-10
NE	0.	3.8E-06	6.5E-07	2.9E-07	1.5E-07	1.1E-07	4.6E-08	1.3E-08	3.3E-09	1.2E-09	5.5E-10
ENE	0.	2.8E-06	4.8E-07	2.2E-07	1.3E-07	8.2E-08	4.1E-08	1.0E-08	2.8E-09	1.1E-09	4.4E-10
E	0.	3.0E-06	5.3E-07	2.4E-07	1.4E-07	1.0E-07	4.6E-08	1.2E-08	3.3E-09	9.1E-10	2.4E-10
ESE	0.	3.8E-06	6.2E-07	2.9E-07	1.6E-07	1.1E-07	5.2E-08	1.1E-08	3.3E-09	1.1E-09	4.4E-10
SE	0.	4.3E-06	7.2E-07	3.3E-07	1.9E-07	1.4E-07	5.9E-08	2.1E-08	7.7E-09	2.8E-09	1.1E-09
SSE	0.	4.2E-06	6.3E-07	3.0E-07	1.7E-07	1.2E-07	5.2E-08	1.7E-08	5.6E-09	2.4E-09	1.1E-09
S	0.	2.2E-06	3.2E-07	1.5E-07	9.2E-08	6.3E-08	2.6E-08	7.2E-09	2.2E-09	7.7E-10	2.7E-10
SSW	0.	1.6E-06	2.8E-07	1.3E-07	7.5E-08	4.9E-08	2.1E-08	6.1E-09	1.8E-09	7.8E-10	3.8E-10
SW	0.	1.6E-06	2.6E-07	1.2E-07	6.8E-08	5.1E-08	2.1E-08	6.8E-09	1.7E-09	5.3E-10	1.6E-10
WSW	0.	1.9E-06	3.1E-07	1.3E-07	7.9E-08	5.4E-08	2.2E-08	6.7E-09	2.5E-09	1.1E-09	5.2E-10
W	0.	2.3E-06	3.9E-07	1.7E-07	9.5E-08	6.9E-08	3.0E-08	8.4E-09	2.2E-09	7.5E-10	2.7E-10
WNW	0.	4.4E-06	7.0E-07	3.0E-07	1.7E-07	1.1E-07	5.7E-08	1.8E-08	5.9E-09	2.0E-09	7.9E-10
NW	0.	4.5E-06	7.6E-07	3.3E-07	1.9E-07	1.3E-07	5.6E-08	1.7E-08	6.5E-09	2.7E-09	1.1E-09
NNW	0.	4.2E-06	6.6E-07	2.9E-07	1.7E-07	1.2E-07	5.1E-08	1.5E-08	4.5E-09	1.3E-09	3.4E-10
N	0.	2.7E-06	4.5E-07	2.0E-07	1.3E-07	8.5E-08	4.2E-08	1.4E-08	5.2E-09	1.8E-09	5.5E-10

NUMBER OF VALID OBSERVATIONS = 8459
NUMBER OF INVALID OBSERVATIONS = 301
NUMBER OF CALMS LOWER LEVEL = 46
NUMBER OF CALMS UPPER LEVEL = 0

TABLE 5.2-7

TERRAIN/RECIRCULATION ADJUSTED
FLORIDA POWER & LIGHT COMPANY
ST LUCIE UNIT 2
HUTCHINSON ISLAND, FLORIDA
PERIOD OF RECORD: 9/1/77 TO 8/31/78

AVERAGE ANNUAL RELATIVE DEPOSITION RATE (square meter -1)

BASE DISTANCE IN MILES/KILOMETERS

AFTD SECT	DESIGN DIST MI	.50 .80	1.50 2.41	2.50 4.02	3.50 5.63	4.50 7.24	7.50 12.07	15.00 24.13	25.00 40.22	35.00 56.32	45.00 72.40
NNE	0.	2.1E-08	2.7E-09	1.1E-09	5.9E-10	4.1E-10	1.5E-10	3.6E-11	9.3E-12	3.0E-12	1.1E-12
NE	0.	1.7E-08	2.3E-09	9.1E-10	4.5E-10	2.8E-10	1.0E-10	2.3E-11	4.5E-12	1.3E-12	5.1E-13
ENE	0.	9.0E-09	1.2E-09	5.0E-10	2.6E-10	1.5E-10	6.4E-11	1.2E-11	2.5E-12	7.7E-13	2.8E-13
E	0.	1.1E-08	1.5E-09	5.6E-10	3.0E-10	2.1E-10	7.7E-11	1.5E-11	3.1E-12	7.0E-13	1.5E-13
ESE	0.	1.3E-08	1.6E-09	6.8E-10	3.4E-10	2.0E-10	8.4E-11	1.4E-11	2.8E-12	8.0E-13	2.7E-13
SE	0.	2.2E-08	3.0E-09	1.2E-09	6.5E-10	4.1E-10	1.5E-10	4.0E-11	1.1E-11	3.2E-12	1.1E-12
SSE	0.	1.8E-08	2.2E-09	9.5E-10	5.0E-10	3.1E-10	1.2E-10	2.8E-11	6.9E-12	2.5E-12	9.3E-13
S	0.	1.3E-08	1.5E-09	6.6E-10	3.6E-10	2.3E-10	8.0E-11	1.7E-11	3.9E-12	1.1E-12	3.3E-13
SSW	0.	1.2E-08	1.7E-09	6.8E-10	3.6E-10	2.2E-10	8.0E-11	1.7E-11	4.0E-12	1.4E-12	5.9E-13
SW	0.	1.6E-08	2.1E-09	8.8E-10	4.7E-10	3.3E-10	1.2E-10	2.7E-11	5.3E-12	1.4E-12	3.7E-12
WSW	0.	1.7E-08	2.4E-09	9.2E-10	5.0E-10	3.2E-10	1.2E-10	2.6E-11	7.5E-12	2.7E-12	1.1E-12
W	0.	1.5E-08	2.0E-09	7.7E-10	4.1E-10	2.8E-10	9.9E-11	2.3E-11	4.6E-12	1.2E-12	3.9E-13
WNW	0.	2.5E-08	3.2E-09	1.2E-09	6.6E-10	4.1E-10	1.7E-10	4.1E-11	1.0E-11	2.9E-12	9.6E-13
NW	0.	2.4E-08	3.3E-09	1.2E-09	6.8E-10	4.1E-10	1.6E-10	3.5E-11	1.0E-11	3.5E-12	1.3E-12
WNW	0.	2.7E-08	3.3E-09	1.3E-09	6.9E-10	4.4E-10	1.6E-10	3.6E-11	8.0E-12	1.9E-12	4.2E-13
N	0.	1.7E-08	2.2E-09	9.2E-10	5.2E-10	3.3E-10	1.3E-10	3.4E-11	9.5E-12	2.7E-12	7.2E-13

NUMBER OF VALID OBSERVATIONS = 8676
NUMBER OF INVALID OBSERVATIONS = 84
NUMBER OF CALMS LOWER LEVEL = 49
NUMBER OF CALMS UPPER LEVEL = 0

TABLE 5.2-8

TERRAIN/RECIRCULATION ADJUSTED
FLORIDA POWER & LIGHT COMPANY
ST LUCIE UNIT 2
HUTCHINSON ISLAND, FLORIDA
PERIOD OF RECORD: 9/1/77 TO 8/31/78

AVERAGE ANNUAL RELATIVE CONCENTRATION DEPLETED (sec/cubic meter)

BASE DISTANCE IN MILES/KILOMETERS

AFTD SECT	DESIGN DIST MI	.50 .80	1.50 2.41	2.50 4.02	3.50 5.63	4.50 7.24	7.50 12.07	15.00 24.13	25.00 40.22	35.00 56.32	45.00 72.40
NNE	0.	3.5E-06	5.2E-07	2.3E-07	1.3E-07	8.9E-08	3.8E-08	1.0E-08	3.0E-09	1.1E-09	4.1E-10
NE	0.	3.6E-06	5.8E-07	2.3E-07	1.3E-07	8.4E-08	3.4E-08	8.6E-09	1.9E-09	6.7E-10	2.8E-10
ENE	0.	2.4E-06	3.7E-07	1.7E-07	9.2E-08	5.8E-08	2.7E-08	5.8E-09	1.5E-09	5.0E-10	1.9E-10
E	0.	2.4E-06	3.7E-07	1.6E-07	8.7E-08	6.3E-08	2.6E-08	6.0E-09	1.5E-09	3.8E-10	9.0E-11
ESE	0.	3.3E-06	4.8E-07	2.1E-07	1.2E-07	6.9E-08	3.3E-08	6.9E-09	1.6E-09	5.2E-10	1.9E-10
SE	0.	4.0E-06	6.0E-07	2.6E-07	1.4E-07	1.0E-07	4.0E-08	1.2E-08	3.9E-09	1.4E-09	5.1E-10
SSE	0.	2.7E-06	3.8E-07	1.7E-07	9.3E-08	6.0E-08	2.6E-08	7.2E-09	2.1E-09	8.2E-10	3.4E-10
S	0.	1.8E-06	2.5E-07	1.2E-07	6.7E-08	4.5E-08	1.7E-08	4.3E-09	1.2E-09	3.7E-10	1.2E-10
SSW	0.	1.6E-06	2.6E-07	1.1E-07	6.4E-08	4.1E-08	1.6E-08	4.3E-09	1.2E-09	4.7E-10	2.0E-10
SW	0.	1.9E-06	2.6E-07	1.1E-07	6.4E-08	4.6E-08	1.8E-08	5.1E-09	1.2E-09	3.4E-10	1.0E-10
WSW	0.	2.1E-06	3.2E-07	1.3E-07	7.7E-08	5.0E-08	1.9E-08	5.1E-09	1.7E-09	6.9E-10	3.1E-10
W	0.	1.9E-06	3.1E-07	1.2E-07	6.8E-08	4.7E-08	1.9E-08	4.9E-09	1.1E-09	3.3E-10	1.1E-10
WNW	0.	3.8E-06	5.6E-07	2.2E-07	1.3E-07	8.2E-08	3.6E-08	1.0E-08	2.8E-09	9.5E-10	3.3E-10
NW	0.	4.2E-06	6.5E-07	2.6E-07	1.5E-07	9.4E-08	3.9E-08	1.0E-08	3.5E-09	1.3E-09	5.1E-10
NNW	0.	4.4E-06	6.5E-07	2.7E-07	1.5E-07	9.9E.08	4.0E-08	1.1E-08	2.8E-09	7.0E-10	1.7E-10
N	0.	2.7E-06	4.0E-07	1.6E-07	1.0E-07	6.3E-08	2.8E-08	8.6E-09	2.8E-09	8.8E-10	2.5E-10

NUMBER OF VALID OBSERVATIONS = 8676
NUMBER OF INVALID OBSERVATIONS = 84
NUMBER OF CALMS LOWER LEVEL = 49
NUMBER OF CALMS UPPER LEVEL = 0

TABLE 5.2-9

TERRAIN/RECIRCULATION ADJUSTED
FLORIDA POWER & LIGHT COMPANY
ST LUCIE UNIT 2
HUTCHINSON ISLAND, FLORIDA
PERIOD OF RECORD: 9/1/77 TO 8/31/78

AVERAGE ANNUAL RELATIVE CONCENTRATION (sec/cubic meter)

BASE DISTANCE IN MILES/KILOMETERS

AFTD SECT	DESIGN DIST MI	.50 .80	1.50 2.41	2.50 4.02	3.50 5.63	4.50 7.24	7.50 12.07	15.00 24.13	25.00 40.22	35.00 56.32	45.00 72.40
NNE	0.	3.7E-06	6.1E-07	2.9E-07	1.7E-07	1.2E-07	5.4E-08	1.6E-08	5.4E-09	2.1E-09	8.9E-10
NE	0.	3.9E-06	6.8E-07	3.0E-07	1.6E-07	1.1E-07	4.9E-08	1.4E-08	3.6E-09	1.3E-09	5.8E-10
ENE	0.	2.6E-06	4.4E-07	2.1E-07	1.2E-07	7.7E-08	3.8E-08	9.8E-09	2.7E-09	1.0E-09	4.2E-10
E	0.	2.6E-06	4.3E-07	1.9E-07	1.2E-07	8.4E-08	3.8E-08	9.7E-09	2.7E-09	7.5E-10	1.9E-10
ESE	0.	3.5E-06	5.7E-07	2.7E-07	1.5E-07	9.2E-08	4.8E-08	1.1E-08	2.9E-09	1.0E-09	4.0E-10
SE	0.	4.3E-06	6.9E-07	3.3E-07	1.9E-07	1.3E-07	5.8E-08	2.1E-08	7.0E-09	2.7E-09	1.1E-09
SSE	0.	2.8E-06	4.4E-07	2.1E-07	1.2E-07	8.1E-08	3.6E-08	1.2E-08	3.9E-09	1.6E-09	7.3E-10
S	0.	1.9E-06	3.1E-07	1.4E-07	8.6E-08	5.9E-08	2.5E-08	7.2E-09	2.2E-09	7.5E-10	2.6E-10
SSW	0.	1.7E-06	2.9E-07	1.4E-07	8.3E-08	5.5E-08	2.4E-08	7.0E-09	2.1E-09	9.1E-10	4.4E-10
SW	0.	2.1E-06	3.1E-07	1.4E-07	8.2E-08	6.0E-08	2.5E-08	8.3E-09	2.1E-09	6.5E-10	2.1E-10
WSW	0.	2.3E-06	3.8E-07	1.6E-07	9.9E-08	6.6E-08	2.8E-08	8.6E-09	3.2E-09	1.4E-09	6.6E-10
W	0.	2.3E-06	3.6E-07	1.5E-07	8.8E-08	6.4E-08	2.7E-08	7.6E-09	2.0E-09	6.7E-10	2.5E-10
WNW	0.	4.1E-06	6.6E-07	2.8E-07	1.6E-07	1.1E-07	5.3E-08	1.7E-08	5.2E-09	1.9E-09	7.1E-10
NW	0.	4.6E-06	7.8E-07	3.3E-07	1.9E-07	1.3E-07	5.6E-08	1.7E-08	6.5E-09	2.7E-09	1.1E-09
NNW	0.	4.9E-06	7.6E-07	3.3E-07	1.9E-07	1.3E-07	5.7E-08	1.7E-08	4.9E-09	1.4E-09	3.7E-10
N	0.	2.8E-06	4.6E-07	2.1E-07	1.3E-07	8.5E-08	4.2E-08	1.4E-08	5.1E-09	1.8E-09	5.3E-10

NUMBER OF VALID OBSERVATIONS = 8676
NUMBER OF INVALID OBSERVATIONS = 84
NUMBER OF CALMS LOWER LEVEL = 49
NUMBER OF CALMS UPPER LEVEL = 0

TABLE 5.2-10

TERRAIN/RECIRCULATION ADJUSTED
FLORIDA POWER & LIGHT COMPANY
ST LUCIE UNIT 2
HUTCHINSON ISLAND, FLORIDA
PERIOD OF RECORD: 9/1/76 TO 8/31/78

AVERAGE ANNUAL RELATIVE DEPOSITION RATE (square meter -1)

BASE DISTANCE IN MILES/KILOMETERS

AFTD SECT	DESIGN DIST MI	.50 .80	1.50 2.41	2.50 4.02	3.50 5.63	4.50 7.24	7.50 12.07	15.00 24.13	25.00 40.22	35.00 56.32	45.00 72.40
NNE	0.	1.9E-08	2.7E-09	1.1E-09	5.8E-10	3.9E-10	1.5E-10	3.5E-11	8.6E-12	2.9E-12	1.0E-12
NE	0.	1.9E-08	2.5E-09	9.9E-10	4.9E-10	3.1E-10	1.1E-10	2.5E-11	4.9E-12	1.5E-12	5.5E-13
ENE	0.	9.9E-09	1.3E-09	5.5E-10	2.9E-10	1.7E-10	7.1E-11	1.3E-11	2.7E-12	8.4E-13	3.0E-13
E	0.	9.4E-09	1.2E-09	5.0E-10	2.7E-10	1.8E-10	6.8E-11	1.3E-11	2.7E-12	6.2E-13	1.3E-13
ESE	0.	1.2E-08	1.6E-09	6.4E-10	3.2E-10	1.8E-10	7.9E-11	1.3E-11	2.7E-12	7.7E-13	2.6E-13
SE	0.	2.1E-08	2.8E-09	1.2E-09	6.1E-10	3.8E-10	1.4E-10	3.7E-11	9.8E-12	3.0E-12	1.0E-12
SSE	0.	2.1E-08	2.5E-09	1.0E-09	5.6E-10	3.5E-10	1.3E-10	3.1E-11	8.0E-12	2.7E-12	1.0E-12
S	0.	1.5E-08	1.9E-09	7.9E-10	4.8E-10	2.7E-10	9.9E-11	2.0E-11	4.7E-12	1.3E-12	4.0E-13
SSW	0.	1.0E-08	1.5E-09	6.2E-10	3.8E-10	2.0E-10	7.2E-11	1.6E-11	3.6E-12	1.3E-12	5.8E-13
SW	0.	1.4E-08	1.9E-09	7.5E-10	4.0E-10	2.8E-10	9.9E-11	2.4E-11	4.9E-12	1.2E-12	3.2E-13
WSW	0.	1.6E-08	2.2E-09	8.6E-10	4.7E-10	3.0E-10	1.1E-10	2.4E-11	7.0E-12	2.6E-12	1.0E-12
W	0.	1.5E-08	2.1E-09	7.9E-10	4.2E-10	2.9E-10	1.1E-10	2.3E-11	4.6E-12	1.3E-12	4.0E-13
WNW	0.	2.7E-08	3.5E-09	1.3E-09	7.2E-10	4.5E-10	1.9E-10	4.5E-11	1.1E-11	3.3E-12	1.0E-12
NW	0.	2.5E-08	3.4E-09	1.3E-09	6.9E-10	4.1E-10	1.6E-10	3.6E-11	1.1E-11	3.5E-12	1.8E-12
NNW	0.	2.7E-08	3.3E-09	1.3E-09	7.0E-10	4.4E-10	1.6E-10	3.6E-11	8.0E-12	1.9E-12	4.2E-13
N	0.	1.5E-08	2.0E-09	8.2E-10	4.7E-10	2.9E-10	1.2E-10	3.1E-11	8.7E-12	2.4E-12	6.3E-13

NUMBER OF VALID OBSERVATIONS = 17135
NUMBER OF INVALID OBSERVATIONS = 385
NUMBER OF CALMS LOWER LEVEL = 95
NUMBER OF CALMS UPPER LEVEL = 0

TABLE 5.2-11

TERRAIN/RECIRCULATION ADJUSTED
FLORIDA POWER & LIGHT COMPANY
ST LUCIE UNIT 2
HUTCHINSON ISLAND, FLORIDA
PERIOD OF RECORD: 9/1/76 TO 8/31/78

AVERAGE ANNUAL RELATIVE CONCENTRATION DEPLETED (sec/cubic meter)

BASE DISTANCE IN MILES/KILOMETERS

AFTO SECT	DESIGN DIST MI	.50 .80	1.50 2.41	2.50 4.02	3.50 5.63	4.50 7.24	7.50 12.07	15.00 24.13	25.00 40.22	35.00 56.32	45.00 72.40
NNE	0.	3.1E-06	4.8E-07	2.2E-07	1.2E-07	8.4E-08	3.5E-08	9.6E-09	2.8E-09	1.0E-09	3.9E-10
NE	0.	3.6E-06	5.5E-07	2.3E-07	1.3E-07	8.2E-08	3.3E-08	8.6E-09	1.9E-09	6.5E-10	2.6E-10
ENE	0.	2.5E-06	3.9E-07	1.8E-07	9.6E-08	6.0E-08	2.8E-08	6.3E-09	1.5E-09	5.2E-10	2.0E-10
E	0.	2.6E-06	4.1E-07	1.7E-07	9.7E-08	6.9E-08	2.9E-08	6.6E-09	1.7E-09	4.1E-10	1.0E-10
ESE	0.	3.3E-06	5.1E-07	2.2E-07	1.2E-07	7.2E-08	3.5E-08	6.9E-09	1.6E-09	5.3E-10	2.0E-10
SE	0.	4.0E-06	6.0E-07	2.6E-07	1.6E-07	1.0E-07	4.1E-08	1.2E-08	4.0E-09	1.4E-09	5.1E-10
SSE	0.	3.2E-06	4.6E-07	2.1E-07	1.1E-07	7.4E-08	3.1E-08	8.8E-09	2.6E-09	1.0E-09	4.1E-10
S	0.	1.9E-06	2.6E-07	1.2E-07	6.8E-08	4.6E-08	1.8E-08	4.4E-09	1.2E-09	3.7E-10	1.2E-10
SSW	0.	1.6E-06	2.5E-07	1.1E-07	6.1E-08	4.0E-08	1.6E-08	4.1E-09	1.1E-09	4.4E-10	2.0E-10
SW	0.	1.6E-06	2.4E-07	1.0E-07	5.8E-08	4.2E-08	1.6E-08	4.7E-09	1.1E-09	3.0E-10	8.7E-11
WSW	0.	1.9E-06	2.9E-07	1.2E-07	6.9E-08	4.5E-08	1.7E-08	4.6E-09	1.6E-09	6.2E-10	2.8E-10
W	0.	2.1E-06	3.2E-07	1.2E-07	7.1E-08	5.0E-08	2.0E-08	5.2E-09	1.2E-09	3.5E-10	1.2E-10
WNW	0.	3.8E-06	5.7E-07	2.3E-07	1.3E-07	8.4E-08	3.8E-08	1.0E-08	3.0E-09	9.8E-10	3.4E-10
NW	0.	4.0E-06	6.4E-07	2.6E-07	1.5E-07	9.4E-08	3.9E-08	1.0E-08	3.5E-09	1.3E-09	5.1E-10
NNW	0.	4.2E-06	6.0E-07	2.4E-07	1.5E-07	9.3E-08	3.7E-08	1.0E-08	2.6E-09	6.6E-10	1.7E-10
N	0.	2.5E-06	3.8E-07	1.6E-07	1.08-07	6.3E-08	2.8E-08	8.6E-08	2.9E-09	8.8E-10	2.5E-10

NUMBER OF VALID OBSERVATIONS = 17135
NUMBER OF INVALID OBSERVATIONS = 385
NUMBER OF CALMS LOWER LEVEL = 95
NUMBER OF CALMS UPPER LEVEL = 0

TABLE 5.2-12

TERRAIN/RECIRCULATION ADJUSTED
FLORIDA POWER & LIGHT CO.
ST LUCIE UNIT 2
HUTCHINSON ISLAND, FLORIDA
PERIOD OF RECORD: 9/1/76 TO 8/31/78

AVERAGE ANNUAL RELATIVE CONCENTRATION (sec/cubic meter)

BASE DISTANCE IN MILES/KILOMETERS

AFTD SECT	DESIGN DIST MI	.50 .80	1.50 2.41	2.50 4.02	3.50 5.63	4.50 7.24	7.50 12.07	15.00 24.13	25.00 40.22	35.00 56.32	45.00 72.40
NNE	0.	3.5E-06	5.8E-07	2.6E-07	1.6E-07	1.1E-07	5.0E-08	1.5E-08	5.1E-09	2.0E-09	8.2E-10
NE	0.	3.8E-06	6.6E-07	2.9E-07	1.6E-07	1.1E-07	4.7E-08	1.4E-08	3.4E-09	1.3E-09	5.7E-10
ENE	0.	2.6E-06	4.6E-07	2.2E-07	1.3E-07	8.0E-08	4.0E-08	9.8E-09	2.8E-09	1.0E-09	4.3E-10
E	0.	2.9E-06	4.8E-07	2.2E-07	1.3E-07	9.2E-08	4.2E-08	1.1E-08	3.0E-09	8.3E-10	2.1E-10
ESE	0.	3.6E-06	6.0E-07	2.8E-07	1.5E-07	9.6E-08	5.0E-08	1.1E-08	3.0E-09	1.1E-09	4.1E-10
SE	0.	4.3E-06	7.1E-07	3.3E-07	1.9E-07	1.4E-07	5.9E-08	2.1E-08	7.0E-09	2.8E-09	1.1E-09
SSE	0.	3.5E-06	5.3E-07	2.6E-07	1.5E-07	9.9E-08	4.4E-08	1.4E-08	4.7E-09	2.0E-09	8.9E-10
S	0.	2.1E-06	3.2E-07	1.5E-07	8.9E-08	6.0E-08	2.5E-08	7.2E-09	2.2E-09	7.5E-10	2.6E-10
SSW	0.	1.7E-06	2.9E-07	1.3E-07	8.0E-08	5.2E-08	2.3E-08	6.6E-09	2.0E-09	8.6E-10	4.2E-10
SW	0.	1.8E-06	2.9E-07	1.3E-07	7.5E-08	5.5E-08	2.3E-08	7.6E-09	2.0E-09	5.9E-10	1.9E-10
WSW	0.	2.1E-06	3.4E-07	1.5E-07	9.0E-08	6.0E-08	2.5E-08	7.9E-09	2.9E-09	1.3E-09	5.9E-10
W	0.	2.3E-06	3.7E-07	1.5E-07	9.2E-08	6.6E-08	2.9E-08	8.4E-09	2.2E-09	7.1E-10	2.6E-10
WNW	0.	4.2E-06	6.7E-07	2.9E-07	1.7E-07	1.1E-07	5.5E-08	1.7E-08	5.4E-09	2.0E-09	7.4E-10
NW	0.	4.5E-06	7.6E-07	3.3E-07	1.9E-07	1.3E-07	5.6E-08	1.7E-08	6.5E-09	2.7E-09	1.1E-09
NNW	0.	4.5E-06	7.1E-07	3.1E-07	1.8E-07	1.2E-07	5.4E-08	1.6E-08	4.9E-09	1.3E-09	3.5E-10
N	0.	2.8E-06	4.6E-07	2.0E-07	1.3E-07	8.5E-08	4.2E-08	1.4E-08	5.2E-09	1.8E-09	5.5E-10

NUMBER OF VALID OBSERVATIONS = 17185
NUMBER OF INVALID OBSERVATIONS = 385
NUMBER OF CALMS LOWER LEVEL = 95
NUMBER OF CALMS UPPER LEVEL = 0

TABLE 5.2-13

PERIOD OF RECORD: 9/1/76 TO 8/31/78
TERRAIN/RECIRCULATION ADJUSTED
ST LUCIE UNIT 2

AVERAGE ANNUAL RELATIVE CONCENTRATION
(sec/cubic meter)

SECTOR	EXCLUSION ZONE	MILK COW	MEAT ANIMAL	MILK GOAT	RESIDENCE	VEGETABLE GARDEN
NNE	1.2E-06	9.5E-08	9.5E-08	9.5E-08	9.5E-08	9.5E-08
NE	1.3E-06	9.1E-08	9.1E-08	9.1E-08	9.1E-08	9.1E-08
ENE	9.3E-07	6.9E-08	6.9E-08	6.9E-08	6.9E-08	6.9E-08
E	9.9E-07	7.8E-08	7.8E-08	7.8E-08	7.8E-08	7.8E-08
ESE	1.2E-06	8.5E-08	8.5E-08	8.5E-08	8.5E-08	8.5E-08
SE	1.5E-06	1.1E-07	1.1E-07	1.1E-07	1.1E-07	1.1E-07
SSE	1.1E-06	8.3E-08	8.3E-08	8.3E-08	8.3E-08	8.3E-08
S	6.5E-07	5.1E-08	5.1E-08	5.1E-08	6.7E-08	5.1E-08
SSW	6.0E-07	4.4E-08	4.4E-08	4.4E-08	1.6E-07	1.6E-07
SW	6.1E-07	4.7E-08	4.7E-08	1.4E-07	1.9E-07	1.9E-07
WSW	7.1E-07	5.0E-08	5.0E-08	5.0E-08	2.3E-07	2.3E-07
W	7.7E-07	5.6E-08	1.1E-07	5.6E-08	2.0E-07	8.8E-08
WNW	1.4E-06	9.8E-08	1.1E-07	9.8E-08	2.4E-07	2.2E-07
NW	1.6E-06	1.1E-07	1.1E-07	1.1E-07	1.1E-07	1.1E-07
NNW	1.4E-06	1.1E-07	1.1E-07	1.1E-07	1.1E-07	1.1E-07
N	9.3E-07	7.2E-08	7.2E-08	7.2E-08	7.2E-08	7.2E-08

TABLE 5.2-14

PERIOD OF RECORD: 9/1/76 TO 8/31/78
TERRAIN/RECIRCULATION ADJUSTED
ST LUCIE UNIT 2

AVERAGE ANNUAL RELATIVE CONCENTRATION DEPLETED
(sec/cubic meter)

SECTOR	EXCLUSION ZONE	MILK COW	MEAT ANIMAL	MILK GOAT	RESIDENCE	VEGETABLE GARDEN
NNE	1.0E-06	6.9E-08	6.9E-08	6.9E-08	6.9E-08	6.9E-08
NE	1.1E-06	6.8E-08	6.8E-08	6.8E-08	6.8E-08	6.8E-08
ENE	8.1E-07	5.1E-08	5.1E-08	5.1E-08	5.1E-08	5.1E-08
E	8.7E-07	5.8E-08	5.8E-08	5.8E-08	5.8E-08	5.8E-08
ESE	1.1E-06	6.2E-08	6.2E-08	6.2E-08	6.2E-08	6.2E-08
SE	1.3E-06	8.2E-08	8.2E-08	8.2E-08	8.2E-08	8.2E-08
SSE	1.0E-06	6.1E-08	6.1E-08	6.1E-08	6.1E-08	6.1E-08
S	5.7E-07	3.8E-08	3.8E-08	3.8E-08	5.1E-08	3.8E-08
SSW	5.2E-07	3.2E-08	3.2E-08	3.2E-08	1.2E-07	1.2E-07
SW	5.3E-07	3.4E-08	3.4E-08	1.2E-07	1.5E-07	1.5E-07
WSW	6.2E-07	3.7E-08	3.7E-08	3.7E-08	1.9E-07	1.9E-07
W	6.7E-07	4.1E-08	8.5E-08	4.1E-08	1.7E-07	6.8E-08
WNW	1.3E-06	7.3E-08	8.1E-08	7.3E-08	1.8E-07	1.8E-07
NW	1.3E-06	7.9E-08	7.9E-08	7.9E-08	8.0E-08	7.9E-08
NNW	1.3E-06	7.9E-08	7.9E-08	7.9E-08	7.9E-08	7.9E-08
N	8.2E-07	5.3E-08	5.3E-08	5.3E-08	5.3E-08	5.3E-08

TABLE 5.2-15

PERIOD OF RECORD: 9/1/76 TO 8/31/78
TERRAIN/RECIRCULATION ADJUSTED
ST LUCIE UNIT 2

AVERAGE ANNUAL RELATIVE DEPOSITION RATE
(square meter^{-1})

SECTOR	EXCLUSION ZONE	MILK COW	MEAT ANIMAL	MILK GOAT	RESIDENCE	VEGETABLE GARDEN
NNE	6.0E-09	3.2E-10	3.2E-10	3.2E-10	3.2E-10	3.2E-10
NE	5.6E-09	2.6E-10	2.6E-10	2.6E-10	2.6E-10	2.6E-10
ENE	3.1E-09	1.4E-10	1.4E-10	1.4E-10	1.4E-10	1.4E-10
E	2.9E-09	1.5E-10	1.5E-10	1.5E-10	1.5E-10	1.5E-10
ESE	3.6E-09	1.6E-10	1.6E-10	1.6E-10	1.6E-10	1.6E-10
SE	6.4E-09	3.1E-10	3.1E-10	3.1E-10	3.1E-10	3.1E-10
SSE	6.0E-09	2.8E-10	2.8E-10	2.8E-10	2.8E-10	2.8E-10
S	4.3E-09	2.2E-10	2.2E-10	2.2E-10	3.1E-10	2.2E-10
SSW	3.4E-09	1.7E-10	1.7E-10	1.7E-10	7.2E-10	7.2E-10
SW	4.4E-09	2.2E-10	2.2E-10	8.2E-10	1.2E-09	1.2E-07
WSW	4.8E-09	2.4E-10	2.4E-10	2.4E-10	1.4E-09	1.4E-09
W	4.7E-09	2.4E-10	5.1E-10	2.4E-10	1.1E-09	4.1E-10
WNW	8.2E-09	3.9E-10	4.4E-10	3.9E-10	1.1E-09	9.7E-10
NW	7.5E-09	3.4E-10	3.4E-10	3.4E-10	3.5E-10	3.4E-10
NNW	7.6E-09	3.6E-10	3.6E-10	3.6E-10	3.6E-10	3.6E-10
N	4.6E-09	2.4E-10	2.4E-10	2.4E-10	2.4E-10	2.4E-10

TABLE 5.2-16

GASEOUS EFFLUENT CONCENTRATIONS* CONTRIBUTED TO THE BACKGROUND

	Airborne (Ci/m^3)	On Ground (Ci/m^2)	In Vegetation (pCi/Kg)
Kr-83m	5.1(-14)**	-	-
Kr-85m	8.6(-13)	-	-
Kr-85	1.0(-11)	-	-
Kr-87	2.0(-13)	-	-
Kr-88	1.2(-12)	-	-
Xe-131m	1.1(-11)	-	-
Xe-133m	5.1(-12)	-	-
Xe-133	1.2(-9)	-	-
Xe-135	4.1(-12)	-	-
I-131	6.1(-15)	3.2(-11)	9.0
I-133	7.1(-15)	4.0(-12)	8.1(-1)
Mn-54	2.5(-16)	4.6(-11)	2.2(-1)
Fe-59	8.1(-17)	2.4(-12)	4.9(-4)
Co-58	8.1(-16)	3.7(-11)	5.8(-1)
Co-60	3.9(-16)	4.1(-10)	3.6(-1)
Sr-89	1.8(-17)	5.9(-13)	1.3(-2)
Sr-90	3.3(-18)	6.7(-12)	2.8(-3)
Cs-134	2.5(-16)	1.2(-10)	1.8(-1)
Cs-137	4.2(-16)	8.3(-10)	3.2(-1)
A-41	1.3(-12)	-	-
C-14	4.1(-13)	9.8(-7)	2.8(+2)
H-3	2.9(-11)	4.7(-5)	1.4(+3)

*Concentrations calculated at the EZ due to routine operation of St Lucie Unit 2.

$X/Q = 1.6 \times 10^{-6}\ sec/m^3$ NW of the plant

$D/Q = 8.2 \times 10^{-9} m^2$ WNW of the plant

**( ) Denotes power of 10.

TABLE 5.2-17 Sheet 1 of 2

RADIONUCLIDE CONCENTRATIONS FROM LIQUID EFFLUENTS
FROM ROUTINE OPERATION OF ST LUCIE UNIT 2

Nuclide	Annual Avg (1) (µCi/m)	Peak (2) (µCi/m)	Ocean Avg (3) (µCi/m)	Sediment Avg (4) (µCi/m^2)
H-3	5.0(-7)*	5.0(-7)	5.7(-8)	-
Cr-51	7.3(-13)	7.5(-12)	7.3(-14)	1.0(-6)
Mn-54	1.2(-12)	1.2(-12)	1.2(-13)	1.9(-5)
Fe-55	6.4(-13)	8.1(-13)	6.4(-14)	3.0(-5)
Fe-59	4.5(-13)	5.5(-13)	4.5(-14)	1.0(-6)
Co-58	9.8(-12)	1.1(-11)	9.8(-13)	3.5(-5)
Co-60	9.4(-12)	9.6(-12)	9.4(-13)	7.7(-7)
Zr-95	1.4(-12)	9.9(-12)	1.4(-13)	4.5(-6)
Nb-95	2.0(-12)	2.0(-12)	2.0(-13)	3.5(-6)
Np-239	3.2(-13)	3.2(-13)	3.2(-14)	3.8(-8)
Br-83	7.9(-14)	7.9(-14)	7.9(-15)	4.0(-10)
Rb-86	3.9(-13)	3.9(-13)	3.9(-14)	3.6(-7)
Sr-89	1.8(-13)	8.7(-12)	1.7(-14)	4.4(-7)
Sr-91	6.9(-14)	1.3(-13)	6.9(-15)	1.4(-9)
Y-91m	3.9(-14)	3.9(-14)	3.9(-15)	6.5(-11)
Y-91	5.9(-14)	7.9(-12)	5.9(-15)	1.7(-7)
Mo-99	3.1(-11)	1.7(-10)	3.1(-12)	4.3(-6)
Tc-99m	4.0(-11)	4.0(-11)	4.0(-12)	5.0(-7)
Ru-103	1.6(-13)	8.0(-12)	1.6(-14)	3.2(-7)
Ru-106	2.4(-12)	4.7(-12)	2.4(-13)	4.4(-5)
Ag-110m	4.3(-13)	4.3(-13)	4.3(-14)	5.4(-6)
Te-127m	7.9(-14)	7.9(-14)	7.9(-15)	4.3(-7)
Te-127	2.5(-13)	2.5(-13)	2.5(-14)	4.9(-9)
Te-129m	5.5(-13)	5.5(-13)	5.5(-14)	9.3(-7)
Te-129	3.9(-13)	3.9(-13)	3.9(-14)	9.2(-10)
I-130	3.2(-13)	3.2(-13)	3.2(-14)	8.6(-9)
Te-131m	5.5(-13)	5.5(-13)	5.5(-14)	3.5(-8)
Te-131	9.8(-14)	9.8(-14)	9.8(-15)	8.6(-11)
I-131	1.2(-10)	4.0(-10)	1.2(-11)	4.8(-5)
Te-132	8.1(-12)	2.1(-11)	8.1(-13)	1.3(-6)
I-132	1.2(-11)	1.2(-11)	1.2(-12)	5.7(-8)
I-133	8.4(-11)	1.1(-10)	8.4(-12)	3.7(-6)
I-134	3.0(-14)	3.7(-14)	3.0(-15)	5.4(-11)
Cs-134	2.8(-11)	9.5(-11)	2.8(-12)	1.0(-3)
I-135	1.6(-11)	1.8(-11)	1.6(-12)	2.2(-7)
Cs-136	5.3(-12)	3.6(-11)	5.3(-13)	3.4(-6)
Cs-137	3.3(-11)	2.2(-10)	3.3(-12)	5.3(-3)
Ba-140	8.9(-14)	8.2(-12)	8.9(-15)	5.7(-8)
La-140	9.8(-14)	1.5(-12)	9.8(-15)	8.1(-9)
Ce-141	3.0(-14)	3.0(-14)	3.0(-15)	4.8(-8)
Pr-143	2.0(-14)	7.1(-12)	2.0(-15)	1.4(-8)
Ce-144	5.1(-12)	1.1(-11)	5.1(-13)	7.3(-5)
Pr-144	2.0(-14)	2.0(-14)	2.0(-15)	1.2(-11)
All Others	3.9(-14)	7.5(-12)	3.9(-15)	-

* ( ) denotes power of 10.

TABLE 5.2-17 Sheet 2 of 2

(1) Annual average concentrations in the discharge canal assuming average annual dilution flow rate of 510,000 gpm and releases as given in Section 3.5.

(2) Assuming release from the boric acid condensate tank at the maximum pump rate of 50 gpm and uniform mixing in the discharge flow.

(3) Concentrations are in the ocean at the discharge point. Based on a 10 fold dilution factor (see Section 5.2.2.1).

(4) These are average concentrations in the sediment at the discharge point. These concentrations were calculated based on guidelines and equation A-5 given in NRC Regulatory Guide 1.109 Rev 1 (1977) p.1.109-14.

TABLE 5.2-18

ANNUAL DOSE TO BIOTA OTHER THAN MAN
FROM LIQUID EFFLUENTS FROM ST LUCIE UNIT 2

Organism	Dose (mrad/yr)
Fish	1.0*
Invertebrates	5.5
Algae	2.3
Raccoon	9.2(-1)
Chelonia mydas	2.0

*( ) Denotes power of 10.

TABLE 5.2-19

ANNUAL POPULATION - INTERGRATED DOSES (MAN-REM)
FROM ST LUCIE UNIT 2

Type of Dose	Whole Body	Thyroid
Liquid Effluents		
Fish Consumption	6.6(-3)*	6.1(-2)
Invertebrate Consumption	5.7(-3)	5.2(-2)
Shoreline Activities	3.8(-3)	3.8(-3)
Gaseous Effluents		
Submersion	1.0	1.0
Direct From Ground	1.8(-1)	1.8(-1)
Inhalation	1.3(-1)	5.0(-1)
Ingestion - Vegetables	3.4(-2)	1.3(-1)
Meat	1.1(-2)	1.8(-2)
Milk	1.1(-1)	1.5
Total	1.5	3.4

* ( ) Denotes power of 10.

TABLE 5.2-20

COMPLIANCE WITH 10CFR50, APPENDIX I

Type of Dose	Appendix I Guidelines	St Lucie Unit 2 Calculated Exposure
A. LIQUID EFFLUENTS		
Dose to whole body (mrem/yr) from all pathways	3	4.6(-3)*
Dose to any organ (mrem/yr) from all pathways	10	1.4(-2)
B. GASEOUS EFFLUENTS		
Gamma air dose (mrad/yr)	10	4.7(-1)
Beta air dose (mrad/yr)	20	1.3
Dose to whole body (mrem/yr) of an individual (external)	5	5.3(-2)
Dose to skin of an (mrem/yr) individual	15	1.3(-1)
Resulting dose to any organ (mrem/yr) from all pathways	15	3.0

*( ) Denotes power of 10.

TABLE 5.2-21

RADIATION EXPOSURES
(COMPARATIVE INFORMATION)

REM - Radiation Dose Unit
MILLIREM - 1/1000 of a Rem

ANNUAL WHOLE BODY EXPOSURES FROM NATURAL BACKGROUND RADIATION (Cosmic Radiation; Radioactivity in Rocks, Soil, Building Materials, Radioactivity in Body)

United States	70-200 Millirem (.07-.2 rem)	
Special Areas	Average	Population
Brazil - Monazite Sand Areas	500 Millirem (.5 rem)	30,000
India - Monazite Sand Areas	1300 Millirem (1.3 rem)	100,000
France - Granitic, Schistous Sandstone Areas	180-350 Millirem (.18-.35 rem)	7,000,000 (one-sixth of French population)

10CFR20 GUIDELINES - ANNUAL WHOLE BODY EXPOSURE

Occupational Exposure	5000 Millirem (5 rem)
Individual in Population	500 Millirem (.5 rem)
Suitable Sample Population Group	170 Millirem (.17 rem)

FIRST DETECTABLE CLINICAL EFFECTS - ACUTE WHOLE BODY EXPOSURES

25,000 - 100,000 Millirem (25-100 rem)

COSMIC RADIATION EXPOSURE TO WHOLE BODY DURING ROUND-TRIP FLIGHT FROM WASHINGTON, D.C. to WEST COAST AT 35,000 FEET

3-5 Millirem (.003-.005 rem)

ADDITIONAL EXPOSURE FROM LIVING IN A STONE OR BRICK HOUSE AS COMPARED TO A WOODEN HOUSE

Generally higher by values that range up to more than 50 millirem per year.

TABLE 5.2-22

ASSUMPTIONS USED IN DOSE EVALUATIONS

1) The approximately areal center of each county was taken as the food production center of that county.

2) The total vegetable production of the Southeastern Counties (Tables 2.1-22 and 23) for 1977 was apportioned according to the country acreage records for 1973-74 (Table 2.1-21).

3) Population for the year 2000 was taken from Table 2.1-1.

4) Meat production data for 1977 taken from Table 2.1-17.

5) Dairy production data for 1977 taken from Table 2.1-18.

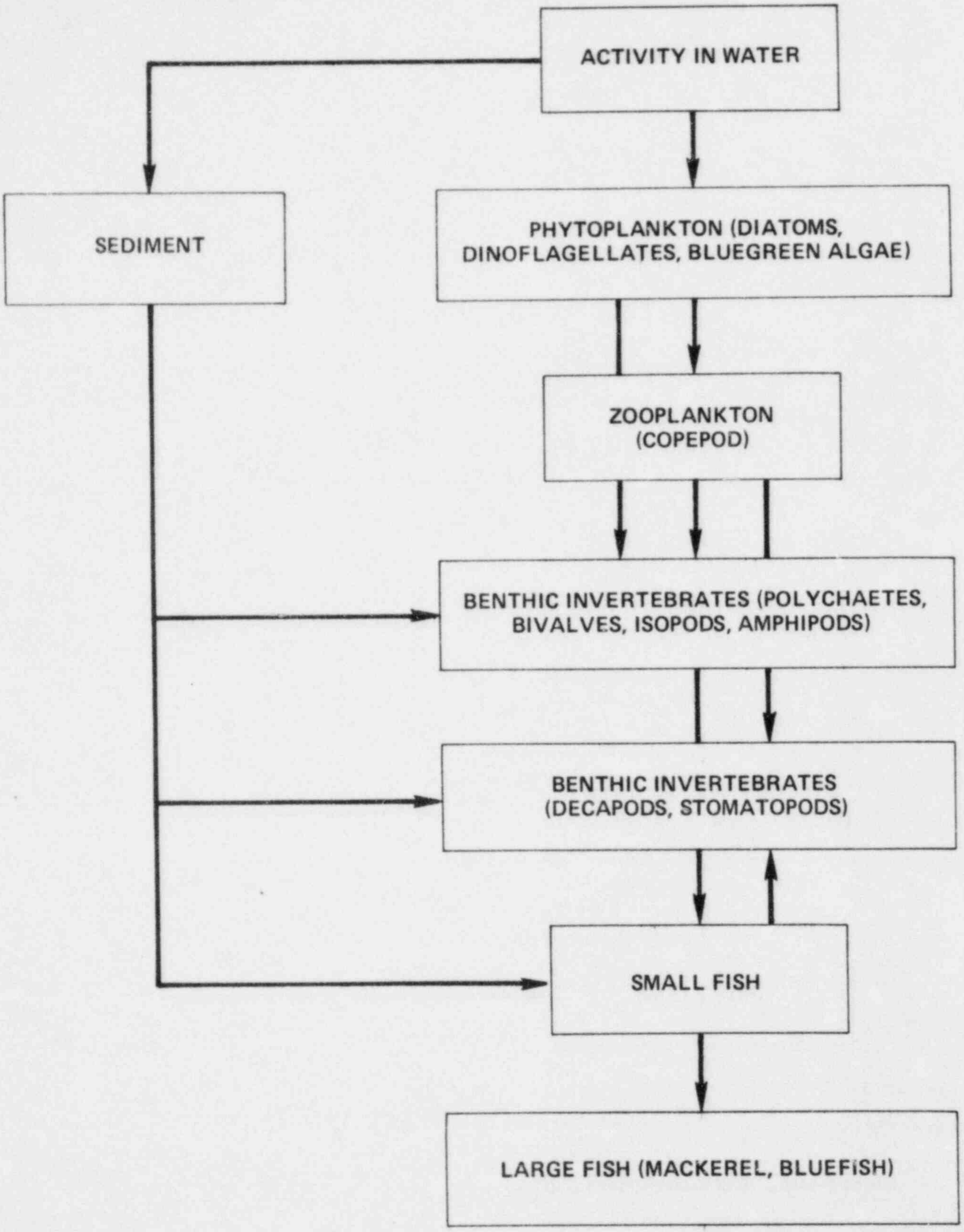
6) The dilution factor used for the "population" calculations was taken as a constant 200 for 50 miles along the shore on either side of the site.

7) The dilution factor used for the "individual" calculations was taken as 10 on the ocean-side and unity in the discharge canal.

8) The shoreline useage factor for the "population" calculations was taken as the reference value for the "individual" to account for the resort characteristic of the site environs.

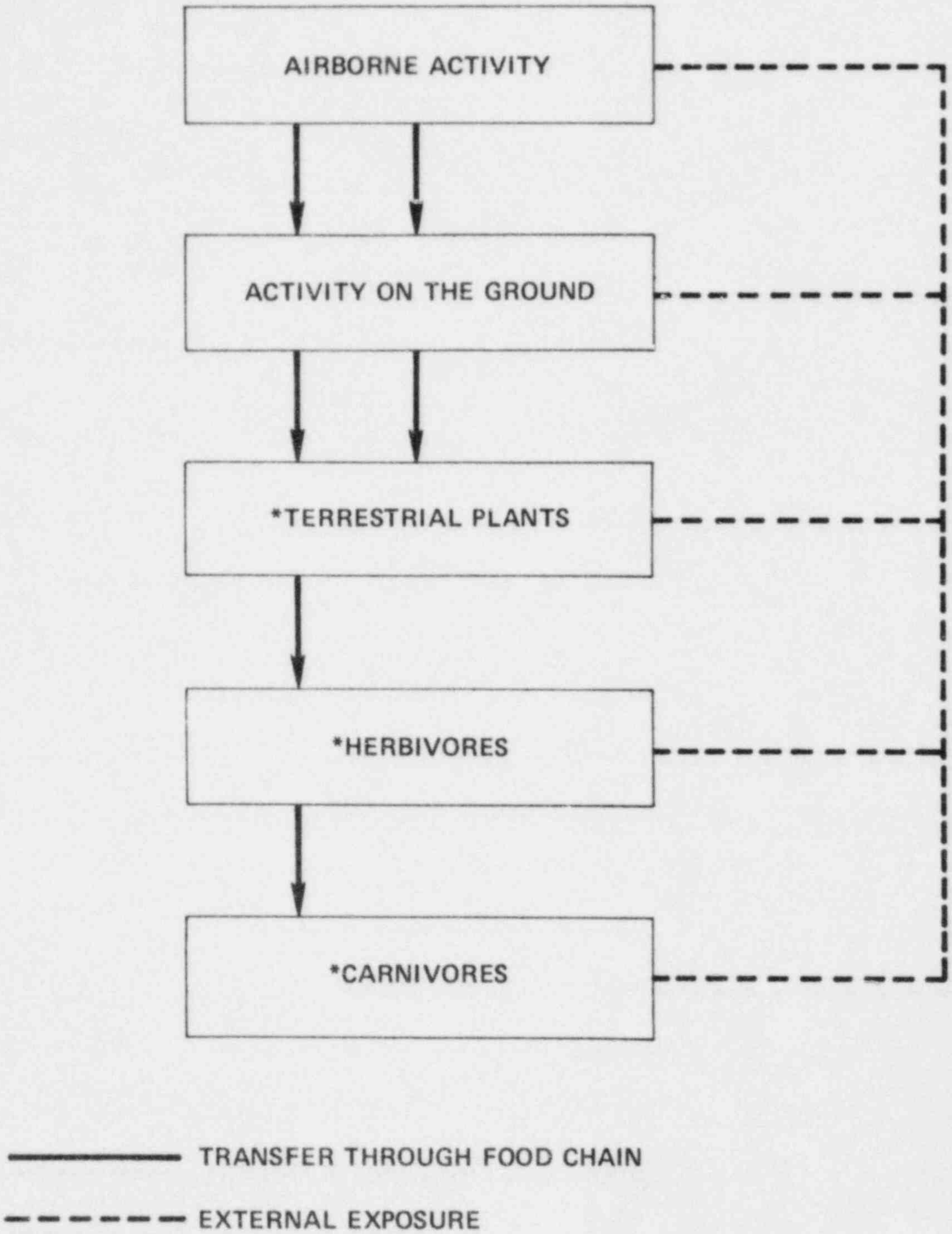
9) The direct radiation calculation was based on the assumption that the restricted area may extend as far as 350 feet from center line of containment and the unrestricted area, three feet beyond that point.

10) The age group distribution taken was the same as that in Amendments 7 and 8 to the St Lucie Unit 2 Environmental Report-Construction Permit.



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

TRANSFER OF RADIONUCLIDES THROUGH THE MARINE FOOD WEB
FIGURE 5.2–1



* THE SPECIFIC ORGANISMS ARE LISTED IN SECTION 2.2-1

FLORIDA POWER & LIGHT COMPANY
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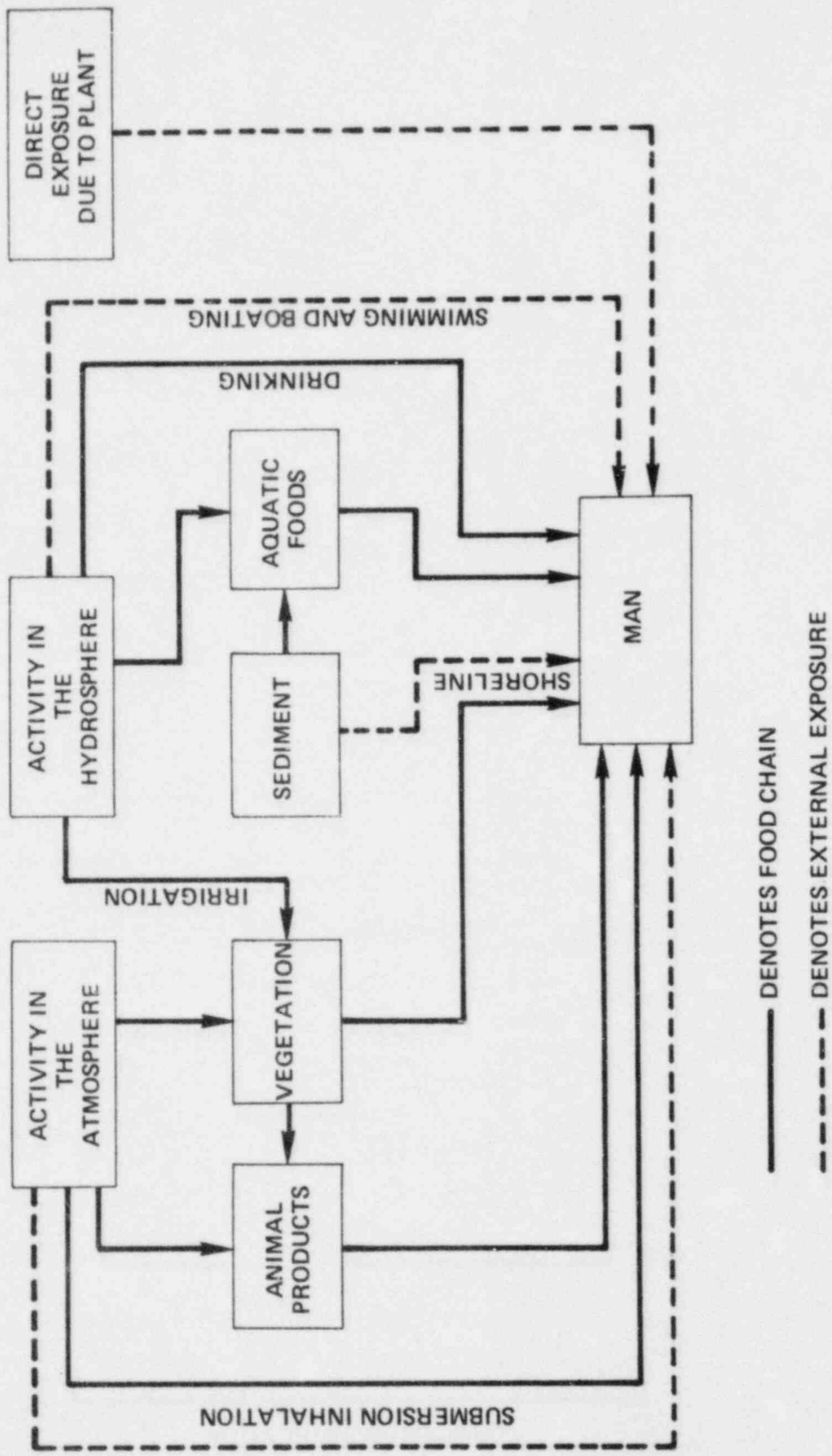
ROUTES OF EXPOSURE OF TERRESTRIAL BIOTA
FIGURE 5.2–2



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

RADIATION EXPOSURE PATHWAYS TO MAN
FIGURE 5.2–3

5.3 EFFECTS OF CHEMICAL AND BIOCIDE DISCHARGES

5.3.1 INTRODUCTION

The various chemical and biocide systems which produce discharges to the Atlantic Ocean are discussed in Section 3.6. The quantity of each waste discharge, the constituents and their concentrations after treatment, as listed in Table 3.6-1, are in compliance with USEPA effluent limitations (40CFR423) and applicable State of Florida water quality standards.

The treated chemical and biocide effluents are diluted and released to the Atlantic Ocean via discharge pipelines/diffusers (see Section 3.4 for physical description). Floor drainage from the turbine building and other miscellaneous buildings is directed to storm drainage basins where the effluents are subject to detention, dilution, evaporation, and/or percolation.

5.3.2 EFFECTS ON WATER QUALITY OF ATLANTIC OCEAN

Presented in Table 5.3-1 are the estimated increases in pollutant concentrations above the ocean ambient resulting from discharges from St Lucie Unit 2. Most of the chemical effluent discharges, as indicated in the table, meet applicable federal and state water quality limitations and standards, even before any dilution with the Atlantic Ocean occurs.

The maximum and average total residual chlorine (TRC) concentrations shown are based on the results of the 1977 TRC monitoring program[1] for St Lucie Unit 1, but are also applicable to St Lucie Unit 2 due to similar discharge. The maximum TRC discharges (0.08 mg/l) would only occur two percent of the time during the year. The maximum TRC concentrations are in compliance with USEPA effluent limitations[2] of 0.1 mg/l at point of discharge. The required mixing zones and dilutions for the discharge condition, in order to meet the State of Florida Water Quality Standards Class III: "instantaneous maximum TRC concentrations should be less than 0.01 mg/l" have been computed and presented in Table 5.3-2.

It has been demonstrated from the operational monitoring program discussed in Section 2.2.2.8 that discharges from St Lucie Unit 1 are not stressing the offshore environment. Since effluent discharges from St Lucie Unit 2 are no different than those from St Lucie Unit 1, no adverse effects are expected on the water quality of the Atlantic Ocean from St Lucie Unit 2 operation.

Floor drainage from the turbine building and other miscellaneous buildings is released to the storm water basins for further removal of suspended solids. The effluents are diluted/mixed with storm runoff collected from plant structures, and are eventually evaporated to the atmosphere and/or infiltrated into the sandy soils. Due to the relatively high quality of the effluents and additional dilution available, these effluents, if discharged, would have negligible effects on the receiving water body.

SECTION 5.3: REFERENCES

1. Florida Power and Light Company, Chlorination Study for St Lucie Plant, February 1978.

2. U.S. Environmental Protection Agency, Draft NPDES Permit No. FL0002208, issued to St Lucie Unit 1, Florida Power and Light Company, 1979.

TABLE 5.3-1

SUMMARY OF CHEMICAL WASTE DISCHARGES
INTO THE ATLANTIC OCEAN FROM ST LUCIE UNIT 2

Treated Waste Stream Discharge	Chemicals and Pollutants	Estimated Concentration in Circulating Water (mg/l)	State of Florida Water Quality Standard Class III Water (mg/l)	Estimated Increase in Average Concentration (mg/l) at Dilution and Distance			
				2 (21 ft)	5 (64 ft)	7.5 (88 ft)	10 (1300 ft)
Neutralization Basin	Total Dissolved Solids	9.00×10^{-1}	-	4.50×10^{-1}	1.80×10^{-1}	1.20×10^{-1}	9.00×10^{-2}
	Total Suspended Solids	3.46×10^{-3}	-	1.73×10^{-3}	6.92×10^{-4}	4.61×10^{-4}	3.46×10^{-4}
(Demineralizer Regeneration, Activated Carbon Bed Backwash)	Chloride (as $CaCo_3$)	6.70×10^{-2}	-	3.35×10^{-2}	1.34×10^{-2}	8.93×10^{-3}	6.70×10^{-3}
	Sulfate (as $CaCo_3$)	3.34×10^{-2}	-	1.67×10^{-2}	6.68×10^{-3}	4.48×10^{-3}	3.34×10^{-3}
	pH	6.5 8.5	6.5 ~ 8.5	No change	No change	No change	No change
	Oil/Grease	1.74×10^{-3}	-	8.70×10^{-4}	3.48×10^{-4}	2.32×10^{-4}	1.74×10^{-4}
Steam Generator Blowdown Treatment System	Total Dissolved Solids	1.66×10^{-5}	-	8.30×10^{-6}	3.32×10^{-6}	2.21×10^{-6}	1.66×10^{-6}
	Total Suspended Solids	8.32×10^{-5}	-	4.16×10^{-5}	1.66×10^{-5}	1.11×10^{-5}	8.32×10^{-6}
	pH	6.5 8.5	6.5 ~ 8.5	No change	No change	No change	No change
	SiO_2	8.32×10^{-7}	-	4.16×10^{-7}	1.66×10^{-7}	1.11×10^{-7}	8.32×10^{-8}
	P	0.14	0.1	0.07	0.03	0.02	0.014
	Cu	8.32×10^{-7}	0.015	4.16×10^{-7}	1.65×10^{-7}	1.11×10^{-7}	8.32×10^{-8}
	Fe	8.32×10^{-7}	0.3	4.16×10^{-7}	1.65×10^{-7}	1.11×10^{-7}	8.32×10^{-8}
	Oil/Grease	8.32×10^{-6}	-	4.16×10^{-6}	1.65×10^{-6}	1.11×10^{-6}	8.32×10^{-7}
Biocide Waste	Total Residual chlorine	Max. 0.08 Aug. 0.027	<0.01	0.04 0.014	0.016 0.005	0.011 0.004	0.008 0.003

Note: (1) Based on circulating water flow of 514,000 gpm

(2) Number of dilutions and corresponding distances are estimated, using information in Section 5.1.2.2

TABLE 5.3-2

MIXING ZONE PARAMETERS FOR TOTAL RESIDUAL CHLORINE (TRC) DISCHARGE FROM PLANT OPERATION[1]

Plant Operation	TRC Concentration (mg/l)	Dilutions[2]	Distance[3] (ft)	Residence Time (sec)
Unit 2 only				
Maximum	0.08	8	114	29
Average	0.027	2.5	29	3
Units 1 and 2[4]				
Maximum	0.04	4	126	17
Average	0.014	1.5	59	4.6

Notes: (1) Based on circulating water flow of 514,000 gpm per unit.

(2) Number of dilutions necessary to meet the State of Florida Water Quality Standard of TRC concentration of 0.01 mg/l outside of the mixing zone.

(3) Distances are measured from the issuing ports.

(4) Based on nonconcurrent chlorination schedule, and two unit circulating water flows.

5.4 EFFECTS OF SANITARY WASTE DISCHARGE

5.4.1 INTRODUCTION

This section discusses the effects of sanitary waste discharges from the St Lucie plant on water quality of the Atlantic Ocean. Sanitary wastes from St Lucie Units 1 and 2 are treated in a package-type extended aeration treatment facility, as described in Section 3.7. This treatment plant will achieve 90 to 95 percent removal of BOD_5 and suspended solids. The effluent will meet USEPA criteria as shown in Table 5.4-1 and State of Florida Department of Environmental Regulation Standards, as shown in Table 5.4-2.

5.4.2 MIXING AND DILUTION

Treated effluent of about 12 gpm from the St Lucie Units 1 and 2 sanitary waste treatment facility is discharged into the St Lucie plant intake canal. The effluent is diluted approximately 8.7×10^4 times by the two unit condenser cooling water flow of 1,040,000 gpm through the plant.

5.4.3 IMPACTS ON WATER QUALITY OF THE ATLANTIC OCEAN

As shown in Tables 5.4-1 and 5.4-2, effluent from the St Lucie plant sanitary treatment facility already meets or exceeds applicable federal and state standards before discharge into the intake canal. Due to the large volume into which it is discharged (diluted by about 8.7×10^4 times before discharge into the Atlantic Ocean), no impacts are expected on the receiving water body.

TABLE 5.4-1

ST LUCIE PLANT SANITARY WASTE CHARACTERISTICS
COMPARED WITH USEPA SECONDARY TREATMENT INFORMATION
(40CFR133)

Parameter	Design Criteria		St Lucie Plant Sanitary Waste Effluent
	7 day mean	30 day mean	
BOD_5 (mg/l)	45	30	15
Suspended Solids (mg/l)	45	30	12 - 24
Fecal Coliform Bacteria (#/100 ml)	400	200	0 - 50
pH	6.0 - 9.0		6.0 - 9.0

TABLE 5.4-2

ST LUCIE PLANT SANITARY WASTE CHARACTERISTICS COMPARED WITH STATE OF FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION STANDARDS (FAC 17-6)

Parameter	Standard		St Lucie Plant Sanitary Waste Effluent
	1 day max	30 day mean	
Total suspended solids (mg/l)	25	12	12-24
Total P (mg/l)	5	3	<3
pH	6.0 - 9.0		6.0 - 9.0

5.5 EFFECTS OF OPERATION AND MAINTENANCE OF THE TRANSMISSION SYSTEMS

As stated in Section 3.9 (Transmission Facilities), FP&L has installed three 240 KV circuits for the transmission system during the construction of St Lucie Unit 1. Therefore, the construction and operation of St Lucie Unit 2 will not require any additional facilities for the transmission system. Procedures for operation and maintenance of these transmission lines were discussed in the St Lucie Unit 2 Environmental Report - Construction Permit.

5.6 OTHER EFFECTS

5.6.1 LAND USE

St Lucie Unit 2 is not expected to have any adverse effects on land uses. The land on FP&L's property (other than utility facilities) consists of undeveloped mangrove and sandy beaches (Section 2.1.3.2). The beaches are used for recreation by fishermen and occasional swimmers. No impact is expected on these uses.

The area within five miles of St Lucie Unit 2 (Section 2.1.3.5) consists mostly of water and forest/marsh cover. Only seven percent of the area within five miles of the plant is currently devoted to urban or developed uses. Over the life of the plant, residential uses within five miles are expected to increase. However, since over two-thirds of the area is submerged, residential and urban uses will never become the dominant element. Impacts of St Lucie Unit 2 upon surrounding cultural resources are expected to be minimal.

5.6.2 PLANT OPERATION AND MAINTENANCE NOISE

5.6.2.1 Description of Plant Operation and Maintenance Noise

The noise produced by the operation of St Lucie Unit 2 will be composed of various complex noise sources that will operate both continuously and intermittently. Noise sources such as main transformers, the turbine generator and circulating water pump motors operate continuously, whereas noise sources such as atmospheric steam dump valves, emergency diesel generators and the public address system operate intermittently. Consequently, a distinction is made between continuous and intermittent noise sources.

Sources of noise in electric motors, such as circulating water pump motors, are mechanical (bearings and rotors), aerodynamic and magnetic. The noise generated by the various ventilation fans are associated mainly with the turbulence created by the passage of the blades through the air (aerodynamic noise). This noise is radiated to surrounding areas primarily through the intake and discharge openings.

Transformer noise is a combination of both core generated noise and cooling fan noise. When transformer windings are energized, and alternating magnetic flux is produced in the core steel, causing successive elongation and contraction of the material resulting in core vibration. This is heard as the characteristic "hum" of the transformer. Cooling fan noise, being of a turbulent nature, presents a continuous frequency spectrum superimposed on discrete harmonics of the number of blades times speed.

Steam turbine generator noise is created by friction, turbulence, imbalanced, rotating parts, pressure drops, mass flow, magnetic attraction, and other motions related to the change in velocity of the moving parts. Flow related sources account for the majority of middle to high frequency noises emitted by a turbine generator. Low frequency noise is created by rotor imbalance and fluctuating electromagnetic force.

The venting of steam to the atmosphere usually creates a high intensity noise which is frequently the result of both shock interaction noise and the turbulent jet of the steam that mixes with the atmosphere.

The emergency diesel generator noise is the result of casing, inlet and exhaust noise.

In summary, plant operations are characterized by essentially steady noise from air and steam handling, mechanical and electrical processes; punctuated by intermittent noise from atmospheric dump valves, emergency diesel generators and the public address system.

Maintenance activities usually consist of routine inspection and replacement of machinery parts such as pumps and motor components. These activities produce a sound level which is normally lower than plant operation sound levels.

5.6.2.2 Plant Operation Noise Level Estimates - Methodology

Based on plant engineering design, the following major noise sources were selected as being representative of St Lucie Unit 2 continuous operation:

a) Turbine Generator

b) Two Main Transformers

c) Two Auxiliary Transformers

d) Turbine Building - Ground to Operating Floor

e) Four Circulating Water Pump Motors

f) Ventilation System

The six major systems were combined logarithmically and projected around the station in 5 dB(A) intervals, as shown in Figure 5.6-1, taking into account geometrical spreading and molecular absorption. Intermittent noise sources such as the emergency diesel generators and the public address system were projected individually around the station taking into account geometrical spreading and atmospheric absorption. Because the steam dump valve manufacturer could not provide octave band spectra for their atmospheric steam dump valves (only dB(A) values), the noise levels produced by this equipment were projected around the station taking into account only geometrical spreading. Consequently, the sound levels shown in Table 5.6-2 should be viewed as conservative, and the actual sound levels could be lower due to atmospheric absorption.

5.6.2.3 Acoustical Treatment of Plant Noise Sources

The following mitigation measures are implemented to reduce noise impact:

a) Emergency Diesel Generators

The two emergency diesel generators are fitted with exhaust silencers.

b) Atmospheric Steam Dump Valves

Applicant is installing steam dump valves of the "Self Drag" type (velocity control element), that control noise of escaping steam flow by reducing the velocity through the trim of the valve.

5.6.2.4 Applicable Noise Statutes

The noise control regulations and guidelines applicable to the operation of St Lucie Unit 2 were reviewed with the following results:

a) On the local level, St Lucie County does not have a noise ordinance that would limit plant operation noise levels (in decibels).

b) At the state level, Florida has not yet promulgated standards for environmental noise related to power plants.

5.6.2.5 Plant Operation Noise Assessment

Because the plant is expected to operate for a period of 40 years, it is appropriate to rely on the "Leq" (Equivalent A - weighted sound level) and on the "L_{dn}" (day-night sound level) descriptors, considered by the EPA as the best measures to determine long-term noise effects.

Equivalent A-weighted sound level is defined as the constant sound level that, in a given situation and time period, produces the same sound energy as the actual time-varying A-weighted sound. The Equivalent A-weighted sound level or 24 hours is symbolized as Leq (24). The L_{dn} is defined as the A-weighted sound level during a 24-hour period with a 10 dB weighting applied to nighttime sound levels. The 10 dB penalty is added because noise events are more intrusive at night.

5.6.2.6 Plant Operation and Maintenance Noise Impact

Table 5.6-1 summarizes the noise produced by continuous operation of St Lucie Unit 2 in nearby existing residential areas (without the addition of existing ambient noise). As seen from this table, the L_{dn} operational sound levels entering the nearby residential areas range from about 28 dB in the NNW sector (5.1 miles distance) to about 55 dB in the SE sector (1.1 mile distance). Leq (24) sound levels range from a low of 22 dB in the NNW sector (5.1 mile distance) to a high of 49 dB in the SE sector (1.1 mile distance).

Tables 5.6-2 and 5.6-3 show a shift of zero to two decibels in existing ambient L_{dn} values around the St Lucie site due to St Lucie Unit 2 operation. Because this shift is less than five decibels, it is considered minimal and would not produce a significant change in the general pattern of community reaction to operational noise from St Lucie Unit 2.

TABLE 5.6-1

SOUND LEVELS PRODUCED BY THE CONTINUOUS OPERATION OF ST LUCIE UNIT 2 IN THE EXISTING RESIDENTIAL AREAS

Distance From Plant (miles)	Sector	Continuous Sound Level or L_{eq24} (approximately)
1.1	SE	49
5.0	SSE	30
4.1	S	35
2.3	SSW	45
2.0	SW	47
1.9	WSW	48
2.0	W	48
2.5	WNW	44
3.5	NW	38
5.1	NNW	22

TABLE 5.6-2

SOUND LEVELS PRODUCED BY THE CONTINUOUS OPERATION OF ST LUCIE UNIT 2 AND THE COMPUTED SOUND LEVELS INDICATIVE OF THE EXISTING WEEKDAYS AMBIENT FIELD AROUND ST LUCIE SITE (dB)

Position	Description	Computed Existing Ambient Ldn-Weekdays	Continuous Plant Operation Ldn	Plant Operation Plus Ambient Ldn	Shift in the Existing Ambient Ldn Values
1	Along Route A1A	69	45	69	0
2	Along Route A1A	72	50	72	0
3	Along Route A1A	73	38	73	0
4	Along Route 712	65	42	65	0
5	Along Route 707	57	54	59	2
6	Along Route 707	58	42	58	0
7	Near Residences	57	36	57	0
8	Near Residences	56	40	56	0
9	South of Residences along Route 1	59	37	59	0

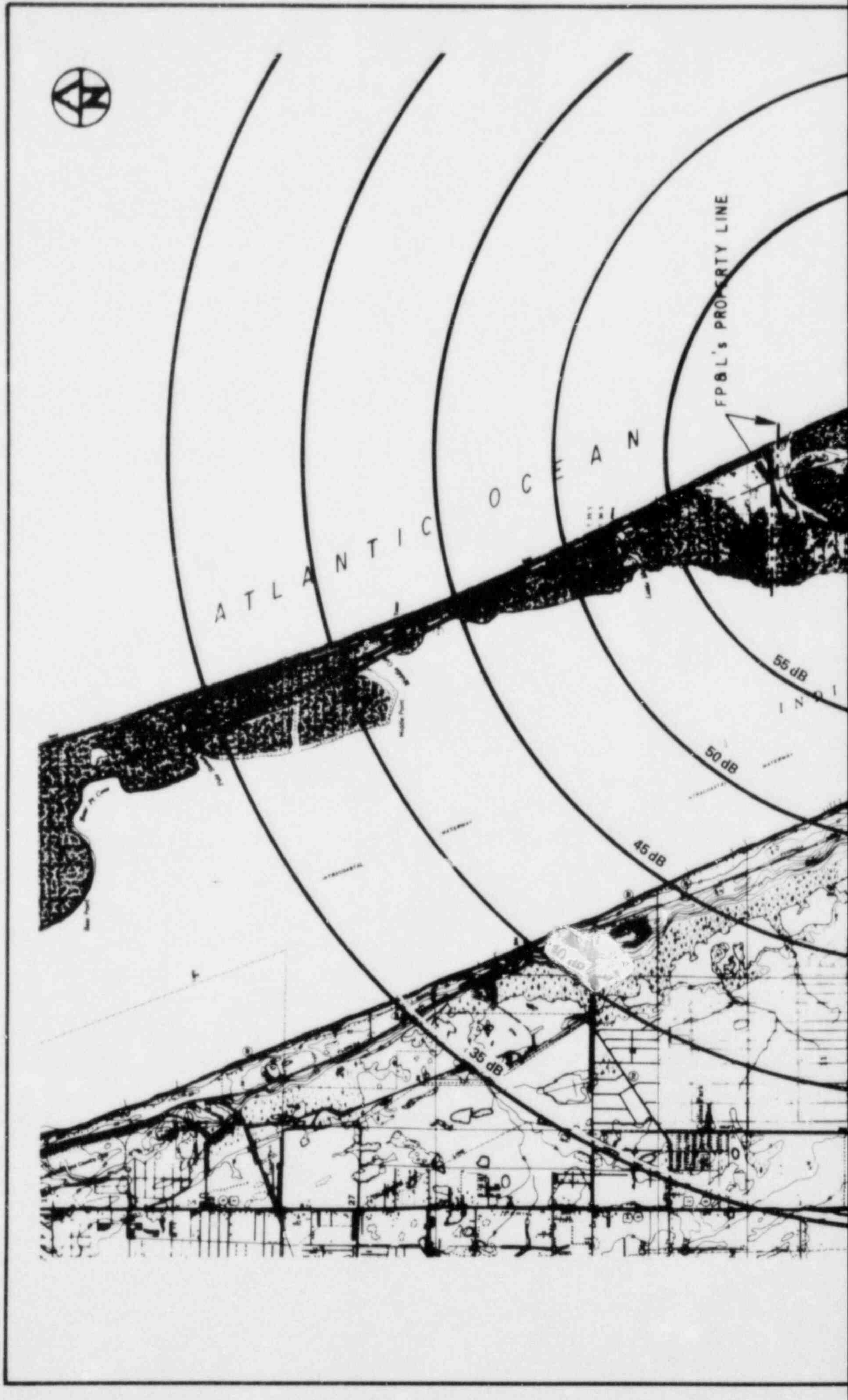
NOTE: The computed ambient values shown in this table are the result of half an hour measurement period conducted during the daytime (7:00 - 22:00) and half an hour measurement period conducted during the nighttime (22:00 - 7:00).

TABLE 5.6-3

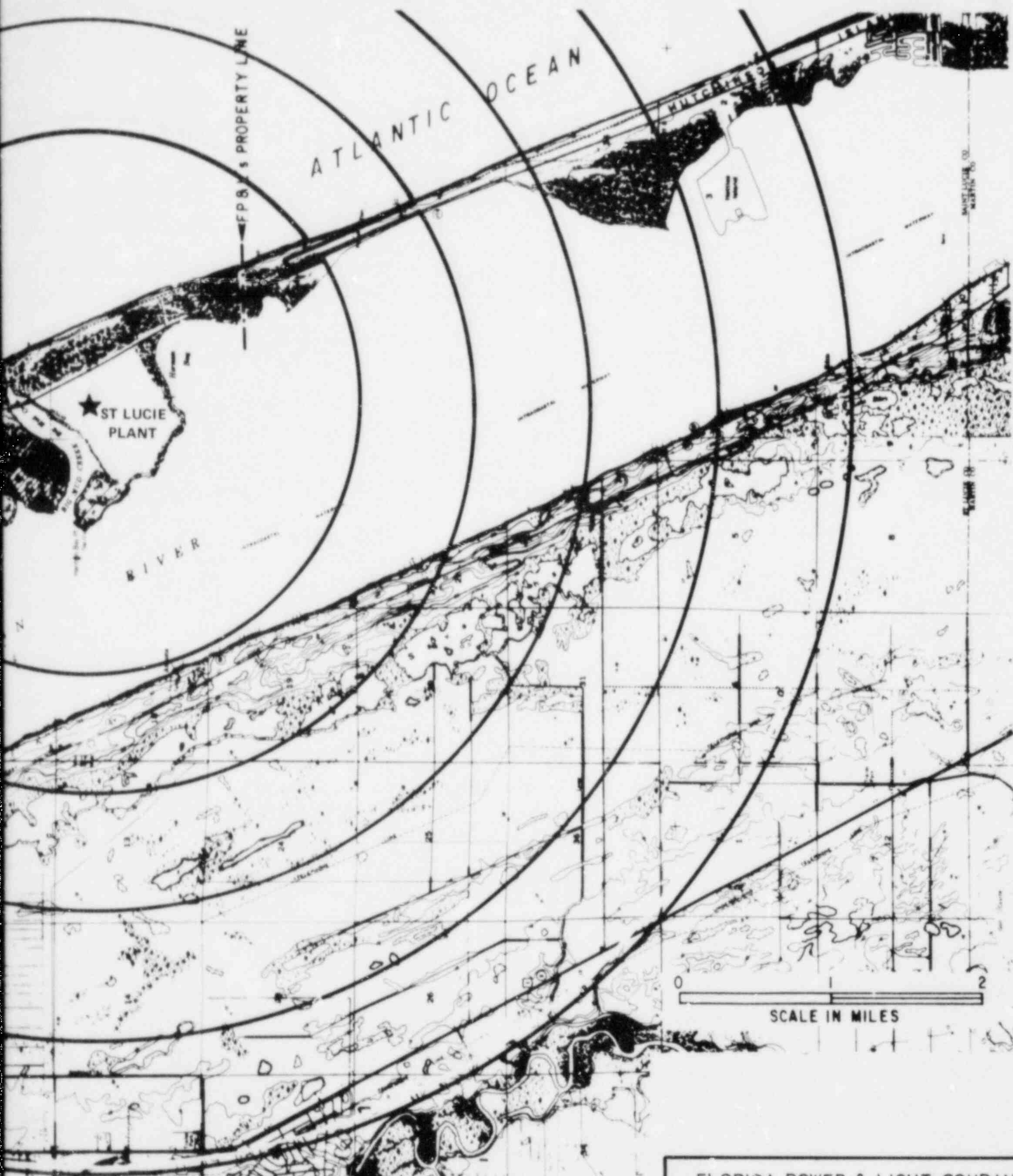
SOUND LEVELS PRODUCED BY THE CONTINUOUS OPERATION OF ST LUCIE UNIT 2 AND THE COMPUTED SOUND LEVELS INDICATIVE OF THE EXISTING WEEKDAYS AMBIENT FIELD AROUND ST LUCIE SITE (dB)

Position	Description	Computed Existing Ambient Ldn-Weekdays	Continuous Plant Operation Ldn	Plant Operation Plus Ambient Ldn	Shift in the Existing Ambient Ldn Values
1	Along Route AlA	70	45	70	0
2	Along Route AlA	69	50	69	0
3	Along Route AlA	66	38	66	0
4	Along Route 712	67	42	67	0
5	Along Route 707	63	54	63.5	0.5
6	Along Route 707	61	42	61	0
7	Near Residences	55	36	55	0
8	Near Residences	55	40	55	0
9	South of Residences along Route 1	52	37	52	0

NOTE: The computed ambient values shown in this table are the result of half an hour measurement period conducted during the daytime (7:00 - 22:00) and half an hour measurement period conducted during the nighttime (22:00 - 7:00).



ATLANTIC OCEAN
FP&L's PROPERTY LINE
55 dB
50 dB
45 dB
35 dB



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

L_{dn} CONTINUOUS PLANT OPERATION SOUND CONTOURS

FIGURE 5.6-1

5.7 RESOURCES COMMITTED

Resources committed for the operation of St Lucie Unit 2 have been previously discussed in Section 5.8 of the Environmental Report - Construction Permit. However, in view of current governmental policy regarding plutonium, spent fuel from St Lucie Unit 2 will not be reprocessed to recover plutonium. Spent fuel will be placed in either a suitable storage or disposal facility.

The impacts of plant operation on biotic resources are presented in Sections 5.1.3, 5.3 and 5.4 of this document.

5.8 DECOMMISSIONING AND DISMANTLING

Present Nuclear Regulatory Commission (NRC) regulations (Regulatory Guide 1.86) do not require the applicant for a nuclear power plant operating license to submit a detailed decommissioning plan until the end of the station's useful life. Consequently, although Florida Power & Light Company has given serious consideration to the matter, in order to maintain some degree of flexibility among the various decommissioning options, no specific plan for the decommissioning of St Lucie Unit 2 has been developed. At the end of the station's useful lifetime, FP&L will prepare a proposed decommissioning plan for review by NRC, based on the then available information and requirements. The plan will comply with NRC decommissioning rules and regulations then in effect.

5.8.1 DECOMMISSIONING ALTERNATIVES

While decommissioning will occur only after the termination of plant operation, it is expected that it will be accomplished through the application of one of the then available alternative methods. The experience gained in the continued use of these methods and any developing variations for nuclear plant decommissionings in the interim years will further ensure the effectiveness of the St Lucie Unit 2 decommissioning.

There are now three primary methods for decommissioning commercial nuclear power reactors; mothballing, in-place entombment, and dismantling with removal of radioactive components. The major characteristics of each of these methods are described below. It may become practicable at selected sites under favorable conditions to use a fourth alternative. This is conversion to a new nuclear system or a fossil fuel system by utilizing the existing turbine generator system with a new steam supply system. The original nuclear steam supply system is separated from the electric generating system and disposed of in accordance with one of the three primary modes. This fourth alternative is not treated separately here, since with respect to nuclear steam supply system decommissioning, it is not distinct from the primary methods. It is likely that the method ultimately selected for the St Lucie Unit 2 decommissioning will be a combination of two or more of the primary methods.

Mothballing of a nuclear reactor facility consists of putting the facility in a state of protective storage. In general, the facility may be left intact except that all fuel assemblies and the radioactive liquids would be removed from the site. Adequate radiation monitoring, both inplant and off site, and appropriate security procedures would be established to ensure that the health and safety of the public are not endangered.

In-place entombment consists of sealing radioactive or contaminated components (e.g., the pressure vessel and internal components of the reactor) within a structure integral with the biological shield. All fuel assemblies, radioactive liquids and other wastes, and certain selected components would be shipped offsite. The sealing of the structure will provide integrity over the period of time in which significant quantities of radioactivity remain with the material in the entombment. An appropriate and continuing surveillance program will be utilized.

In the removal/dismantling method, all fuel assemblies, radioactive fluids and waste, and other materials having radioactivity levels above accepted unrestricted levels would be removed from the site. The facility owner then would have unrestricted use of the site and long term surveillance would not be required. In the extreme application of this method, the owner may desire to dismantle the remainder of the facility and remove or otherwise dispose of all structural material and components.

Experience with decommissioning of civilian nuclear power reactors in the United States includes the shutdown or dismantling of six facilities. In these decommissionings, each of the three primary methods described above has been employed. The Carolina Virginia Tube Reactor and the Pathfinder Reactor decommissionings are examples of the mothballing method, while the Hallam Nuclear Power Facility, the Boiling Nuclear Superheater Power Station, and the Piqua Reactor decommissionings were of the entombment type. The Elk River Reactor decommissioning is most nearly exemplary of application of the removal/dismantling technology. Although the sizes of the facilities decommissioned to date have been significantly smaller than St Lucie Unit 2, the experience gained reinforces the conclusion that St Lucie Unit 2 can be decommissioned while protecting the health and safety of the public.

5.8.2 COST OF DECOMMISSIONING

Several recent studies[1,2,3] have been performed which attempt to estimate the cost of decommissioning a large PWR. Not all these studies give cost estimates for each decommissioning option, however, they all give a cost estimate for complete removal/dismantling. These estimates are given in Table 5.8-1. The removal of everything from the site, including subsurface structures, increased the estimated cost of the Reference 3 study significantly. Reference 1 gives the cost estimates for the greatest number of decommissioning options, these relative cost estimates are presented in Table 5.8-2. The relative cost estimates are given, because of the uncertainty in the dollar estimates indicated in Table 5.8-1.

Mothballing generally results in the lowest initial decommissioning costs. However, it should be noted that mothballing as well as entombment require additional costs for maintenance and surveillance of between 0.8 percent and 6.8 percent of the initial decommissioning cost per year. The very long duration for which maintenance and surveillance will be required makes mothballing and entombment economically impractical solutions for the permanent disposition of the facility.

Decommissioning by mothballing and entombment can therefore be viewed as interim in nature and would most likely be followed at some future time by removal and dismantling. Table 5.8-2 includes costs for the initial measures taken alone as well as those for the initial measures followed by eventual dismantling with and without interim security costs included.

5.8.3 ENVIRONMENTAL IMPACT OF DECOMMISSIONING

The process of decommissioning the St Lucie Unit 2 reactor will result in the exposure of individuals to small amounts of direct radiation and to releases of small amounts of radioactive materials. Since the regulations which pertain to radiation protection, effluent discharge, and the transportation and disposal of radioactive wastes during decommissioning are the same as those which apply during normal plant operation, any such exposure will be at levels as low as reasonably achievable (ALARA). The decommissioning of the plant will be performed in accordance with detailed specifications prepared and administered by persons experienced in nuclear plant work. The radiation safety aspects of each item of work will be evaluated, and the performance of the work will be monitored by experienced health physics personnel.

Estimates of the radiological environmental impact from decommissioning that have been made by Reference 1 are presented in Table 5.8-3. The gaseous and liquid effluents shown are based upon prompt removal/dismantling. Other decommissioning methods would result in lower releases. Airborne emissions can result from such activities as component cutting and structure demolition. Since cutting of the pressure vessel can create the highest concentration of airborne radioactivity, consideration would be given to utilizing a controlled envelope inside the containment. The controlled blasting of the concrete structures within the containment can result in the highest concentration of non-radioactive airborne particulates. Estimates of the peak concentrations which would occur at the containment vent outlet are given in Table 5.8-3.

The radioactive liquid wastes generated during decontamination will be processed by the waste management system prior to discharge from the plant. The radioactivity concentration of this waste is indicated in Table 5.8-3, which gives expected concentrations prior to dilution.

Each of the decommissioning methods will require a certain amount of demolition activity resulting in nonradiological environmental effects. In each case, it is expected that the resultant impacts would be less than those occurring during initial plant construction.

After decommissioning by the removal and dismantling method, St Lucie Unit 2 site would have no land use restrictions that might interfere with the continued use of the site for industrial purposes. For the mothballing and entombment alternatives, the irretrievable commitment of land would probably be limited to the area actually occupied by undismantled plant structures. In the long term, if either a prompt or delayed removal alternative is selected, there would be no irretrievable commitment of land.

SECTION 5.8: REFERENCES

1. Atomic Industrial Forum, "An Engineering Evaluation of Nuclear Power Reactor Decommissioning Alternatives," AIF/NESP - 009 AIF. Washington, D.C. 1976.

2. Battelle Pacific Northwest Laboratory, "Technology, Safety, and Costs of Decommissioning a Reference Pressurized Water Reactor Power Station", NUREG/CR-0130.

3. NUS Corporation, "San Onofre Nuclear Generating Station Decommissioning Alternatives", Report 1851, 1977.

TABLE 5.8-1

ESTIMATED COSTS FOR COMPLETE REMOVAL/DISMANTLING OF A LARGE PRESSURIZED WATER REACTOR

Reference	Reported Cost (10^6 $)	Year of Estimate	Assumed Escalation	Cost Estimate (10^6 1978 $)
1	27	1975	1.29	35
2	43	1978	1.00	43
3	51	1976	1.11	57

TABLE 5.8-2

RELATIVE COSTS OF DECOMMISSIONING ALTERNATIVES

	Normalized Cost[1]
Mothballing	1.0
Entombment	3.2
Partial Removal/Dismantling	8.8
Complete Removal/Dismantling	11.7
Mothballing followed by Partial Removal/Dismantling[2]	
Without Security	5.8
With Security	9.5
Mothballing followed by Complete Removal/Dismantling[2]	
Without Security	9.9
With Security	13.6
Entombment followed by Partial Removal/Dismantling[2]	6.6
Entombment followed by Complete Removal/Dismantling[2]	10.7

(1) Multiple of mothballing cost which is defined as 1.0 in AIF Document AIF/NESP-009-009SR (1976), which lists a value of $2.3 million. An industry estimate of the initial costs of mothballing is $2.45 million (US Nuclear Regulatory Commission, "Standard Review Plan 5.9" - Nov., 1977).

(2) Removal/Dismantling assumed to occur 108 years after initial mothballing or entombment.

Source: Atomic Industrial Forum, "An Engineering Evaluation of Nuclear Power Reactor Decommissioning Alternatives". AIF/NESP - 009 AIF. Washington, D.C., 1976.

TABLE 5.8-3

ENVIRONMENTAL IMPACTS OF DECOMMISSIONING

A. EFFLUENTS*

1) Gaseous

Non-Radioactive Concentration: Total Particulates (peak concentration) 11 gm/m^3

Radioactive Concentrations:	Co-60	1.8×10^{-11}	μCi/cc
	Fe-55	8.7×10^{-11}	μCi/cc
	Mn-54	2.5×10^{-12}	μCi/cc
Dose at Exclusion Area Boundary		8.2×10^{-4}	mrem/yr

2) Liquid

Total Liquid: 2.0×10^5 gallons

Radioactive Contents:	Co-58	3.0×10^2	μCi
	Co-60	4.2×10^3	μCi
	Fe-55	2.2×10^4	μCi
	Zn-65	2.4×10^3	μCi
	Cs-137	1.2×10^3	μCi
Release Concentration		5.0×10^{-5}	Ci/ml

B. DIRECT EXPOSURE

	Occupational Exposures	Exposure to the public from the transportation of waste		
	man-rem	man-rem	# of shipments	
Mothballing	150	0.2	16+	(16)**
Entombing	130	0.9	91	(91)
Removal/Dismantling	630	4.3	4207	(460)
Mothballing - Removal/Dismantling	460	2.3	4233	(476)
Entombing - Removal/Dismantling	440	3.0	4298	(551)

* Gaseous and liquid effluents are based upon prompt removal/dismantling.
\+ Total shipment including radioactive shipments.
** Number of radioactive shipments in parentheses.

Source: Atomic Industrial Forum, "An Engineering Evaluation of Nuclear Power Reactor Decommissioning Alternatives" AIF/NESP - 009 AIF Washington D.C., 1976.

MONITORING PROGRAMS

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6.1 PREOPERATIONAL ENVIRONMENTAL PROGRAM

The Final Environmental Statement Related to Construction of St Lucie Unit 2 required that a preoperational environmental monitoring program be defined for St Lucie Unit 2. This program is in effect, and is the operational environmental monitoring program for St Lucie Unit 1. Program elements are described in Appendix B to Operating License No. DPR-67, Environmental Technical Specifications for Florida Power & Light Company's St Lucie Unit 1. Further information on this program is contained in three reports[1-3] submitted to USNRC by FP&L, in accordance with the St Lucie Unit 1 Environmental Technical Specifications.

6.1.1 SURFACE WATERS

Environmental monitoring of Atlantic Ocean waters, offshore of the St Lucie site, began in March 1976. The environmental monitoring program conducted by Applied Biology Inc serves two functions: 1) it provides preoperational information on physical, chemical and ecological parameters for St Lucie Unit 2; 2) the operational effects of St Lucie Unit 1 on the Atlantic Ocean are measured. Monitoring programs not defined in the St Lucie Unit 1 Environmental Technical Specifications are described below.

6.1.1.1 Tides

Ocean tide features at St Lucie are described from the unpublished tide record for Vero Beach, Florida, supplemented by a monitoring program at the plant site. The National Ocean Survey monitored ocean tides at a location about one mile north of Riomar, which is across the Indian River from Vero Beach. The NOS monitoring station, about 21 nautical miles north of the St Lucie plant site, was operated from June 1970 to November 1973, providing a tide record for 33 months of this period.

Ocean tides were also monitored by FP&L at the St Lucie plant site, near the circulating water intake location from April 1976 to May 1977. Three float-type drum recording gauges, Leupold and Stevens Model A-71, were installed in stilling wells which were mounted on the intake warning pylons. The gauge zero was surveyed relative to the local plant site datum, which is defined as 1.85 feet below National Geodetic Vertical Datum. Tidal elevation resolution was generally less than 0.1 feet except during brief periods of heavy swell when some wave effect was noticeable in the record. After combining the records from all three instruments data recovery was at least 94 percent during the monitoring interval of May 9, 1976, to May 8, 1977. Data were compiled as a listing of high and low tide elevations relative to the site datum.

6.1.1.2 Currents

Ocean currents near the St Lucie Unit 1 discharge were measured by Continental Shelf Associates (CSA), Tequesta, Florida, from November 1973 through May 1975[4]. Two General Oceanics Model 2010 film recording current meters were installed at a monitoring station location 2000 feet offshore, at a water depth of 32 feet below mean low water. Surface currents were measured with a meter attached to a taut wire mooring 26 feet above the bottom. Bottom currents were measured one foot above bottom with the second meter mounted on a concrete block anchor. The tilting vane type current meters were serviced routinely at 20 to 30 day intervals when film packs were retrieved for processing. Data recovery was at least 82 percent for bottom current measurements and 67 percent for the surface record. Both bottom and surface current speed and direction were listed for 15 minute measurement intervals. After reducing the current data, CSA presented current speed and direction in the form of joint frequency distributions for 0.1 fps increments and 30 degree sectors. The independent distributions of current speed and direction are summarized in Tables 2.4-1 through 2.4-4 to describe seasonal trends and ranges.

Current measurements acquired during a ten day interval in March-April, 1977, were obtained as part of a program to evaluate performance of the St Lucie Unit 1 diffuser[5]. An array of four in situ current meters was used to measure mid-depth currents within a one nautical mile radius of the diffuser. Environmental Devices Corporation (ENDECO) Model 105 current meters were deployed with recording intervals set for one-half hour increments.

6.1.2 GROUNDWATER

The series of subsurface investigations performed to determine the groundwater environment of the St Lucie site have been described in the St Lucie Unit 2 Environmental Report - Construction Permit.

6.1.3 AIR

6.1.3.1 Onsite Meteorological Measurements

The onsite meteorological program is designed to provide a dispersion climatology for use in safety planning of radioactive effluent releases and as a means of determining the appropriately conservative meteorological parameters to be used in estimating the potential consequences of hypothetical accidents. Analysis of meteorological data collected at the St Lucie tower permitted an assessment of the diffusion parameters characteristic of the site. The instrument package which complies with NRC Regulatory Guide 1.23 RO[6] is described in Sections 6.1.3.1.2 through 6.1.3.1.4.

The parameters which are monitored are wind speed, wind direction, temperature differential (delta T), dewpoint, temperature, barometric pressure and precipitation. The parameter, heights, and number of sensors installed at the St Lucie si e are listed in Table 6.1-1.

6.1.3.1.1 Meteorological Tower

A meteorological tower was erected at the St Lucie Plant site on Hutchinson Island in "ecember 1970. A 199 foot frame tower is located on site 2400 feet north of the reactor complex. It is situated in an area of relatively flat terrain characterized by mangrove trees in the range of eight to ten feet in height. Figure 6.1-1 illustrates the location of the meteorological tower relative to the rest of the plant site.

6.1.3.1.2 Instrumentation

a) Wind Speed

The wind speed sensors at the 32.8 foot and the 190.0 foot levels are Climatronics F460-WS wind speed transmitters. Each sensor consists of a sensitive three cup anemometer which drives a multi-holed light chopper in the transmitter. The rotating light chopper produces an electrical signal output from a phototransistor and a light emitting diode source. The resulting signal is shaped into a square wave whose frequency is proportional to the wind speed. This square wave signal is then sent to the translator for conversion to engineering units.

The specifications of the Climatronics model #F460-WS wind speed anemometer are as follows:

Accuracy	±0.15 mph or 1 percent, whichever is greater
Threshold	0.58 mph
Range	0 to 100 mph
Distance Constant	5 feet maximum
Temperature Operating Range	-40°F to 120°

b) Wind Direction

Climatronics F460-WD wind direction transmitters are used to measure the wind direction at the upper and lower levels. Each wind direction sensor consists of a light weight counterbalanced vane connected to a precision low torque potentiometer located in the transmitter. The position of the vane is sensed by the potentiometer and is sent to the translator as a dc voltage.

The specifications of the Climatronics model #F460-WD wind direction sensor are as follows:

Accuracy	$\pm 3^{\circ}$ of azimuth
Threshold	0.58 mph
Range	0 to 540°
Distance Constant	3.7 feet maximum
Damping Ratio	0.4
Temperature Operating Range	-40°F to 120°F

The signal conditioning equipment is the Climatronics Model 100078 analog translator. The output of the translator is 0-1.0 volt for 0-120 mph wind speed. Wind direction output is 0-1.0 volt for 0-540°.

c) Air Temperature

Two Rosemount resistance temperature sensors Model 104 MB are used for the direct measurement of ambient temperature and delta T. The platinum resistance temperature sensor provides an extremely predictable and repeatable resistive output with changes in temperature. The Rosemount temperature sensors are coupled with Rosemount Model 414L linear bridges to provide a millivolt output signal with an accuracy of +0.17°F. Differential temperature is measured between the upper and lower temperature sensors (0-0.1 volt for 0-100°F) by using a differential amplifier supplied with the control room equipment for temperature differential. The differtial output range is ±15°F. The heights of each temperature sensor are given on Table 6.1-1.

The sensor consists of a precision, wire-wound resistance element, a protective enclosure, a mounting housing, and provisions for electrical connections.

The specifications of the Model 104 MB sensors are as follows:

Accuracy	±.085°F @ 32°F
Response Time	5.5 seconds
Range of Probes	-100°F to 500°F
Resistance at 32°F	approx 100 ohms (dependent on probe)
Radiation Shield	under test radiation intensity of 1.56 gram calories/cm^2/min, radiation errors are less than 0.2°F.
Aspiration Rate	10 ft/sec
Operating Temp Range of Shield	-40°F to 150°F
Shield Finish	highly reflective Dupont polar white epoxy

d) Rain Gauge

The precipitation sensor is a Belfort tipping bucket rain gauge. This type of sensor funnels rain into a small receptacle which tilts when it has received 0.01 inch of rain and another identical receptacle moves in place ready to receive the next 0.01 inch of rain. In the process of tipping, an electrical contact is closed momentarily. A translator card is connected to this electrical contact and counts the tips by adding 0.01 volts (0.01 inches precipitation). After each 1 inch accumulation of precipitation the translator automatically resets the output to 0.0 volts.

Belfort tipping bucket rain gauge (No. 595)

Sensitivity	0.01 inches
Range	infinite
Accuracy	2 percent for rainfall rate of 1 in/hour or less
	4 percent for rainfall rate of 3 in/hour
	6 percent for rainfall rate of 6 in/hour

e) Dewpoint

Dewpoint (at the 34.7 foot level) is measured by a Foxboro Model 2711 AAG lithium chloride dew cell. The range of the sensor is 0 to 120°F; the accuracy is ±0.5°F between 10 and 90 percent relative humidity. The linear output is recorded on a Bristol Model 550 Dynamaster analog recorder.

f) Barometric Pressure

A Belfort microbarograph (USWB No. 355-31SW) is employed to provide a continuous strip chart record of atmospheric pressure. It is calibrated to within .005 inches (.17 mbs).

6.1.3.1.3 Telemetric and Data Recording System Description

The meteorological data acquisition system for the St Lucie Plant is designed in accordance with the requirements listed in NRC Regulatory Guide 1.23 RO[6]. The data acquisition equipment is at the onsite meteorological tower. The data output of the sensing equipment is routed to a local recording station located at the base of the meteorological tower.

The six parameters are recorded on individual, single point analog recorders. The chart width is 4.8 inches for each parameter. The range for the wind speed is 0-120 mph. The chart range for wind direction is 540° to eliminate full scale wiping. The delta T recorder has a ±15°F chart range. The temperature recorders have a 0-120°F range. The dewpoint has a 0-120°F range. Chart drive speeds are 1.5 inches per hour.

The following is a summary of the recorders provided in the local recording station at the base of the tower:

Laboratory Data Control
Model 2802
also Navy I.D. RO-447/GMQ29

a) Wind Speed Recorders (2) - 0-120 mph range

b) Wind Direction Recorders (2) - 0-540^{o} sweep range

c) Dewpoint - 0-120^{o} range

d) Delta T Recorder - $\pm 15^{o}F$ range

The telemetry system will be designed and described at a later point in time.

6.1.3.1.4 Data Reduction

Meteorological data for the diffusion evaluation are presently recorded on strip charts located in the recording station at the base of the meteorological tower. The data are reduced to mean hourly data and placed on computer punch cards. Present data include:

a) Wind direction for the 32.8 and 190.0 foot levels of the meteorological tower.

b) Wind speed for the 32.8 and 190.0 foot levels.

c) Vertical temperature lapse rates between the 110.3-foot and 32.8-foot levels and between 190.0-foot and 32.8-foot levels.

d) Ambient temperature for the 34.7, 112.0 and 191.9 foot levels.

e) Dew point temperature for the 34.7 and 110.3 foot levels

f) Precipitation at the surface.

6.1.3.1.5 Calibration and Maintenance

a) Wind Direction/Wind Speed Translator System

The translator cards supplying power to the wind direction and wind speed sensors are capable of supplying a "zero" and "span" or "full scale" output using an internally calibrated voltage, precision resistance or crystal frequency oscillator. Values for the "as found" and "as left" test are documented for both "zero" and "span" modes at the remote site. This procedure documents any changes made during the calibration and readings indicated by the analog system.

b) Wind Direction Sensor Calibration

The bearings in the wind direction sensor are changed every year with replacement date and sensor serial number documented. The wind vane is pointed toward a known azimuth and the reading compared with expected voltage and chart readings. Repeatability and proper

540^{o} switching of the potentiometer are noted and documented. All values are checked for readings $\pm 5^{o}$ of known azimuth points. Calibration is performed and documentation on the "as found" and "as left" conditions recorded for analog indicator at the remote site.

c) Wind Speed Sensor Calibration

Wind speed sensor bearings are replaced every six months with sensor serial number and replacement date properly documented.

The sensor is checked by inhibiting any movement of the cups and checking for expected voltage and analog outputs. Calibration is performed after noting the "as found" condition. Documentation of "as left" condition is made for the tower site recorders.

d) Temperature System

A variable precision resistance is substituted for each temperature probe. Factory calibration curves are compared with a five point resistance test to verify temperature bridge linearity throughout the system operating range. Values recorded by the digital and analog systems are documented for the "as found" and "as left" condition for each point calibration.

e) Delta Temperature System

A variable millivolt source is substituted into the recorder and a five point linearity check performed against known temperature points. The calibration is documented at each point with the "as found" and "as left" values recorded. A comparison is made with the remote and control room digital and analog recorders with any changes made during the calibration documented.

f) Dew Point Temperature System

The dewprobe is disconnected and substituted with a variable millivolt supply. Probe resistance values are simulated over a five point linearity range to compare with known expected results. Readings from the remote site analog recorder are documented in the "as found" and "as left" mode for the calibration procedure.

g) Dewcell Calibration

The old dewcell is replaced with a spare dewcell that has been cleaned and retreated with lithium chloride (LiCl). Wet and dry bulb readings are taken with a sling psychrometer to determine dew point and compared with the system dew point. Analog recorders in the remote site are compared with the sling psychrometer and values documented.

h) Microbarograph System

The readings from the microbarograph are compared with the test barometer and recorded. A calibration is performed documenting the "as found" and "as left" condition. The battery pack voltage is checked and replaced if below factory specifications of 2.9 volts dc.

i) Rain Gage System

The tipping bucket is activated several times with the correct value being verified on the analog recorder. Values are logged and documented to indicate consistency in readings.

6.1.3.1.6 Data Recovery

Data recovery rates for the two year period are provided on an annual basis in Table 6.1-2. In compliance with NRC Regulatory Guide 1.23, RO[6], the parameters required for valid atmospheric diffusion estimates had recovery rates exceeding 90 percent.

6.1.3.2 Models

6.1.3.2.1 Short Term (Accident) Diffusion Estimates

The objective of this subsection is to describe the methods used to provide conservative estimates of atmospheric diffusion at both the site boundary and at the outer limits of the low population zone (LPZ) for appropriate time periods up to 30 days. The diffusion evaluations for the short term accidents are based on the assumption of a ground-level release (i.e., no reduction in ground concentrations due to elevation of the plume).

6.1.3.2.1.1 Diffusion Model For 0-2 Hours

The analytical procedure for evaluating the 0-2 hour accident period is based on a revision of the model described in NRC Regulatory Guide 1.4 R2[7]. The changes reflect variations in atmospheric diffusion factors that occur as a function of wind direction and variable site boundary distance. Allowances are made for meandering plumes during light winds and stable atmospheric conditions. The new approach is described in the Draft Regulatory Guide 1.XXX (1978)[8].

The model is distance and direction dependent. Variability of wind direction frequency is considered in determining the relative concentration, X/Q, values. The hourly X/Q values are determined as described in the following manner.

During neutral and stable conditions when the wind speed at the lower (10 meter) level is less than 6 meters per second (mps) the relative concentration is computed as:

$$\frac{\chi}{Q} = \frac{1}{\bar{u}\,\pi\Sigma_y\sigma_z} \qquad (1)$$

provided it is less than the greater value calculated from either

$$\frac{\chi}{Q} = \frac{1}{\bar{u}\,(\pi\sigma_y\sigma_z + cA)} \qquad (2)$$

or

$$\frac{\chi}{Q} = \frac{1}{\bar{u}\,(3\pi\sigma_y\sigma_z)} \qquad (3)$$

where,

χ/Q = is relative concentration at ground level (sec/m^3)

π = is 3.14159

$\bar{u}$ = is the hourly average wind speed at the 10 meter level above plant grade (m/sec).

Σ_y = is the lateral plume spread (m) with meander and building wake effects (m) (a function of atmospheric stability, wind speed $\bar{u}$ and downwind distance from the release). For distances up to 800 meters, $\Sigma_y = M\sigma_y$; where M is a function of atmospheric stability and wind speed[3]. For distances greater than 800 meters, $\Sigma_y = (M-1)\,\sigma_y\,(@800m) + \sigma_y$

A = is the smallest vertical plane, cross-sectional area of the building from which the effluent is released (2726 m^2)

c = building shape factor (0.5, dimensionless)

σ_y = is the lateral plume spread (m) at a given distance and stability based on logarithmic fit of NRC curves in[8]

σ_z = is the vertical plume spread (m) at a given distance and stability based on logarithmic fit of NRC curves in[8]

During all other atmospheric stability and/or wind speed conditions, χ/Q is the greater value calculated from equations (2) and (3).

Plume meander was accounted for by modifying the lateral diffusion coefficient σ_y. The meander function (M)[9] is evaluated as follows.

a) For Pasquill stabilities A-C at all wind speeds or all stabilities when wind speed > 6 mps; M = 1

b) For wind speed ≤ 2 mps; Stab D; M = 2
Stab E; M = 3
Stab F; M = 4
Stab G; M = 6

c) For 2 mps < wind speed ≤ 6 mps M is evaluated by a curve fitting technique.

An hourly observation is considered to be calm if the wind speed is less than the threshold of the wind instruments. For calm conditions a wind speed is assigned equal to the vane or anemometer starting speed, whichever is higher. A wind direction is assigned in proportion to the directional distribution of non-calm winds with speeds less than 1.5 meters per second. No substitution was made for missing or invalid data.

6.1.3.2.1.2 Diffusion Model For 0-8 Hours

The downwind centerline relative concentration of an effluent, continuously released from a point source at ground level has been evaluated. The model used in the calculations is as follows[8]:

$$\chi/Q = \frac{1}{\bar{u}\,(\pi\sigma_y\sigma_z + cA)} \qquad (4)$$

where,

χ/Q = relative concentration (sec/m^3)

$\bar{u}$ = average hourly wind speed (m/sec) at the 32.8 foot level above plant grade

$\sigma_y \sigma_z$ = the horizontal and vertical dispersion coefficients (m), corresponding to the Pasquill stabilities defined in Regulatory Guide 1.23 RO[6] from measurements of the vertical temperature differential

c = building shape factor (0.5, dimensionless)

A = minimum cross sectional area of the reactor building (2726 meters^2)

Hourly average winds less than or equal to the starting speed of the anemometer or vane (0.36 mps) were considered calm. The calms were directionally assigned in proportion to the distribution of the lowest (non-calm) wind speed class by stability class. Eight hour running average relative concentrations were calculated by wind direction at the exclusion area boundary and at the low population zone distance.

6.1.3.2.1.3 Diffusion Model For 8-24 Hours, 1-4 Days, and 4-30 Days

For the postulated 16 hour, 72 hour, and 624 hour accident periods, the following equation, from Regulatory Guide 1.4 R2[7] was used to calculate the relative concentrations by wind direction at 1.0 mile, the low population zone distance:

$$\chi/Q_n = \frac{1}{n} \sum_{i=1}^{n} \frac{2.032}{\bar{u}_i D \sigma_{z_i}} \qquad (5)$$

where,

D = distance to point of analysis (m)

n = running average time of 16 hours, 72 hours and 624 hours, from $i = 1$ to n

The equation above assumes that the plume meanders are spread uniformly over each of the 22.5 degree sectors. No wake correction factor is allowed as the wake effect becomes negligible beyond approximately eight hours.

6.1.3.2.2 Long Term (Routine) Diffusion Estimates

The long term diffusion characteristics for the St Lucie site were estimated in accordance with the criteria set forth in NRC Regulatory Guide 1.111 R1[9]. The analysis was performed using the onsite meteorological data for a two year period, September 1976 through August 1978 (see Subsection 6.1.3.1).

Relative concentrations (X/Q) resulting from routine releases were calculated using a modification of the puff advection model MESODIF developed by Start and Wendell[10,11]. A ground release was assumed. The Start and Wendell dispersion coefficients were replaced with those consistent with other NRC evaluations from Gifford[12]. Building wake was incorporated to allow for initial dispersion credit in the building cavity. These calculations were made at distances of 0.5, 1.5, 2.5, 3.5, 4.5, 7.5, 15, 25, 35, and 45 miles.

Undepleted relative concentrations (X/Q) were also computed using a straight line plume model. The ratios between the X/Q's from each model were determined and are characterized as the terrain/recirculation correction factors.

6.1.3.2.2.1 Puff Advection Model

Spatial variability of stability, mixing height, wind speed, and wind direction facilitate that the effluent plume from a continuous point source be approximated by the release of a series of puffs. Each puff can be modified or advected independently according to the meteorological conditions of its immediate location. Total integrated concentrations at any sampling point can be calculated from the accumulated exposure due to individual puffs as they pass over the point.

The instantaneous contribution of an individual puff to a sampling point's total integrated concentration, after Slade[13], for a ground release, is given by:

$$\frac{X}{Q}(x,y) = \frac{2}{(2\pi)^{3/2}\sigma_r^2\sigma_z} \exp\left[-\frac{1}{2}\left(\frac{r^2}{\sigma_r^2}\right)\right] \qquad (6)$$

where,

$\frac{X}{Q}(x,y)$ = the instantaneous ground level relative concentration at coordinate (x,y), (seconds/meter^3),

σ_z = the standard deviation of effluent in the vertical direction (meters),

σ_r = the standard deviation of effluent in the horizontal direction (meters),

r = the distance from the center of the puff to the coordinate (x,y) (meters)

Using Equation (5), the total integrated concentrations are calculated as:

$$TIC(x,y) = \sum_{i=1}^{n} \sum_{j=1}^{J} \sum_{k=1}^{K_i} \sum_{l=1}^{L_j} \frac{\frac{X}{Q}_{ijkl}(x,y)}{J\ L_j} \qquad (7)$$

where,

$TIC(x,y)$ = accumulated hourly relative concentration at grid point (x,y), (seconds/meter^3),

n = number of sampling hours,

J = the number of advection steps per hour,

K_i = the number of puffs released up to hour i,

L_j = the number of samples per advection step j, and

$\frac{X}{Q}_{ijkl}(x,y)$ = the instantaneous relative concentration coordinate (x,y) contributed from puff k, during i, advection step j, and sampling step l.

This approximation with adequate sampling frequency will converge to the continuous point source at any level of accuracy required (see Start and Wendell[10]).

The diffusion of effluents is described by the distance and stability dependent values of σ_r and σ_z. Because the time history of a puff includes spatial and temporal variations of meteorological parameters, the value of σ_r and σ_z cannot be determined as a discrete function of stability and distance. These values are determined in a stepwise fashion according to the general form:

$$\sigma = \sigma_o + \Delta\sigma \qquad (8)$$

where,

σ_o = the standard deviation before the advection step (meters),

$\Delta\sigma$ = the incremental change during the advection step just completed (meters), and

σ = the updated standard deviation following the completed advection step (meters).

Between sampling intervals, it is assumed that all meteorological conditions remain constant. Growth of the puff during this interval then is only a function of stability, total distance moved before the advection step, and distance increment moved during the advection step. $\Delta\sigma$ is specified by:

$$\Delta\sigma = S\ (IPAS,\ DIST + \Delta DIST) - S\ (IPAS,\ DIST) \qquad (9)$$

where,

$$S\ (A,B) = 10^{(a(A)+b(A)\ \log\ (B)+c(A)\ (\log(B))^2)}$$

IPAS = the Pasquill stability class characteristic of the advection process,

DIST = the total distance puff has moved prior to advection step,

ΔDIST = the distance increment moved during the advection step,

a,b,c = are coefficients dependent upon stability class, determined in a manner such that the functions S (A,B) fits the curves given by Gifford[12].

In a method similar to that of Turner[14], σ_z at any time and location is allowed to increase via Equation (8) and Equation (9) until a value of 0.80 times the mixing height has been reached. At this point, the effluent is assumed to be uniformly mixed in the vertical direction. If previously values of σ_z already exceed this limit, they are held constant (i.e., $\Delta\sigma$= 0); they are not reduced in any manner because a negative would imply negative diffusion (Start and Wendell[10]).

6.1.3.2.2.2 Straight Line Airflow Model

The use of a ground-level release model in calculating the annual average atmospheric relative concentration (X/Q) values was determined by the meteorological data and the initial plant parameters. Depletion factors are computed directly from depletion curves as are the relative deposition rates[9]. For long term, ground level relative concentrations, the plume is assumed to meander evenly over a 22.5 degree sector.

The hourly relative concentration values are calculated at the sector defined by the wind direction using the equation:

$$X/Q = \frac{2.032}{\sigma_z \bar{u} D} \qquad (10)$$

where:

X/Q = relative ground level concentration (sec/m^3)

σ_z = vertical standard deviation of the plume (meters)

$\bar{u}$ = average wind speed (m/sec)

D = distance from the source (m)

However, with the wake turbulent effect considered, the equation is revised to:

$$X/Q = \frac{2.032}{\sqrt{\sigma_z^2 + \frac{cV^2}{\pi}}\ (\bar{u}D)} \quad (11)$$

where,

c = building shape factor

V = vertical height of the highest adjacent building

The wake factor $\frac{cV^2}{\pi}$ is limited, close to the source, to a factor of twice σ_z^2. So if $\sqrt{3}\,\sigma_z < \sqrt{\sigma_z^2 + \frac{cV^2}{\pi}}$ the equation is:

$$X/Q = \frac{2.032}{\sqrt{3}\,\sigma_z\,\bar{u}\,D} \quad (12)$$

(i.e., X/Q is calculated to be the larger of Equations (11) and (12).

The total integrated relative concentration at each sector and distance is then divided by the total number of hours in the data base.

6.1.3.2.2.3 Methods of Depletion and Deposition Calculation

Depleted X/Q values were computed by applying the depletion factors provided in Figure 2 of NRC Regulatory Guide 1.111 R1[9] to the calculated X/Q values. Relative ground deposition rates were calculated using the equation:

$$D/Q = RDep\ /\ (2 \sin (11.25)\ x) \quad (13)$$

where,

D/Q = ground deposition rate

RDep = relative ground deposition rate

x = calculation distance

6.1.3.2.2.4 Terrain/Recirculation Correction Factors

There is a distinct difference in theory between the PUFF model and the straight line trajectory Gaussian diffusion model. A continuous release is approximated by dividing the plume into a sufficient number of plume elements to represent a continuous plume in the PUFF model. Each element can be modified or advected independently in accord with the meteorological conditions (wind direction and speed, and atmospheric stability) of its immediate location. This would account for the temporal and spatial variations in the airflow in the region of the site. The straight line trajectory Gaussian diffusion model assumes that a constant mean wind transports and diffuses plume effluents in the direction of airflow at the release point within the entire region of interest, i.e., the wind speed and atmospheric stability at the release point are assumed to determine the atmospheric dispersion characteristics in the direction of the mean wind at all distances. Spatial and temporal variations in airflow in the region of coastal sites should be incorporated[9]. This is accomplished by the use of terrain/recirculation correction factors (TCF).

The terrain/recirculation correction factors (TCF) were determined as the ratio between the puff advection estimate and the straight line estimate in the form:

$$TCF_{(x,y)} = \frac{\left[\frac{\chi}{Q}(x,y)\right]_P}{\left[\frac{\chi}{Q}(x,y)\right]_S} \qquad (14)$$

where,

$TCF_{(x,y)}$ = terrain/recirculation correction factor at the point (x,y)

$\frac{\chi}{Q}(x,y)_P$ = the annual average relative concentration at point (x,y) using a puff advection modeling scheme

$\frac{\chi}{Q}(x,y)_S$ = the annual average relative concentration at point (x,y) using a straight line modeling scheme.

6.1.4 LAND

6.1.4.1 Geology and Soils

The geological and soil studies performed to determine the environmental impact of the construction of St Lucie Unit 2 have been described in the St Lucie Unit 2 Environmental Report - Construction Permit. No new geological or soil studies are currently underway at the St Lucie site.

6.1.4.2 Land Use and Demographic Surveys

6.1.4.2.1 Land Use Surveys

Land uses and land cover within a five mile radius of St Lucie Unit 2 were determined through photo interpretation and field checks. During the first week of October 1978, color infrared aerial photographs were taken at an altitude of 4,800 feet of the area within five miles of St Lucie Unit 2. During the weeks of January 14 and March 7, 1979, land uses were field checked.

Once identified, land uses and land cover were classified according to USGS Professional Paper 964 and the Coastal Mapping Handbook.[15,16]. This system considers land use and land cover. According to the USGS, "land use refers to man's activities on and which are directly related to the land. Land cover, on the other hand, describes the vegetational and artificial constructions covering the land surface"[16]. This system uses three levels of classification. Level I is the least detailed classification; Level III is the most detailed. Levels I, II and III were used to classify land uses for this report.

6.1.4.2.2 Demographic Surveys - Resident Population

Estimates and projections of the resident population have been carried out by two different methodologies, one for the area within 50 miles of St Lucie Unit 2 (Methodology A) and the other for the area within five miles of St Lucie Unit 2 (Methodology B).

The resident population of 1978 was estimated, projections were then prepared for the years 1980, 1983 (the date of plant start-up), 1990, 2000, 2010, 2020, and 2030. Data used in preparing the resident and transient population estimates is current to June 1, 1979.

Methodology A: 0-50 miles

Population by annular sector in the region within 50 miles of St Lucie Unit 2 has been estimated and allocated by the technique outlined below.

a) On a USGS map at a scale of 1:250,000, concentric circles are drawn, with the reactor at center point, at distances of 5, 10, 20, 30, 40 and 50 miles. Between five and 50 miles, these circles are divided into 22-1/2 degree segments with each segment centered on one of the 16 cardinal compass points (north, north northeast, northeast, etc). Grid cells created in this manner are referred to as "annular sectors". Between zero and five miles, the area is considered as a whole and is not divided into annular sectors.

b) Population for each annular sector for 1970 has been derived from ONSITE[17], a real-time, interactive computer system that retrieves demographic data according to site and study area specifications. ONSITE is a registered product of Urban Decision Systems made available through National CCS, Inc. The ONSITE system calculates population for each annular sector by searching coordinate MED (Master Enumeration District) lists (as corrected by Urban Decision Corp) for centroids of block groups or enumeration districts falling within the annular sector specified[18].

c) Adjustments have been made in four annular sectors based on comparison of ONSITE data with information provided by county planners. In each case, 1970 census data and, therefore, ONSITE shows no permanent residents in places where settlement has since occurred. The sectors and adjustments are as follows:

1) 30-40 SW - Martin County: Port Mayaca given a base population of 40 in 1970[19].

2) 40-50 WSW - Glades County: Buckhead Ridge given 556 registered voters in 1977[20].

3) 40-50 W - Highlands County: Settlement since 1970 of 30 persons at Rucks Road and SR 70[21].

4) 40-50 NNW - Osceola County: Yeehaw Junction in 1970 had a population of 77; and in 1975, of 97[22].

d) Calculations of projections by annular sector are based on the official State of Florida projections developed by the Division of Population Studies, Bureau of Economic and Business Research, University of Florida at Gainesville, which are the most recent and widely used population projections in the state. These state and county projections have been based on a two stage procedure: state level projections have used a cohort survival methodology; county projections have applied a ratio-share procedure to state totals. According to the report which accompanied population projections released in July 1978, natural increase has played a small role in Florida population growth. Between 1970 and 1977, net migration accounted for more then 90 percent of Florida's population growth[23]. Because net migration levels vary considerably from year to year, three sets of projections were made, based on high, medium, and low migration assumptions. The medium migration assumptions, which average out the effects of rapid and slow growth years, are considered a more accurate predictor of future population than either high or low projections[23]. The medium migration assumptions were therefore selected for use in this report.

State projections cover the years 1978, 1980, 1983, 1990, 2000, 2010 and 2020. The overall growth rate which the Bureau of Economic and Business Research applies to counties in 2010 to derive projections for 2020 is used to derive growth from 2020 to 2030. This seems reasonable based on the uncertainty of events so far in the future.

e) Calculation of population by annular sectors between five to 50 miles is primarily based upon the assumption that each annular sector will maintain its 1970 share of the county population through 2030. This assumption was considered valid for the 50 mile study area because growth is expected to conform for the most part to present patterns. The preponderance of population along the Atlantic Coast and to a lesser extent on Lake Okeechobee is expected to continue due to the desirability of these locations (proximity to the Atlantic and to Lake Okeechobee), natural conditions (primarily soils suitable for development), and existing land use and zoning in these regions. Where necessary, adjustments were made to the assumption that each annular sector will maintain its 1970 share of the County population. These adjustments are discussed in "f", "g" and "h" below, and reflect known development trends.

When an annular sector includes parts of more than one county, its population for 1970 is apportioned to each county based on a breakdown of block groups or enumeration districts provided by ONSITE. Each portion is then calculated as a percentage of the respective counties' totals. This percentage was applied to the county projections to determine the portion of the county's projected population allocated to the annular sector. All the portions are then summed to estimate the total projected population for that annular sector. The resulting overall rate of growth for the 50 mile radius area is 121.7 percent or 2.3 percent per year.

f) In order to reflect accurately the development activity in Palm Beach County in the annular sectors surrounding the city of West Palm Beach, the total population for all four annular sectors is apportioned based on the growth rate of West Palm Beach and the location of housing starts in areas adjacent to the city. The annular sectors affected are SSE 40-50, SSE 30-40, S 40-50, and S 30-40. The reapportionment is made because it is felt that these four sectors would maintain their 1970 share of total county population (48 percent), but that the slow growth rate exhibited by West Palm Beach city from 1960 to 1970 (2.1 percent) would continue for the built-up area. Since the 1970 Census, housing starts have proceeded at a vigorous rate in the three surrounding annular sectors. A map of dwelling units under construction in 1977[24] shows the residential development taking place on vacant land both north and west of the West Palm Beach area.

g) A similar reapportionment is used in the annular sectors surrounding the cities of Fort Pierce and Port St Lucie. Between 1970 and 1978, Port St Lucie's population grew by nearly 1,800 percent, from 330 to 6,465[25]. Concurrently, its share of county population rose from less than one percent to more than eight percent. The location of the residential development within Port St Lucie city limits was identified from aerial photographs taken in 1966 and 1969 by the

Florida Department of Transportation[26]. In the annular sectors within St Lucie County, population projections were adjusted to reflect the increasing share of population held by Port St Lucie.

In addition, in annular sector SW five to ten, a comparison is made of the number existing dwelling units and built-up land to total developable land in the annular sector. Land is considered developable if streets are in place. A total capacity of dwelling units was determined on the basis of existing land development patterns. From the number of residential units already built, a resident population capacity of 20,000 persons was estimated.

h) The 1983 resident population was distributed among the annular sectors to reflect the construction of two development projects: Spanish Lakes III and Midport. Specifically, 666 residents were added to annular sector SW four to five to account for Spanish Lakes III. For Midport, 4843 residents were added to those annular sectors which will house this project upon completion in 1983: 187 residents were added to annular sector SSW three to four, 458 were added to annular sector SSW four to five, 706 were added to annular sector SSW five to ten, 75 were added to annular sector SW three to four, 1813 to annular sector SW four to five, and 1604 to annular sector SW five to ten.

i) Age distribution of the projected population for the year 2000 was based on the distribution of the age groups under 12, 12 through 18, and over 18 in the U.S. population in accordance with 10CFR100, Appendix D.

Methodology B: Zero to Five Miles

In order to allocate population to the annular sectors inside five miles, the following procedures have been undertaken: 1) identification and location by annular sector of existing dwelling units in 1978; 2) development of factors to express the relative suitability for development of annular sectors inside five miles; and 3) the allocation of expected population growth for the five mile area for the required years to 2030.

a) On a base map constructed from USGS maps at a scale of 1:24,000, a circular grid has been superimposed at radii of one mile intervals (one, two, three, four, and five miles) and 16 sectors of 22-1/2 degrees centered on north. The number of dwelling units was counted from aerial photographs taken by Aerial Cartographics, Inc of Orlando, Florida in October and November 1978 and recorded on the map. Field checks were made in early January, 1979 to resolve questionable interpretations and to verify multi-family dwellings and the number of units in them. The number of permanent residents in major residential developments such as Spanish Lakes and Nettles Island have been verified with inquiries to their respective management offices[27,28]. In addition, the number of residents anticipated to reside in Spanish Lakes III and Midport was determined with inquiries to the developers and the Treasure Coast Regional Planning Council.

The estimated population for the five mile radius was allocated to annular sectors according to the distribution of dwelling units, the number of persons per dwelling unit, and estimates of seasonal versus permanent residents.

b) On a base map of the zero to five mile region, areas suitable for residential development have been identified. Areas considered unsuitable for residential development included water bodies, FP&L property and portions of the mangrove areas on Hutchinson Island, the transmission line right of way and parts of the Savannahs purchased by the State of Florida for conservation on the mainland.

The most recent zoning maps[29,30] have been overlaid on the annular sector grid and base map. To determine residential development potential, the area zoned for each residential category is calculated for each annular sector and a dwelling unit density factor applied. (Dwelling unit density factors are the average of the range of dwelling units per acre in each class of residential land use as indicated in the St. Lucie County Growth Management Plan (29)). The numbers for each residential category in an annular sector are summed to determine the total residential development potential for each annular sector. These totals are added together for the entire five mile region. Each annular sector's development capability factor is the percentage of each annular sector's residential development potential to the total residential development potential within five miles.

c) For the required years from 1980 to 2030, the expected increase in population (derived from Methodology A) is allocated among annular sectors using the relative development capability factors as defined in (b).

6.1.4.2.3 Demographic Surveys - Transient Population

Figures 2.1-10 and 2.1-11 show total transient population by annular sector for 1978 through 2030. These estimates and projections have been reached by estimating the number of tourists and seasonal visitors, the number of participants at attractions or events, employment at major industries and enrollment at colleges in each annular sector.

Methodology for Estimating Peak Daily and Seasonal Transient Population by Annular Sector

Peak daily and seasonal transient population was estimated for 1978 and projected to the year 2030 for the area within 30 miles of St Lucie Unit 2. The 1978 peak daily and seasonal transient population was based on calculations of the number of people staying in tourist lodgings, campgrounds and with friends and relatives. Those people visiting attractions, working for major employers within the study area and attending colleges in the area are listed separately. The latter transient groups were not added to the transient population totals shown in Table 2.1-5 and Figures 2.1-10 and 2.1-11 to preclude double-counting.

Tourist Population

Inside the ten mile radius, the number of tourists staying in tourist lodgings (such as hotels, motels) and in campgrounds has been determined by contacting listed tourist accommodations[31-33], locating them within the proper annual sector, and inquiring as to their peak capacity or 100 percent occupancy.

The number of tourists staying with friends and relatives within ten miles of St Lucie Unit 2 has been determined by dividing the total resident population in each annual sector by 5.09. This factor was derived by dividing the peak number of visitors to the State of Florida not staying in motels and campgrounds in 1977[34]. As previously mentioned, the number of tourists staying in motels, hotels and campgrounds was obtained by phone survey of listed tourist accomodations. This number was subtracted from the total number of tourists, to obtain the number of tourists who stay with friends and relatives. Within the ten mile radius the number of people staying in tourist accommodations was added to those staying with friends and relatives, to derive a total peak daily and seasonal tourist transient population.

Between ten and 30 miles, each campground has been located and its peak capacity ascertained. For other tourist lodgings, each annular sector was given a share of the total lodging units licensed by the State of Florida for the county within which it fell[35]. It is assumed that an annular sector's share of lodging units was the same as its share of the total county resident population. For example, annular sector SSE 20-30 contains 0.089 percent of Martin County's resident population. Therefore, 0.089 percent of the total licensed tourist lodgings in Martin County was allocated to this annular sector.

Peak occupancy of lodging establishments is calculated at three persons per unit with an occupancy rate of 100 percent for the peak season. This occupancy rate is based on inquiries to each lodging establishment within the ten mile radius.

As within the ten mile radius, the number of tourists staying with friends and relatives between ten and 30 miles from St Lucie Unit 2, was determined by dividing the resident population in this area by 5.09. Once again, the number of persons staying in tourist facilities was added to the number of persons staying with friends and relatives to determine peak daily and seasonal visitors for the ten to 30 mile radii.

To project peak daily and seasonal transient visitors for the required years to 2030, two methods have been used, one for the years between 1978 and 1985, and one for the years between 1985 and 2030.

For projections to the year 1985, an annual rate of increase of eight percent estimated by the State of Florida Division of Tourism has been used. The Division of Tourism projections to 1985 are based, in part, on questionnaires administered to tourists arriving by auto and air. Responses to these questionnaires are used to establish annual tourist population figures. Projections are then determined on the basis of a linear annual growth rate reflecting the latest annual increase in tourist population. Thus, since the tourist population grew by eight percent from 1977 to 1978, this number is used as the annual rate of increase to 1985[32,34].

The Division of Tourism does not prepare tourist projections beyond the year 1985. A second projection method was developed for 1985 to 2030. For 1985 to 2030, a growth rate of 2.1 percent was used which is based on a linear regression of the historical growth rate of the tourist population during the years 1970-1978.

Having thus estimated the total tourist population for the required years between 1985 and 2030, it was necessary to allocate the population to each annular sector. To do this, it is assumed that each annular sector's share of campgrounds, other tourist lodgings, and persons staying with friends or relatives would remain the same as it was in 1978. Furthermore, based on 1978 data, it was determined that 27 percent of the total tourist population within 30 miles of St Lucie Unit 2 stayed at campgrounds, 23 percent stayed in hotels, motels or other tourist lodgings, and 50 percent stayed with friends and relatives. It is assumed that these percentages would also remain constant during the years under consideration.

Transient Population at Attractions and Events

Attractions and events occurring within 50 miles of St Lucie Unit 2 are shown in Figure 2.1-12. These events, along with estimated and projected attendance, are shown in Table 2.1-7. Attendance at events has been projected at the average annual rate of growth for the entire 50 mile radius; 121.7 percent for the 52 year projection period, or an average annual rate of 2.3 percent. If a facility had a maximum attendance which could not be exceeded, this was left constant. In the future, additional stadiums, frontons, civic centers, etc, may be established in the study areas; but since none is presently proposed, there is no way to predict their locations or capacity.

Transient Population at Major Industrial Employers and Colleges

Major industrial employers and colleges within 50 miles of St Lucie Unit 2 attract large numbers of people from a large area on a regular basis. Any employer with more than 500 persons on a shift has been included in the totals for the annular sector in which it was located. Since expansion and contraction are difficult to predict, and because none had plans to expand employment significantly, the number of employees has been held constant throughout the 52 year period. Table 2.1-8 shows full employment and peak daily shifts.

Colleges draw students from the four county area and from around the country. For Indian River Community College, which has four campuses, the proportion of the student body attending class on each campus is assumed to remain constant for the purpose of projecting enrollments. The peak daily population is estimated by projecting total enrollment to 1983 by five year growth rates provided by the school. Student population was interpolated for 1980. Between 1990 and 2030, projections are made by the average annual rate of growth for the 50 mile area. The number of students attending classes on the most heavily scheduled days of the week is used as peak daily population. The proportion of total enrollment to peak class attendance in 1978 is assumed to remain constant throughout the 52 year period.

Methodology for Estimating Transient Population from Transportation

Transient population generated by transportation is comprised of four basic modes: highways, railroads, waterways, and airports. Because transportation is not limited to individual annular sectors, it is described separately from totals for transient population. In addition, traffic volume numbers are given by average daily total number of passengers for highway, rail, waterway, and air traffic.

a) Highway Traffic

Between zero and ten miles from St Lucie Unit 2, travelers on major roads were estimated from the average daily traffic count (ADT)[36] from 1977 at the sampling stations closest to the ten mile radius (preferably at or just inside the ten mile radius line). Major roads include interstate highways and state roads. Where ADT counts separated traffic by direction of flow, travel into the ten mile radius area has been used. Where the directions were combined, the ADT count was divided in half, on the assumption that traffic is evenly distributed in both directions. Numbers of vehicles were increased by 2.4 percent to a 1978 estimate and then multiplied by 2.5 for interstate and turnpike[37], and by 1.5 for state roads, to achieve the number of passengers on the roads.

Between ten and 30 miles of St Lucie Unit 2, highway passengers have been estimated for the two major interstates, I-95 and the Florida Turnpike. The number of persons coming within 30 miles of St Lucie Unit 2 is derived from average daily traffic counts done by the State of Florida Department of Transportation. Numbers of vehicles traveling in the direction toward the plant are multiplied by 2.5 passengers per vehicle to generate passenger estimates.

Projections are calculated by using the expected rate of growth for the entire resident population for the 50 mile radius to 2030. Since it is possible that the vehicles counted at one station are counted at another, there has been no attempt to total passengers, or to assign persons in transit to an annular sector.

b) Waterway Traffic

Transient population on waterways has been derived from passenger counts for the Intracoastal Waterway and Fort Pierce Harbor, number of bridge openings, and operations of locks on the St Lucie Canal. For the Waterway and Harbor, annual total passengers for 1976[38] were divided by 365 to get a daily average. An average annual growth rate of 2.4 percent was used to derive estimates for 1978 and for the required years through 2030.

Estimates of transient population were also derived from the number of drawbridge openings on the Indian River[39,40] and the St Lucie

River[41,42]. The annual number of openings recorded by bridge tenders was divided by 365 to reach a daily average. An average of 1.2 vessels per opening (based on records of openings and vessels at the Roosevelt Bridge) has been applied to the number of openings, and then multiplied by four passengers per vessel[39] to arrive at an average daily number of passengers for each bridge. These estimates do not include passengers on small craft which can pass beneath draw bridges.

On the St Lucie Canal[43], transient population has been derived from lock tender's records of annual total of vessels. The annual total has been divided by 365 days in the year, and multiplied by four persons per vessel to reach an average daily number of passengers. On the St Lucie Canal, all vessels are counted as they pass through the locks.

Projections of transient population at the bridges and on the St Lucie Canal are based on the 2.4 percent average annual rate of growth for the 50 mile radius area.

c) Rail Passengers

Only one rail line within 50 miles of St Lucie Unit 2 has passenger service[44]. The average daily passenger count in 1978 is derived by dividing the total passengers for the year by 365 days. Passenger totals were divided in half for 1980 because of anticipated reductions in Amtrak service to Florida[45]. Passenger totals are projected at two percent per year from 1980 to 1983; and at the annual average growth rate of 2.4 percent per year from 1983 to 2030.

d) Airplane Passengers

Airports with scheduled passenger service in 1978 were considered sources of transient population within 50 miles of St Lucie Unit 2. Only the West Palm Beach International Airport[46] met this criterion (see Section 2.1.2.3.5.4). Estimates for 1978, 1980, 1983, and 1990 are based on projections of passenger service made in 1975, and on actual numbers of passengers in 1977. Interpolations have been made for 1978 and 1983. Projections to 2030 are based on the average annual growth rate of 2.4 percent for the 50 mile radius resident population. Total passengers per year have been divided by 365 to reach the daily average number of passengers.

6.1.4.3 Ecological Parameters

Beach surveys for nesting sea turtles have been conducted May through August in alternate years since 1971. A count of nests created the previous night is performed in nine, 0.75 mile long sampling areas each Monday through Friday during the nesting season. Each weekday night, adult females crawling on the beach to nest are tagged for the future identification. Tagging is done after egg laying commences to avoid alarming the turtle. Subsequent occurrence of the tagged turtles on the beach are recorded by date, location and nesting success.

The species of turtle making the nest is determined by the size and pattern of the nesting crawl and the nest is recorded and marked with a numbered stake. Nest suffering predation are recorded by stake number. False (non-laying) crawls are also noted. In addition to the nest counts in the sample area, the entire island is surveyed for leatherback and green turtle nest. The occurrence and locations of leatherback and green turtle nests are transmitted to the Florida Department of Natural Resources for possible egg removal and "head-starting" programs.

Capture and removal of turtles entering the St Lucie plant intake canal is performed on weekdays throughout the year. Turtles are identified, weighed, measured, examined for general health and condition and released.

6.1.5 RADIOLOGICAL MONITORING

The objective of the environmental radiological surveillance program is to compile sufficient information to permit an accurate prediction of the impact which could be caused by a known discharge of radionuclides into the environment. This capability for prediction of the impacts of a discharge will permit FP&L to accurately estimate the effects which could result from the small quantities of radionuclides released during the operation of St Lucie Units 1 and 2. In this way, technical specifications can be established which will ensure that the radiation protection guidelines for offsite human exposures to radioactivity, set forth in 10CFR20 and Appendix I to 10CFR50, will not be exceeded.

The St Lucie Unit 2 preoperational program is the ongoing monitoring program for St Lucie Unit 1. The St Lucie Site program satisfies the individual requirements for each unit and affords a continuing and comprehensive assessment of the radiological characteristics of surrounding areas. This ongoing program is described in detail in the St Lucie Unit 1 Environmental Radiological Technical Specifications.

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TABLE 6.1-1

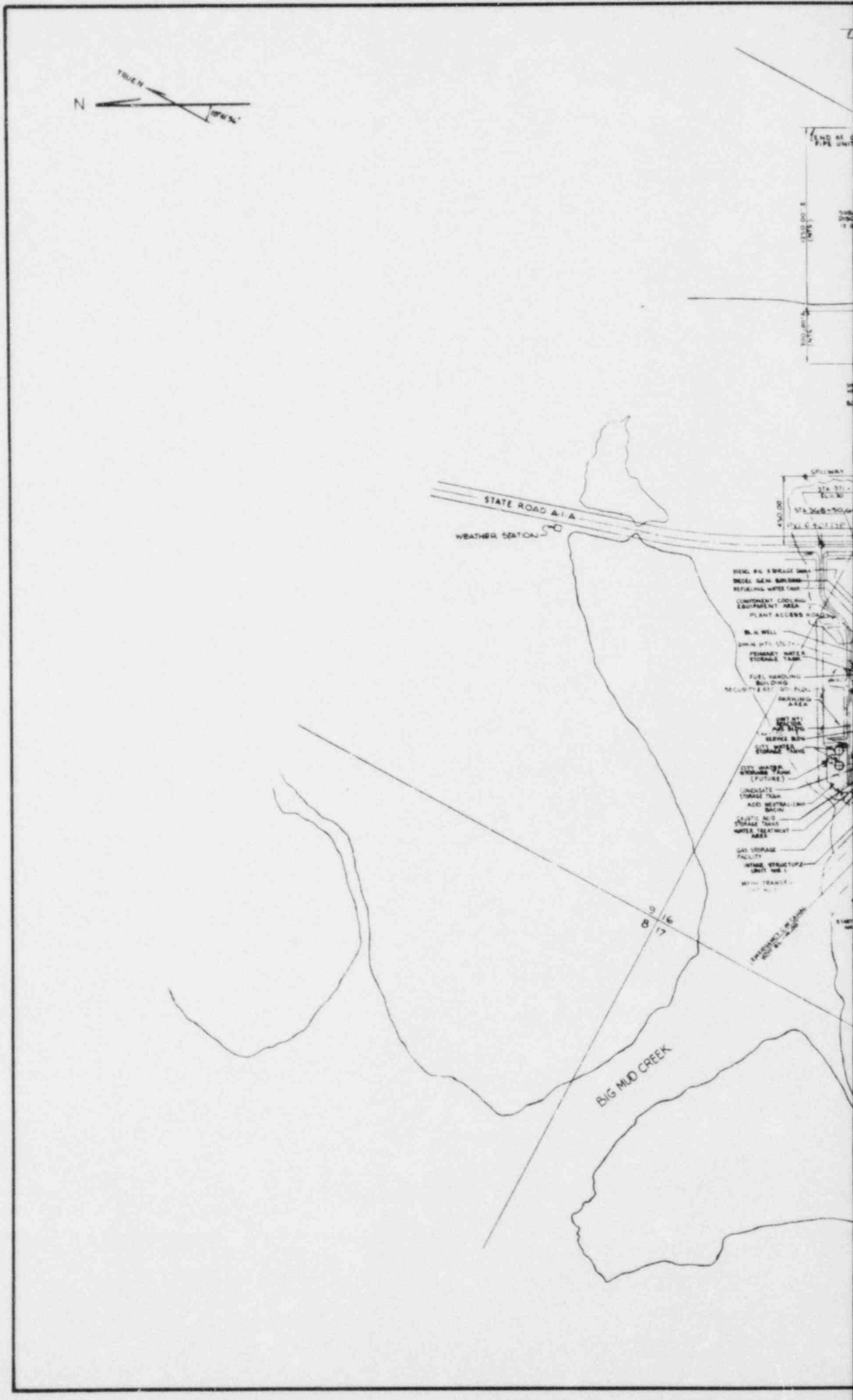
METEOROLOGICAL SENSOR HEIGHTS ON THE ST LUCIE METEOROLOGICAL TOWER

Parameter	Height (feet)		
	Lower	Upper	
Wind Speed	32.8	190.0	
Wind Direction	32.8	190.0	
	Lower	Middle	Upper
Ambient Temperature	34.7	112.0	191.9
Delta Temperature	32.8	110.0	190.5
Dew Point	34.7		110.3
Precipitation	Surface		

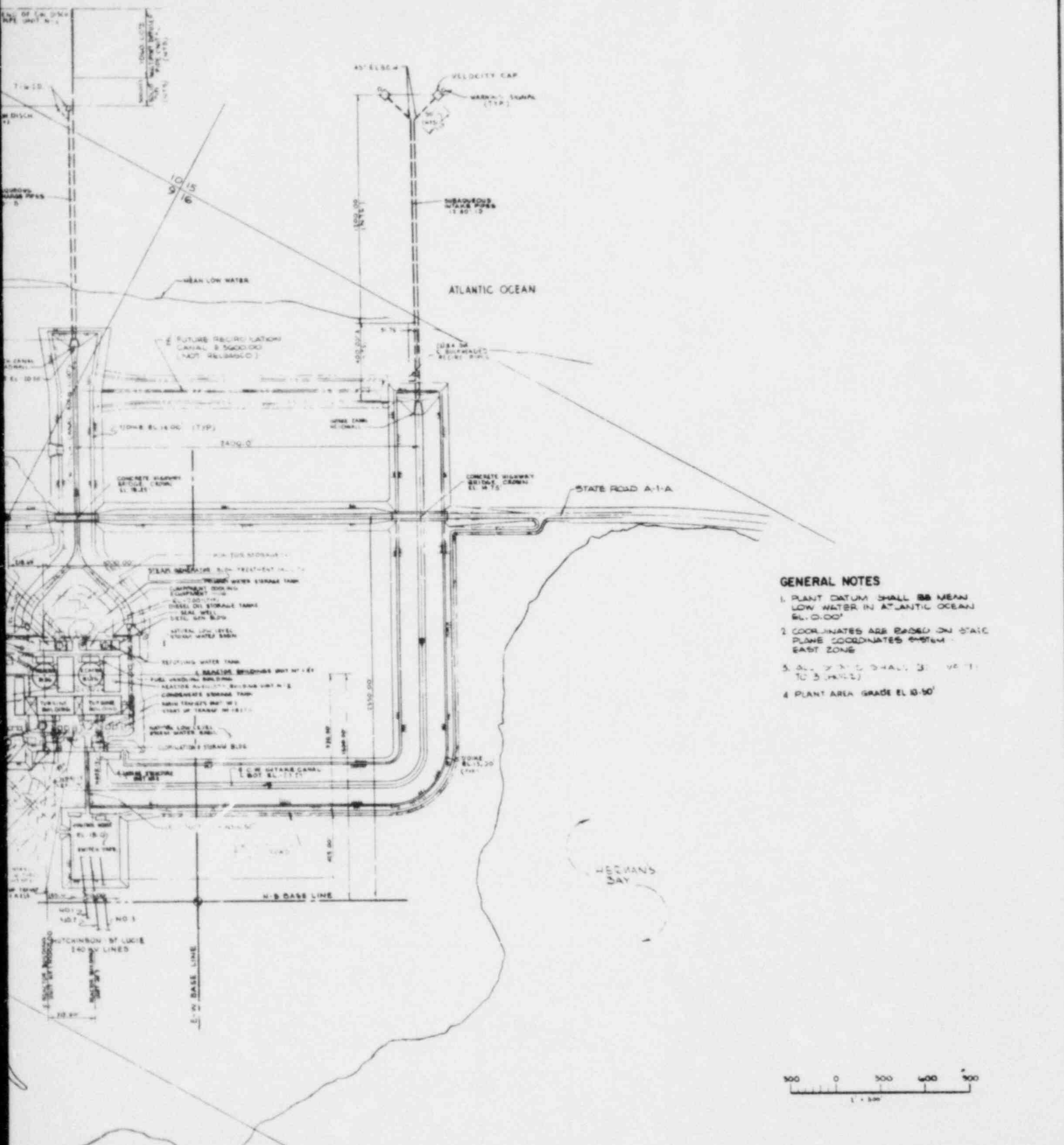
TABLE 6.1-2

DAT` RECOVERY RATES, PERCENT

Parameter	Data Period 1976-1977	1977-1978	1976-1978
Dry Bulb Temp (34.7 ft)	95.6	96.5	96.1
Dry Bulb Temp (191.0 ft)	95.6	94.7	95.2
Dew Point Temp (34.7)	95.5	96.4	96.0
Precipitation	89.7	96.7	93.2
Wind Speed (32.8 ft)	94.8	98.9	96.8
Wind Speed (190.0 ft)	96.5	98.4	97.4
Wind Direction (32.8 ft)	91.9	96.7	94.3
Wind Direction (190.0)	95.0	98.0	96.5
Joint Stability and Wind (32.8 ft)	90.5	96.5	93.5
Joint Stability and Wind (190.0 ft)	93.4	97.8	95.6



N
TRUE N
STATE ROAD A-1-A
WEATHER STATION
SPILLWAY
REFUELING WATER TANK
COMPONENT COOLING EQUIPMENT AREA
PLANT ACCESS ROAD
PRIMARY WATER STORAGE TANK
FUEL HANDLING BUILDING
PARKING AREA
SERVICE BLDG
CITY WATER STORAGE TANK
CITY WATER STORAGE TANK (FUTURE)
CONDENSATE STORAGE TANK
ACID NEUTRALIZING BASIN
CAUSTIC ACID STORAGE TANKS
WATER TREATMENT AREA
GAS STORAGE FACILITY
INTAKE STRUCTURE UNIT NO. 1
BIG MUD CREEK



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

SITE METEOROLOGICAL
TOWER MAP
FIGURE 6.1-1

6.2 APPLICANT'S PROPOSED OPERATIONAL MONITORING PROGRAMS

6.2.1 OPERATIONAL NON-RADIOLOGICAL MONITORING PROGRAM

The non-radiological environmental monitoring programs presently underway at the St Lucie site are described in Section 6.1. These St Lucie Unit 1 operational monitoring programs are also the preoperational programs for St Lucie Unit 2. The scope of these programs is not expected to change when St Lucie Unit 2 becomes operational.

6.2.2 OPERATIONAL RADIOLOGICAL SURVEILLANCE PROGRAM

The environmental radiological surveillance program for the St Lucie site is described in Section 6.1.5. The operational program for St Lucie Unit 1 is also the preoperational program for St Lucie Unit 2. The program will remain unchanged at the startup of St Lucie Unit 2, unless modification is required as experience is gained.

6.3 RELATED ENVIRONMENTAL MEASUREMENT AND MONITORING PROGRAMS

The Florida Power & Light Company is aware of several investigations undertaken near the St Lucie plant site. These studies have been performed by the following groups: Florida Department of Natural Resources; Harbor Branch Foundation, Inc; and the Smithsonian Institution, Fort Pierce Bureau. These programs are briefly described below.

6.3.1 FLORIDA DEPARTMENT OF NATURAL RESOURCES

Since 1971, the Florida Department of Natural Resources has collected marine turtle eggs from various Florida beaches, including Hutchinson Island. Hatchling marine turtles, mostly the green turtle (Chelonia mydas), were reared at several locations in the southeastern United States, and then released at about one year of age[(1)]. To date, about 11,000 green turtle yearlings have been released, with more than 90 recaptures[(2)].

6.3.2 HARBOR BRANCH FOUNDATION, INC.

The Harbor Branch Foundation, Inc has investigated the ichthyofauna of east central Florida, including the Indian River lagoon near the St Lucie plant. The purpose of this study is to provide an updated assessment of the fishes of the Indian River region, related to regional physiography[(3)]. In addition, currents offshore of Hutchinson Island were monitored during 1976. A report on current structure was prepared for the Harbor Branch Foundation, Inc. by a consultant, R M O'Hagen[(4)].

6.3.3 SMITHSONIAN INSTITUTION, FORT PIERCE BUREAU

For two years, the stomatopod and decapod crustaceans associated with sabellarid worm reefs on the east central coast of Florida were investigated. One of the reefs studied, Walton Rocks, is near the St Lucie Plant site[(5)].

SECTION 6.3: REFERENCES

1. Witham, R and C R Futch, 1977. Early growth and oceanic survival of pen-reared sea turtles. Herp. 33(4):404-409.

2. Personal Communication, 1979. Letter from State of Florida Dept. of Natural Resources to Ebasco Services, Inc, Dated 23 August 1979.

3. Gilmore, Jr. R G, 1977. Fishes of the Indian River lagoon and adjacent waters, Florida. Bull Fla St Mus, Biol Sci. 22(3): 101-147.

4. O'Hagen, RM, 1977. Report of offshore current study. mimeo report, 66 pp.

5. Gore, R H et al, 1978. Community composition, stability, and trophic partitioning in decapod crustaceans inhabiting some subtropical sabellarid worm reefs. Bull Mar Sci. 28(2): 221-248.

6.4 PREOPERATIONAL ENVIRONMENTAL RADIOLOGICAL SURVEILLANCE DATA

The operational program for St Lucie Unit 1 has been in effect and is the preoperational program for St Lucie Unit 2. Appendix A to Section 6.4 presents the results of the environmental radiological surveillance program for the St Lucie site for 1977 and 1978.

SECTION 6.4

APPENDIX A

ANNUAL ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

For the Period:

January 1977 to December 1977

January 1978 to December 1978

FLORIDA POWER & LIGHT COMPANY

St. Lucie Plant Unit No. 1

License No. - DPR-67

Docket No. 50-335

ANNUAL ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

for

The Period: 1/01/77 to 12/31/77

Prepared 2/28/78

1. Introduction

This report is submitted in accordance with St. Lucie Plant Technical Specifications' Section 5.6.1.b.

All environmental samples were collected and analyzed during this reporting period in accordance with requirements of St. Lucie Plant's Technical Specifications. The minimum frequency of collection and analyses for specific radionuclide species as required by these specifications have been met or exceeded.

No harmful effects or evidence of irreversible damage to the environment or to the health and safety of individuals or population groups in the regions surrounding St. Lucie Plant have been detected by this monitoring program.

In addition to the Environmental Radiological Monitoring data, this report includes information about the semi-annual census for 500 ft^2 gardens and milk-producing animals.

2. The Monitoring Program

Analytical Responsibility

Environmental radiological monitoring at St. Lucie Plant is carried out by the Orlando Radiological Laboratory of the Department of Health and Rehabilitative Services of Florida (DHRS) personnel.

Number of Samples Analyzed

A total of 1,594 analyses on samples collected from 25 different locations were performed during the period of this report. TABLE 1 summarizes the mean and range values of these analyses.

Split Sample Analyses

At least 20 of the samples collected have been analyzed in the DHRS/ERDA Split-Sampling Program.

3. Evaluation of Data

Except as noted in TABLE 1, none of the sampling locations used in the environmental radiological monitoring program showed evidence of having significant concentrations of a particular radionuclide in a specific sample material much higher than the observed mean for that radionuclide at all sampling locations. Most of the data reported reflect concentration increases as a result of fallout from the Chinese bomb tests of 1977.

Trend plotting of our particulate and direct radiation data reveals no plant-related variations. Also, all data have been evaluated with respect to pre-operational data and have been found to be within the $\pm 2\sigma$ limits observed for these pre-operational data. Comparative data obtained in the assay of control samples also appears in TABLE 1.

4. Non-Routine Reported Measurements

Following the release of water from the Refueling Water Storage Tank (RWST) to the Settling Basin (on site) on 4-12-77, a series of special samples were collected from the Indian River; the ocean east of the intake canal; the ocean east of the discharge canal; a well at a residence on Indian River Drive, west of the plant; and a sample of soil alongside Highway A1A, east of the plant. These samples were analyzed by DHRS and the analytical results showed "no detectable" radionuclides of those that could have been associated with the RWST release.

Following the September-October Chinese weapons tests, air particulate filters from 3 sampling locations and a milk sample were collected and analyzed. ^{144}Ce, ^{106}Ru, and ^{131}I were detected and appeared to be from the Chinese weapons tests.

5. Dairy Herd, Goat, and Garden Census

A dairy herd census was conducted in January and in August during this report period. The nearest dairy is west of the plant site (260°; 14 miles). Data obtained in the assays of samples collected at this location are reported in TABLE 1.

One milk goat has been found at a location SW of the plant site (220°; 2.2 miles). It produces negligible amounts of milk.

An aerial garden census in April, 1977 showed that there were several 500 ft^2 gardens within approximately 5 miles of St. Lucie Plant. Collard greens were sampled at 7609 Indian River Drive; WSW, 2 miles. Results of these analyses appear in TABLE 1.

6. During this period, the environmental radiological monitoring program has found no evidence that the operations of FSL Unit No. 1 contribute harmful effects or irreversible damage to either the environment or to the health and safety of individuals and population groups in the regions surrounding St. Lucie Plant.

TABLE 1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

NAME OF FACILITY St. Lucie Plant Unit 1 DOCKET NO. DPR-67

LOCATION OF FACILITY Hutchinson Island, Florida REPORTING PERIOD 1-01-77 to 12-31-77

Medium or Pathway Sampled	Unit	Analysis for	Number of Sites	Number of Samples	Number of Analyses	All Indicator Locations Mean	All Indicator Locations Range	Location with Highest Mean: Sample Location Distance and Direction	Mean	Range	Control Locations Mean	Control Locations Range	Number Nonroutine Report Measurements
1.0 AIR FILTERS													
1.1 Air Particulates	pCi/m^3	GB	9	468	468	0.12(a)	0.02-2.77	H-30: Residence, 7609 Indian River Drive; WSW, 2 miles	0.16	0.03-2.77	0.13(b)	0.03-2.47	Measurements cited in report.
1.1 Air Iodines	pCi/m^3	^{131}I	9	468	468	ND(c)		None					
1.1 Gamma Scan (monthly composites of filters)	pCi/m^3	γ	9	108	108	ND(c)		None					
1.1 Sr^{89,90} Analysis of Filter Composites	pCi/m^3	^{89}Sr	9	36	36	ND		None					
		^{90}Sr	9	36	36	ND		None					
1.2 Direct Radiation	μRem/hr	γ	9	72	72	6	3-17	H-12: FPL Substation, Stuart, Florida; S, 12 miles	17(e)	16-18	5(b)	4-5	
2.0 WATER													
2.1.1 Discharge Canal	pCi/l	^{3}H	1	12	12	775(b)	<200-4400	H-36: On site, Dis. Canal, West of A1A; ESE, 0.19 miles	775	<200-4400			
		^{89}Sr	1	12	12	ND							
		^{90}Sr	1	12	12	ND							

Medium or Pathway Sampled	Unit	Analysis for	Number of Sites	Number of Samples	Number of Analyses	All Indicator Locations Mean	All Indicator Locations Range	Location with Highest Mean: Sample Location Distance and Direction	Location with Highest Mean: Mean	Location with Highest Mean: Range	Control Location[a] Mean	Control Location[a] Range	Number of Nonroutine Reported Measurements
2.1.2 Ocean Water	pCi/l	^{3}H	2	24	24	<200		None					
		^{89}Sr	2	24	24	ND		None					
		^{90}Sr	2	24	24	ND		None					
2.1.3 Estuarine Water	pCi/l	^{3}H	1	4	4	<200		None					
2.2 Ground Water Well	pCi/l	^{3}H	1	4	4	<200		None					
		GB-DS	1	4	4	ND		None					
		GB-UDS	1	4	4	ND		None					
2.3 Potable Water	pCi/l	^{3}H	3	12	12	<200		None					
		GB-DS	3	12	12	ND		None					
		GB-UDS	3	12	12	ND		None					
3.0 BOTTOM SEDIMENTS													
3.1 Discharge Canal	pCi/kg	^{89}Sr	1	2	2	ND		None					
		^{90}Sr	1	2	2	ND		None					
		^{95}Zr	1	1	1	170	140-200	H-36: On site, Dis. Canal, west of A1A; ESE, 0.19 miles	170	140-200			
		^{144}Ce	1	1	1	300	250-350		300	250-350			
		^{60}Co	1	1	1	240	220-260		240	220-260			

Medium or Pathway Sampled		Unit	Analysis for	Number of			All Indicator Locations		Location with Highest Mean			Control Location(a)		Numbe Nonro Repo Measur
				Sites	Samples	Analyses	Mean	Range	Sample Location Distance and Direction	Mean	Range	Mean	Range	
3.2	Ocean	pCi/kg	^{89}Sr	4	5	5	ND		None			ND(b)		
			^{90}Sr	4	5	5	ND		None			ND(b)		
			^{95}Zr	3	3	3	33	ND-100	H-32: Entomology Lab, Vero Beach, NNW, 19 miles	80	60-100	80(b)	60-100	
3.3	Beach Sand	pCi/kg	^{89}Sr	2	4	4	ND		None			ND(b)		
			^{90}Sr	2	4	4	ND		None			ND(b)		
			^{95}Zr	2	2	2	60	ND-140	H-32: Entomology Lab, Vero Beach, NNW, 19 miles	110	80-140	110(b)	80-140	
3.4	Estaurine	pCi/kg	^{95}Zr	1	2	2	70	ND-90	H-13: On site, North of Big Mud Creek at Indian River; NW, 0.63 miles	70	ND-90			
4.0	AQUATIC BIOTA													
4.1	Crustacea	pCi/kg	γ	2	4	4	(g)		None			(g)		
4.2.1	Fish-Carnivore	pCi/kg	^{89}Sr	2	4	4	ND		None			ND(b)		
			^{90}Sr	2	4	4	6	ND-23	H-32: Entomology Lab, Vero Beach; NNW, 19 miles	17(h)	11-23	10(b)	ND-23	
4.2.2	Fish-Herbivore	pCi/kg	^{89}Sr	2	4	4	ND		None			ND(b)		
			^{90}Sr	2	4	4	12	ND-40	H-32: Entomology Lab; Vero Beach, NNW, 19 miles	23(i)	10-40	23(i)	10-40	

Medium or Pathway Sampled	Unit	Analysis for	Number of Sites	Number of Samples	Number of Analyses	All Indicator Locations Mean	All Indicator Locations Range	Location with Highest Mean: Sample Location Distance and Direction	Location with Highest Mean: Mean	Location with Highest Mean: Range	Control Location[a] Mean	Control Location[a] Range	Number Nonro[illegible] Repo[illegible] Measur[illegible]
5.0 TERRESTRIAL BIOTA													
5.1 Milk	pCi/l	^{137}Cs	2	36	36	18.4	ND-35	H-40: Control-Davis Dairy, Boynton Beach, SSE, 55.8 miles	22[j]	20-35	22[j]	20-35	
		^{89}Sr	2	36	36	ND		None			ND[j]		
		^{90}Sr	2	36	36	3	1.3-3.6	None			3[j]	2-4	
		^{131}I	2	36	36	2	ND-1.5	None			2[j]	ND-2	
5.2.1 Food-Citrus	pCi/kg	^{89}Sr	7	7	7	ND		None					
		^{90}Sr	7	7	7	27.5	11-46	H-22: Lentz Groves, US 1; SSW, 5.5 miles	38	37-39			
								H-23: Montauk Groves, US 1; W, 4.7 miles	46	45-47			
								H-24: Poster Groves, US 1; NNW, 5.35 miles	41	[illegible]			
5.2.2 Food-Leafy Vegetables	pCi/Kg	^{137}Cs	1	1	1	320[k]	300-340	H-31: 7600 Indian River Drive; WSW, 2 miles	320	300-400			
5.3 Soil	pCi/Kg	^{137}Cs	6	6	6	367	ND-1500	H-32: Entomology Lab, Vero Beach; NNW, 19 miles	420	390-450	420[b]	390-450	
								H-08: FPL Substation, west of US 1; NNW, 5.7 miles	1400	1300-1500			

Medium or Pathway Sampled	Unit	Analysis for	Number of Sites	Number of Samples	Number of Analyses	All Indicator Locations Mean	All Indicator Locations Range	Location with Highest Mean: Sample Location Distance and Direction	Mean	Range	Control Location[(a)] Mean	Control Location Range	Number Nonroutine Reported Measurements
5.3 Soil (cont'd)													
		^{144}Ce	6	6	6	125	ND-900	H-08: FPL Substation, west of US 1; WNW, 5.7 miles	700	500-900	ND[(b)]		
		^{95}Zr	6	6	6	195	ND-690	H-08: FPL Substation, west of US 1; WNW, 5.7 miles	620	550-690	150[(b)]	100-200	
								H-09: FPL Substation, west of US 1; SSW, 7.3 miles	230	200-260			
		^{89}Sr	6	6	6	ND		None			ND[(b)]		
		^{90}Sr	6	6	6	22	ND-160	H-32: Entomology Lab, Vero Beach; NNW, 19 miles	120	80-160	120[(b)]	80-160	

NOTES:

(a) Data observed during April, May and October influenced by fallout from Chinese weapon tests.

(b) H-32: Department of Health and Rehabilitative Services Entomology Laboratory, East of U.S. 1, Vero Beach; NNW, 19 miles.

(c) All individual stations were non-detectable; only the weekly composite of 10-16-77 gave a concentration of 0.16 ± 0.01 pCi/m^3.

(d) Assumed ND. Only composites of October showed evidence of radionuclides (^{95}Zr, ^{144}Ce, ^{106}Ru), which are indicative of Chinese weapon tests fallouts.

(e) This monitor is located on/near natural radioactivity deposit. All other monitors, other than control, had a mean of 4.4 µrem/hr and a r[illegible] of 3.4 to 5.0 µrem/hr.

(f) ^3H present in April-June only with a mean of 2500 pCi/l and a range of 300-4400 pCi/l.

(continued)

Medium or Pathway Sampled	Unit	Analysis for	Number of			All Indicator Locations		Location with Highest Mean			Control Location[a]		Number o[f] Nonrouti[ne] Reporte[d] Measureme[nts]
			Sites	Samples	Analyses	Mean	Range	Sample Location Distance and Direction	Mean	Range	Mean	Range	

NOTES (cont'd)

(g) Gamma spectral analysis indicates only natural radioactivities.

(h) One sample only; unclassified fish. None detected in a sample of mullet.

(i) Two samples of mullet.

(j) Control sample is H-40, Davis Dairy, Boynton Beach, SSE, 55.8 miles.

(k) Collard greens.

FLORIDA POWER & LIGHT COMPANY

St. Lucie Plant Unit No. 1

License No. - DPR-67

Docket No. 50-335

ANNUAL ENVIRONMENTAL RADIOLOGICAL

MONITORING REPORT

for

The Period: 1/01/78 to 12/31/78

Prepared 3/27/79

1. Introduction

This report is submitted in accordance with St. Lucie Plant Technical Specifications' Section 5.6.1.b.

All environmental samples were collected and analyzed during this reporting period in accordance with requirements of St. Lucie Plant's Technical Specifications. The minimum of frequency of collection and analyses for specific radionuclide species as required by these specifications have been met or exceeded.

No harmful effects or evidence of irreversible damage to the environment or to the health and safety of individuals or population groups in the regions surrounding St. Lucie Plant have been detected by this monitoring program.

In addition to the Environment Radiological Monitoring data, this report includes information about the semi-annual census for 500 ft^2 gardens and milk-producing animals.

2. The Monitoring Program

Analytical Responsibility

Environmental radiological monitoring at St. Lucie Plant is carried out by the Orlando Radiological Laboratory of the Department of Health and Rehabilitative Services of Florida (DHRS) personnel.

Number of Samples Analyzed

A total of 1,174 analyses on samples collected from 25 different locations were performed during the period of this report. TABLE 1 summarizes the mean and range values of these analyses.

Split Sample Analyses

At least 20 of the samples collected have been analyzed in the DHRS/ERDA Split-Sampling Program.

3. Evaluation of Data

Except as noted in TABLE 1, none of the sampling locations used in the environmental radiological monitoring program showed evidence of having significant concentrations of a particular radionuclide in a specific sample material much higher than the observed mean for that radionuclide at all sampling locations.

Trend plotting of our particulate and direct radiation data reveals no plant-related variations. Also, all data have been evaluated with respect to pre-operational data and have been found to be within the $\pm 2\sigma$ limits observed for these pre-operational data. Comparative data obtained in the assay of control samples also appears in TABLE 1.

4. Non-Routine Reported Measurements

Following the March Chinese weapons test, a weekly composite of air particulate filters and a milk sample were collected and analyzed. ^{131}I was detected and appeared to be from the Chinese weapons tests.

5. Dairy Herd, Goat, and Garden Census

A dairy herd census was conducted in February and in August during this report period. The nearest dairy is west of the plant site (260°); 14 miles) Data obtained in the assays of samples collected at this location are reported in TABLE 1.

One milk goat has been found at a location SW of the plant site (220°; 2.2 miles). It produces negligible amounts of milk.

An aerial garden census in March, 1978 showed that there were several 500 ft^2 gardens within approximately 5 miles of St. Lucie Plant. Collard Greens were sampled at 7609 Indian River Drive; WSW, 2 miles, Results of these analyses appear in TABLE 1.

6. Conclusions

During this period, the environmental radiological monitoring program has found no evidence that the operations of PSL Unit No. 1 contribute harmful effects or irreversible damage to either the environment or to the health and safety of individuals and population groups in the regions surrounding St. Lucie Plant.

TABLE 1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

NAME OF FACILITY St. Lucie Plant Unit 1 DOCKET NO. DPR-67

LOCATION OF FACILITY Hutchinson Island, FL REPORTING PERIOD 1-01-78 to 12-31-78

Medium or Pathway Sampled	Unit	Analysis for	Number of			All Indicator Locations		Location with Highest Mean			Control Location[a]		Number of Nonroutine Reported Measurements
			Sites	Samples	Analyses	Mean	Range	Sample Location Distance and Direction	Mean	Range	Mean	Range	
1.0 AIR FILTERS													
1.1 Air Particulates	pCi/m^3	Gβ	9	474	474	0.05	0.005-0.27	H-32: Entomology Lab, Vero Beach; NNW, 19 miles	0.16	0.07-0.23	0.05[a]	0.006-0.14	Measurements cited in their report
1.1 Air Iodines	pCi/m^3	^{131}I	9	474	474	ND[i]		None					
1.1 Gamma Scan (monthly composites of filters)	pCi/m^3	γ	9	108	108	ND		None					
1.1 $Sr^{89,90}$ Analysis of Filter Composites	pCi/m^3	^{89}Sr	9	36	36	ND		None					
		^{90}Sr	9	36	36	ND		None					
1.2 Direct Radiation	μRem/hr	γ	9	72	72	6	4-20	H-12: FPL Substation, Stuart, Florida; S, 12 miles	19	17-20	5[a]		

Medium or Pathway Sampled	Unit	Analysis for	Number of			All Indicator Locations		Location with Highest Mean			Control Location[a]		Number of Nonroutine Reported Measurements
			Sites	Samples	Analyses	Mean	Range	Sample Location Distance and Direction	Mean	Range	Mean	Range	
2.0 WATER													
2.1.1 Discharge Canal	pCi/l	^{3}H	1	12	12	263	<200-960	H-36: On site, Dis. Canal, west of A1A; ESE 0.19 miles	263	<200-960			
		^{89}Sr	1	12	12	ND		None					
		^{90}Sr	1	12	12	ND		None					
2.1.2 Ocean Water	pCi/l	^{3}H	2	24	24	<200		None			<200[a]		
		^{89}Sr	2	24	24	ND		None			ND		
		^{90}Sr	2	24	24	ND		None			ND		
2.1.3 Estaurine Water	pCi/l	^{3}H	1	4	4	<200		None					
2.2 Ground Water Well	pCi/l	^{3}H	1	4	4	<200		None					
		Gβ-DS	1	4	4	<1	ND-3	H-30; Residence, Indian River Drive	<1	ND-3			
		Gβ-UDS	1	4	4	ND		None					
2.3 Potable Water	pCi/l	^{3}H	3	12	12	ND		None					
		Gβ-DS	3	12	12	<1	ND-9	H-11; St. Lucie County Health Dept., Ft. Pierce, FL	3	ND-9			
		Gβ-UDS	3	11	11	ND		None					

Medium or Pathway Sampled	Unit	Analysis for	Number of			All Indicator Locations		Location with Highest Mean			Control Location (a)		Number of Nonroutine Reported Measurements
			Sites	Samples	Analyses	Mean	Range	Sample Location Distance and Direction	Mean	Range	Mean	Range	
3.0 BOTTOM SEDIMENTS													
3.1 Discharge Canal	pCi/kg	^{89}Sr	1	2	2	ND		None					
		^{90}Sr	1	2	2	ND		None					
		^{58}Co	1	2	2	70	ND-140	H-36: On Site, Dis. Canal, West of A1A; ESE, 0.19 miles	140	ND-140			
3.2 Ocean	pCi/kg	^{89}Sr	4	5	5	ND		None			ND[(a)]		
		^{90}Sr	4	5	5	ND		None			ND[(a)]		
3.3 Beach Sand	pCi/kg	^{89}Sr	3	6	6	ND		None			ND[(a)]		
		^{90}Sr	3	6	6	ND		None			ND[(a)]		

Medium or Pathway Sampled	Unit	Analysis for	Number of: Sites	Samples	Analyses	All Indicator Locations: Mean	Range	Location with Highest Mean: Sample Location Distance and Direction	Mean	Range	Control Location[a]: Mean	Range	Number of Nonroutine Reported Measurements
4.0 AQUATIC BIOTIA													
4.1 Crustacea[c]	pCi/kg	^{89}Sr	2	3	3	ND		None			ND[a]		
		^{90}Sr	2	3	3	ND		None			ND[a]		
4.2.1 Fish - Carnivore	pCi/kg	^{89}Sr	2	3	3	ND		None			ND[a]		
		^{90}Sr	2	3	3	ND		None			ND[a]		
4.2.2 Fish -[d] Herbivore	pCi/kg	^{89}Sr	2	4	4	ND		None					
		^{90}Sr	2	4	4	3	ND-13	H-32: Entomology Lab; Vero Beach, NNW, 19 miles	13		13[a]		

Medium or Pathway Sampled	Unit	Analysis for	Number of			All Indicator Locations		Location with Highest Mean			Control Location(a)		Number of Nonroutine Reported Measurements
			Sites	Samples	Analyses	Mean	Range	Sample Location Distance and Direction	Mean	Range	Mean	Range	
5.0 TERRESTRIAL BIOTA													
5.1 Milk	pCi/l	^{137}Cs	2	36	36	21.6	ND-64	H-40: Control-Davis Dairy; Boynton Beach, SSE, 55.8 miles	30(e)	ND-64	30(e)	ND-64	
		^{90}Sr	2	36	32(f)	3	2-3	H-40: " " " "	3		3		
		^{89}Sr	2	36	32(f)	ND		None			ND(e)		
		^{131}I	2	36	32	<1	ND-.91(j)	H-03: Meadowbrook Dairy; 14 miles, SSW	<1	ND-.91	<1(e)	ND-.36	
5.2.1 Food(g) Citrus	pCi/kg	^{89}Sr	7	7	7	ND		None					
		^{90}Sr	7	7	7	22	10-32	H-22: Lentz Groves, US 1; SSW 5.5 miles	32				
		^{137}Cs	7	7	7	13	ND-90	H-24: Poster Groves, US 1; WNW 5.35 miles	90				
5.2.2 Food(h) - Leafy Vegetables	pCi/kg	^{137}Cs	1	1	1	330		H-41: 7609 Indian River Drive; WSW, 2 miles	330				
		^{90}Sr	1	1	1	43		H-41: 7609 Indian River Drive; WSW, 2 miles					
		^{89}Sr	1	1	1	ND		None					

Medium or Pathway Sampled	Unit	Analysis for	Number of			All Indicator Locations		Location with Highest Mean			Control Location[a]		Number of Nonroutine Reported Measurements
			Sites	Samples	Analyses	Mean	Range	Sample Location Distance and Direction	Mean	Range	Mean	Range	

(a) H-32: Department of Health and Rehabilitative Services, Entomology, Laboratory, East of U.S. 1, Vero Beach, NNW, 19 miles

(b) ND: None detectable

(c) Blue Crab

(d) Mullet

(e) Control sample is H-40, Davis Dairy, Boynton Beach, SSE, 55.3 miles

(f) Two samples destroyed in Lab Accident

(g) Grapefruit, Citrus, Oranges

(h) Turnip Greens

(i) All analysis were non-detectable except for week of March 27, 1978. Weekly composite for that week gave Iodine concentration of 0.07 ± 0.02 pCi/m^3

(j) All analysis but two were non-detectable for Iodine 131. The H 03 milk sample the week of 3-10-78 had a concentration of 0.91 ± 0.46 pCi/l .

EFFECTS OF ACCIDENTS

CHAPTER 7

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EFFECTS OF ACCIDENTS

CHAPTER 7

LIST OF TABLES

7.1 STATION ACCIDENT INVOLVING RADIOACTIVITY

7.1.1 INTRODUCTION

Accidents which cause concern from the environmental protection standpoint are those which might result in an uncontrolled release of radioactive materials to the environment. Numerous barriers and features are provided which guard against accidental or uncontrolled releases of radioactive materials from the plant. These barriers are 1) the sealed metal cladding tubes which contain the fuel pellets, 2) the reactor coolant system which encloses the reactor, 3) the containment which houses the reactor coolant system, and 4) the shield building which encloses the containment. Additional protection of the public is provided by safety features which control the release of radioactivity in the event of an accident, and the site location, which further reduces the potential effects to the general public of an accidental release of radioactivity.

7.1.2 ANALYSIS OF ENVIRONMENTAL EFFECTS OF ACCIDENTS

The classification of accidents and incidents follows that of NRC Regulatory Guide 4.2 Rev 2 (1976) "Preparation of Environmental Reports for Nuclear Power Plants". This variety of accidents and incidents has been analyzed, covering a wide range of severity, to facilitate an assessment of environmental risk. Table 7.1-1 summarizes the events which were considered. These represent a spectrum of events from relatively minor to the most severe which are postulated in NRC Regulatory Guide 4.2, Rev 2 (1976). Calculated results of these events are shown in Table 7.1-2 in terms of exclusion area boundary and integrated population doses. Details of the parameters used for each accident are included in the discussion of that event.

7.1.3 DOSE CALCULATION METHODOLOGY

The radiological impacts of the postulated events are evaluated in terms of the radiation doses delivered to individuals and to the population as a whole. Whole body doses due to external exposure and thyroid doses due to inhalation are calculated for: 1) an individual at the exclusion area boundary and 2) the population within 50 miles of the St Lucie Unit 2 site. The calculated exposures are limited to whole body and thyroid gland because these are the critical organs of exposure for the radionuclides of potential concern.

The individual doses have been calculated using the following dose models:

$$\text{Thyroid Dose (rems)} = \sum_{i=1}^{n} B \frac{\chi}{Q} T_i Q_i$$

$$\text{Whole Body Dose (rems)} = \sum_{i=1}^{n} \frac{\chi}{Q} W_i Q_i$$

B = individual breathing rate for an adult; taken as 20.0 m^3/day.

T_i = thyroid dose conversion factor for the i^{th} iodine isotop (given in Table 7.1-3)

W_i = whole body dose conversion factor for the i^{th} gas isotope (given in Table 7.1-3); this factor is based on immersion in a semi-infinite cloud of gamma emitters.

Q_i = amount of activity of the i^{th} isotope released; for Class 1 through Class 7 accidents, Q_i is equal to the total release for the incident; for Class 8 accidents, Q_i is calculated for a time period of 30 days, which is effectively the entire release associated with a Class 8 accident.

$\frac{X}{Q}$ = the atmospheric dispersion factor (sec/m^3); these values have been calculated using onsite data at the 50 percent probability level and presented in Tables 7.1-9 through 7.1-13.

Population doses were calculated using the projected population for the year 2000 which is presented in Section 2.1.2.

7.1.4 CLASS 1: TRIVIAL INCIDENTS

Pursuant to NRC Regulatory Guide 4.2, Rev 2 (1976), Class I accidents have not been considered here. These low level releases are evaluated as routine releases and are included in the plant release source terms discussed in Section 3.5. The environmental consequences of these low level releases are given in Section 5.2. In all cases, the resultant doses are well within the requirements of 10CFR20 and 10CFR50.

7.1.5 CLASS 2: SMALL RELEASES OUTSIDE CONTAINMENT

Pipes, valves and flanges of systems containing fluids or gases with potentially significant radioactive concentrations are designed, fabricated and erected to minimize leakages that may occur during normal plant operations.

Although constructed with the intention of having no leakage, wear and use-related activities can cause small leakage source terms. These low level releases are evaluated as routine releases and are included in the plant release source terms discussed in Section 3.5. The environmental consequences of these low level releases are given in Section 5.2. In all cases the resultant doses are well within the requirements set forth in 10CFR20 and 10CFR50.

7.1.6 CLASS 3: RADWASTE SYSTEM FAILURE

7.1.6.1 Introduction

Class 3 accidents are identified as postulated accidents initiated by equipment failure or operator error that result in the release of radioactive contaminants to the atmosphere of the reactor auxiliary building. Accidents that are considered in this category are: equipment leakage or malfunction of a waste gas decay tank; equipment leakage or malfunction of a liquid radwaste storage tank; rupture of a waste gas decay tank; and rupture of a liquid radwaste storage tank.

7.1.6.2 Equipment Leakage or Malfunction of a Waste Gas Decay Tank

7.1.6.2.1 Description

For the purposes of this analysis it is assumed that an inadvertent venting occurs in which a portion of the radioactivity contained in a waste gas decay tank is released to the environment via the plant stack. This event could result from an operator error.

7.1.6.2.2 Calculation Assumptions

a) Twenty-five percent of the average inventory in a waste gas decay tank has been assumed to be released via the gas decay tank discharge header (see Table 7.1-4, Part I).

b) The airborne radioactivity released via the gas decay tank discharge is vented unfiltered to the environment.

c) X/Q values have been calculated using onsite data at the 50 percent probability level. Various wind directions and frequencies from onsite meteorological data have been used to determine the offsite population exposure (Section 2.3).

7.1.6.2.3 Probability of Occurrence

Due to the design of the waste gas decay tanks and the quality control during fabrication, the probability of a release of the stored radioactive gases in the waste gas decay tanks as a result of component failure and inadvertent venting is considered small.

7.1.6.2.4 Radiological Effects

Using the assumptions stated, doses have been calculated and are shown in Table 7.1-2.

7.1.6.3 Equipment Leakage or Malfunction of a Liquid Waste Holdup Tank

7.1.6.3.1 Description

This postulated accident is defined as an unspecified leak or malfunction that results in the release of a portion of the average inventory of the tank containing the largest quantities of significant isotopes in the waste management system. The airborne radioactivity released from this tank during the accident is then vented directly to the environment.

7.1.6.3.2 Calculation Assumptions

a) Twenty-five percent of the average inventory in a liquid waste holdup tank has been assumed to be released into the reactor auxiliary building.

b) An iodine partition factor of 0.001 for air to water has been assumed.

c) The airborne radioactivity released into the reactor auxiliary building is released unfiltered to the environment via a plant vent. (See Table 7.1-4, Part II).

d) X/Q values have been calculated using onsite data at the 50 percent probability level. Various wind directions and frequencies from onsite meteorological data have been used to determine the offsite population exposure (see Section 2.3).

7.1.6.3.3 Probability of Occurrence

Postulated events that could result in the release of quantities as large as 25 percent of the radioactive inventory of a liquid holdup waste tank are cracks in the steel tanks and operator error. The probability of small cracks, and resulting low level leak rates is very small because the liquid waste holdup tanks are not subject to high pressures or unusually high stresses.

A liquid radwaste release initiated by an operator error is also considered a remote possibility. Operating techniques and administrative procedures which will be utilized emphasize detailed system and equipment operating instruction and will minimize the potential for operator error.

In the unlikely event that a release of liquid radioactive wastes does occur, floor drain sump pumps located in the reactor auxiliary building will automatically activate and remove the spilled liquid upon receipt of a high water level alarm in the sump pump floor drains.

In view of the above discussion, the probability of an accident of this type occurring is considered small.

7.1.6.3.4 Radiological Effects

Using the assumptions stated, the doses have been calculated and are shown in Table 7.1-2.

7.1.6.4 Rupture of a Waste Gas Decay Tank

7.1.6.4.1 Description

This postulated accident is defined as an unspecified event that initiates the complete rupture of a waste gas decay tank. The airborne radioactivity released from this tank during the accident is then to be vented directly to the environment via the plant vent.

7.1.6.4.2 Calculation Assumptions

a) One hundred percent of the average tank inventory has been assumed to be released, as shown in Table 7.1-4, Part III. This evaluation is based on normal operating conditions.

b) The airborne radioactivity released into the reactor auxiliary building has been assumed to be released unfiltered to the environment.

c) X/Q values have been calculated using onsite data at the 50 percent probability level. Various wind directions and frequencies from onsite meteorological data have been used to determine the offsite population exposure (see Section 2.3).

7.1.6.4.3 Probability of Occurrence

Rupture of a waste gas tank is considered highly unlikely. The radioactive gases stored in the decay tanks will consist of fission product gases, hydrogen, and nitrogen cover gases. The nitrogen will be added in the various collection and holdup tanks to preclude the possibility of obtaining a flammable mixture of hydrogen gas. Hence, a tank rupture as a result of ignition of hydrogen in the decay tank is considered remote. The system will also be designed to appropriate industry and seismic Category I component standards. In addition, a system monitor with associated alarms, isolation valves, and system surveillance will assure that the possibility of this type of accident is small.

7.1.6.4.4 Radiological Effects

Using the assumptions stated, the doses have been calculated and are shown in Table 7.1-2.

7.1.6.5 <u>Rupture of a Liquid Radwaste Holdup Tank</u>

7.1.6.5.1 Description

This postulated accident is defined as an unspecified event that initiates the complete rupture of the tank containing the largest quantities of significant isotopes in the waste management system. The airborne radioactivity released from this tank during the postulated accident is then vented to the environment via the plant vent.

7.1.6.5.2 Calculation Assumptions

a) One hundred percent of the average inventory of a liquid waste holdup tank has been assumed to be released into the reactor auxiliary building.

b) An iodine partition factor of 0.001 for air to water has been assumed.

c) The airborne radioactivity released has been assumed to be released unfiltered to the environment (see Table 7.1-4 Part IV).

d) X/Q values have been calculated using onsite data at the 50 percent probability level. Various wind directions and frequencies from onsite meteorological data have been used to determine the offsite population exposure (see Section 2.3).

7.1.6.5.3 Probability of Occurrence

Much of the discussion concerning equipment leakage or a malfunction of a liquid radwaste tank is equally applicable to a complete release accident. The probability of a complete rupture or complete malfunction accident is therefore considered even lower than that of the partial release accident described in Section 7.1.6.3.

7.1.6.5.4 Radiological Effects

Using the assumptions stated, doses have been calculated and are presented in Table 7.1-2.

7.1.7 CLASS 4: FISSION PRODUCTS TO PRIMARY SYSTEM (Boiling Water Reactors)

This class of accidents is not applicable to facilities, such as St Lucie 2, that utilize pressurized water reactors.

7.1.8 CLASS 5: FISSION PRODUCTS TO PRIMARY AND SECONDARY SYSTEMS (Pressurized Water Reactors)

7.1.8.1 <u>Fuel Cladding Defects and Steam Generator Leaks</u>

Pipes, valves and flanges of systems containing fluids with potentially significant radioactive concentrations are designed, fabricated and erected, to the degree practicable, to minimize leakage that may occur during normal plant operation. Although constructed with the intention of having no leakage, wear and use related activities can cause primary to secondary steam generator leakage.

The assumptions, conditions and metholodgy used to determine these low level releases and subsequent doses are described in Section 5.2 of this report.

7.1.8.2 <u>Off-design Transient that Induces Fuel Failure Above That Expected and Steam Generator Leaks (such as flow blockage and flux maldistributions)</u>

7.1.8.2.1 Description

An off-design transient that could induce fuel rod failures has been identified as a single reactor coolant pump shaft seizure accident, and, in this analysis, is postulated as the instantaneous seizure of the pump shaft. The reactor coolant flow following such an event would be rapidly reduced. Since a rapid reduction in coolant flow results in a rapid reduction in the margin to departure from nucleate boiling (DNB), a low DNB ratio trip occurs.

In order to assess the radiological consequences of this accident, the reactor coolant radionuclide inventory after the accident has been adjusted to account for the additional fission product release resulting from failure of the fuel cladding by the accident. For the purposes of this analysis, the quantity of noble gases and radioiodines released from the secondary system have been considered to be proportional to the amount of steam that passes through the condenser hotwell during the cooldown period, the condenser hotwell iodine partition factor, and the concentration of radioiodine in the turbine steam.

In the course of the cooldown period, which is assumed to be carried out by dumping steam to the main condenser with the aid of the turbine bypass valves, approximately 1,000,000 lb of steam are dumped to cool the plant. After the plant is sufficiently cooled, the main condenser is shutdown and the condenser vacuum pump discharge to the atmosphere is terminated.

7.1.8.2.2 Calculation Assumptions

a) Of the core inventory, 0.02 percent of the noble gases and 0.02 percent of the core inventory of halogens have been assumed to be released into the reactor coolant.

b) The reactor coolant inventory prior to the accident has been based on 0.5 percent failed fuel.

c) Secondary system equilibrium radioactivity prior to the transient has been calculated assuming a 20 gal/day steam generator leak rate and 10 gpm steam generator blowdown rate.

d) The radionuclides contained in 1,000,000 lb of steam are assumed to pass thorugh the main condenser hotwell during the duration of the accident. This activity is given in Table 7.1-4, Part V.

e) A main condenser iodine partition factor of 0.001 has been assumed.

f) X/Q values have been calculated using onsite data at the 50 percent probability level. Various wind directions and frequencies, from onsite meteorological data, have been used to determine the offsite population exposure (see Section 2.3).

7.1.8.2.3 Probability of Occurrence

Components and materials used to construct the reactor coolant pumps are of the type that have been used successfully in other nuclear power plants. The equipment is designed to seismic Category I requirements. In addition, the reactor coolant pumps will be designed, fabricated, and constructed under a comprehensive quality aasurance program to assure compliance with all applicable specifications and codes. Considering these precautions, the probability of an accident of this type occurring during the lifetime of the plant is considered to be remote.

7.1.8.2.4 Radiological Effects

Using the assumptions stated above, offsite exposures have been calculated and are shown in Table 7.1-2.

7.1.8.3 Steam Generator Tube Rupture

7.1.8.3.1 Description

A steam generator tube rupture accident is an accident that causes a penetration of the barrier between the reactor coolant system and the main steam system. Integrity of this barrier is significant from the radiological safety standpoint, since a leaking steam generator tube would allow transport of reactor coolant into the main steam system. Radioactivity contained in the reactor coolant would mix with shell-side water in the affected steam generator. This radioactivity would then pass to the turbine and condenser.

The noncondensible radioactive materials in the condenser hotwell will be discharged to the environment through a charcoal bed adsorber by the condenser air ejectors.

After 30 minutes, it is assumed that the operator has diagnosed the problem and has closed the main steam and feedwater isolation valves for the leaking steam generator. Radioactivity levels in the steam generator blowdown lines from the damaged steam generator are the main indicator. Plant cooldown is then initiated by dumping steam from the intact steam generator. After the temperature of the reactor coolant is sufficiently reduced, the operator initiates the shutdown cooling and isolates both steam generators. During the plant cooldown period the operator manually regulates safety injection and charging flow rates in order to maintain a measurable pressurizer water level.

Secondary system activities after this steam generator tube rupture were calculated on the basis that during the first 30 minutes following a tube rupture, the reactor coolant leaks from the primary to secondary system. For the purposes of this analysis the post tube rupture secondary system activities have been conservatively assumed to consist of original equilibrium activities plus the activity associated with the leaking reactor coolant. The quantity of noble gases and radioiodines released has been assumed to be proportional to the flow rate of steam through the condenser.

7.1.8.3.2 Calculation Assumptions

a) During the first 30 minutes following a steam generator tube rupture, 15 percent of the reactor coolant has been assumed to leak from the primary to secondary system.

b) The average primary reactor coolant inventory prior to the accident has been calculated assuming 0.5 percent failed fuel.

c) The equilibrium reactor coolant radionuclide concentrations prior to the incident have been calculated assuming a primary to secondary steam generator leak rate of 20 gallons per day and a steam generator blowdown rate of 10 gpm.

d) During the plant cooldown the radionuclides contained in 1,000,000 lb of steam are assumed to pass through the condenser hotwell from the intact and faulted steam generators. This activity is given in Table 7.1-4, Part VI.

e) An iodine partition factor of 0.01 and 0.001 has been assumed for the steam generators and condenser hotwell respectively.

f) X/Q values have been calculated using onsite data at the 50 percent probability level. Various wind directions and frequencies, from onsite meteorological data, have been used to determine the offsite population exposures (see Section 2.3).

7.1.8.3.3 Probability of Occurrence

Combustion Engineering's experience with nuclear steam generators indicates the probability of complete severance of the Inconel vertical U-tubes is remote. No such steam generator tube double-ended rupture has ever occurred and is not expected to occur in a Combustion Engineering steam generator of this design.

The more probable modes of failure result in considerably smaller penetrations of the pressure barrier. They involve the formation of etch pits, small cracks in the U-tubes or cracks in the welds joining the tubes to the tube sheet. These releases are evaluated under normal plant operations in Section 5.2.

7.1.8.3.4 Radiological Effects

Using the assumptions stated, offsite doses have been calculated and are shown in Table 7.1-2.

7.1.9 CLASS 6: REFUELING ACCIDENTS

7.1.9.1 <u>Introduction</u>

Class 6 accidents are postulated events during refueling operations in the reactor building. The accidents considered in Class 6 are the dropping of a fuel bundle assembly and dropping a heavy object onto the reactor core.

7.1.9.2 <u>Fuel Assembly Drop</u>

7.1.9.2.1 Description

This accident has been postulated as an equipment failure or mishandling event that results in the dropping of a spent fuel assembly into the upper refueling pool during refueling operations. It is further assumed that the assembly falls from a height sufficient to rupture one row of fuel rods, whose gap activity is subsequently released to the refueling pool water. The radioactive gases then bubble through the refueling pool water which entrains most of the iodine. The remainder escapes to the reactor building atmosphere. The airborne radioactivity is then passed through charcoal and HEPA filters before being released to the environment.

7.1.9.2.2 Calculation Assumptions

a) This accident occurs no sooner than one week after reactor shutdown.

b) The equilibrium gap activity (noble gases and halogens) in one row of fuel rods, which is equivalent to 16 fuel rods, would be released into the refueling pool water. The gas gap activity has been assumed to be one percent of the total activity of a fuel pin.

c) An iodine decontamination factor (initial activity/final activity) in water of 500 has been assumed.

d) 1.0 percent of the airborn radioactivity released into the reactor building leaks to the environment unfiltered prior to isolation of the containment.

e) 99.0 percent of the airborne radioactivity released into the reactor building has been assumed to be released to the environment via charcoal and HEPA filters.

f) A filter efficiency of 99 percent for the charcoal filters has been assumed. Total activity released to the environment following the accident is included in Table 7.1-4 Part VII.

g) X/Q values have been calculated using onsite data at the 50 percent probability level. Various wind directions and frequencies, from onsite meteorological data, have been used to determine the offsite population exposure (see Section 2.3).

7.1.9.2.3 Probability of Occurrence

The possibility of damage to a fuel assembly as a consequence of equipment failure or mishandling is minimized through equipment design, detailed refueling procedures and personnel training. The reliability of the fuel handling equipment, including the bridge and trolley, the lifting mechanism, the transfer mechanism and all associated instrumentation and controls, is ensured through adoption of preoperational check-out tests. The maximum elevation to which the fuel assemblies can be raised is limited by the design of the handling hoists and manipulators. The refueling equipment platform assembly is constructed to seismic Category I requrements. Considering the precautions that are taken in the design and the operation procedures that are required, the probability of a refueling accident occurring during the lifetime of the plant is considered to be remote.

7.1.9.2.4 Radiological Effects

Using the assumptions stated, offsite doses have been calculated and are shown in Table 7.1-2.

7.1.9.3 Heavy Object Drop Onto Fuel In Core

7.1.9.3.1 Description

This postulated accident assumes that a heavy object is dropped onto the reactor core as a result of an equipment failure or mishandling event. It is further postulated that the heavy object is dropped from a height sufficient to rupture one fuel assembly whose gap activity is subsequently released to the reactor core coolant. The radioactive gases then bubble through the reactor coolant with most of the iodine being entrained. The remainder is then released to the containment atmosphere. The airborne radioactivity is then passed through charcoal and HEPA filters before being released to the environment.

7.1.9.3.2 Calculation Assumptions

a) This accident occurs no sooner than 100 hours after reactor shutdown.

b) The equilibrium gap activity (noble gases and halogens) in one average fuel assembly have been assumed to be releaed into the reactor coolant. The gas gap activity has been assumed to be one percent of the toal activity of the fuel rod

c) An iodine decontamination factor (inital activity/final activity) in water of 500 has been assumed.

d) 1.0 percent of the airborne radioactivity released into the reactor building leaks to the environment unfiltered prior to isolation of the containment.

e) 99.0 percent of the airborne radioactivity released into the reactor building has been assumed to be released to the environment via charcoal and HEPA filters.

f) A filter efficiency of 99 percent for the charcoal filters has been assumed. The total activity released to the environment following the accident is included in Table 7.1-4 Part VIII.

g) X/Q values have been calculated using onsite data at the 50 percent probability level. Various wind directions and frequencies, from onsite meteorological data, have been used to determine the offsite population exposure (see Section 2.J).

7.1.9.3.3 Probability of Occurrence

The discussion of a fuel bundle drop onto the reactor core is equally applicable to a heavy object drop onto the reactor core. The frequency of handling heavy objects over the reactor core is small compared to that of handling fuel assemblies. In addition, the probability of equipment failure during handling operations involving fuel assemblies and heavy objects is of the same order of magnitude. Therefore, the probability of a heavy object drop accident is considered even more remote than the fuel handling accident.

7.1.9.3.4 Radiological Effects

Using the assumptions stated above, offsite doses have been calculated and are presented in Table 7.1-2.

7.1.10 CLASS 7: SPENT FUEL HANDLING ACCIDENTS

7.1.10.1 Introduction

Class 7 accidents are identified as postulated events that involve the handling of spent fuel during yearly refueling operations in the fuel handling building. The accidents considered in Class 7 are: dropping of a fuel assembly in the fuel storage pool; dropping of a heavy object onto the fuel storage rack; and the dropping of a loaded spent fuel shipping cask.

7.1.10.2 Fuel Assembly Drop In Fuel Storage Pool

7.1.10.2.1 Description

This event postulates that a spent fuel assembly is dropped in the refueling pool by the fuel handling crane and onto the spent fuel rack. The assembly falls through the pool water from an unspecified height above the storage rack. Upon impact, the fuel rods fail and release their gas gap activity into the spent fuel pool. The released radioactive gases then bubble through the spent fuel storage water with most of the iodine being entrained and the remainder being releaed to the fuel handling building atmosphere.

Upon receipt of a signal for high radioactivity, the isolation dampers of the normal ventilation system will close and the release is passed through charcoal filters to the environment.

7.1.10.2.2 Calculation Assumptions

a) The accident occurs no sooner than one week after reactor shutdown.

b) An average of one percent of the noble gas activity and one percent of the halogen core activity is in each fuel rod gap and is available for release if the fuel rod is damaged.

c) It is assumed that one row of fuel rods fail.

d) An iodine decontamination factor of 500 in the refueling pool water has been assumed.

e) The airborne radioactivity is passed through 99 percent efficient charcoal filters before being released to the environment. (See Table 7.1-4, Part IX).

f) X/Q values have been calculated using onsite data at the 50 percent probability level. Various wind directions and frequencies, from onsite meteorological data, have been used to determine the offsite population exposure (see Section 2.3).

7.1.10.2.3 Probability of Occurrence

The discussion concerning the Class 6 fuel assembly drop accident is equally applicable to this Class 7 accident. As discussed previously, the probability of a fuel assembly drop accident is considered remote.

7.1.10.2.4 Radiological Effects

Using the assumptions stated, offsite doses have been calculated are are shown in Table 7.1-2.

7.1.10.3 Heavy Object Drop Onto Fuel Rack

7.1.10.3.1 Description

This hypothetical accident postulates that an unspecified heavy object is dropped onto the spent fuel storage rack and results in the release of radioactive gases from the damaged fuel elements. The released radioactive gases then bubble through the spent fuel storage pool water, with the iodine gases undergoing a scrubbing process as the gas bubbles rise to the surface of the water. The noble gases and remaining iodine gas are then released to the fuel handling building atmosphere where the same ventilation procedures, enacted during a fuel assembly drop accident, apply.

The design of the spent fuel handling area and fuel handling equipment is such that no identifiable heavy objects can be lifted or carried over the spent fuel storage racks. However, to provide an upper limit estimate for the maximum hypothetical release for an accident of this type, it is postulated that an unspecified heavy object is dropped onto the spent fuel racks resulting in the release of the gap activity (noble gases and halogens) in one average fuel assembly into the spent fuel pool.

7.1.10.3.2 Calculation Assumptions

a) The accident occurs no sooner than 30 days after reactor shutdown.

b) An average of one percent of the noble gas core activity and one percent of the halogen core activity is in each fuel rod gas gap and is available for release if the fuel rod is damaged.

c) The gas gap activity in one average fuel assembly (236 fuel rods) has been assumed to be released into the spent fuel storage pool.

d) An iodine decontamination factor of 500 has been assumed.

e) The airborne radioactivity is passed through 99 percent efficient charcoal filters before being released to the environment. (See Table 7.1-4, Part X).

f) X/Q values have been calculated using onsite data at the 50 percent probability level. Various wind directions and frequencies, from onsite meteorological data, have been used to determine the offsite population exposure (see Section 2.3).

7.1.10.3.3 Probability of Occurrence

Because there are no identifiable heavy objects that could result in an accident of this nature, and because of the hypothetical nature of the accident analyzed, the opportunity for occurrence of this type of accident at St Lucie Unit 2 is considered nonexistent.

7.1.10.3.4 Radiological Effects

Using the above assumptions, offsite doses have been calculated and are presented in Table 7.1-2.

7.1.10.4 Fuel Cask Drop Accident

7.1.10.4.1 Description

The design of the fuel handling building is such that the only transfer operation that could involve the dropping of a loaded spent fuel cask a significant distance is the transfer of the spent fuel cask from the spent fuel cask storage area pool to the decontamination area. The basis for this accident is a fuel cask drop and subsequent activity release outside fuel handling building.

7.1.10.4.2 Calculation Assumptions

a) The fuel shipping cask contains seven fuel assemblies.

b) All of the noble gas gap activity from one fully loaded fuel shipping cask (120 days cooling) is released. This activity is shown in Table 7.1-4, Part XI.

c) An average of one percent of the noble gas core activity is in each fuel rod gap and is available for release if the fuel rod is damaged.

d) Activity is released instantaneously and unfiltered, to the environment.

e) X/Q values have been calculated using onsite data at the 50 percent probability level. Various wind directions and frequencies, from onsite meteorological data, have been used to determine the offsite population exposure (see Section 2.3).

7.1.10.4.3 Probability of Occurrence

Equipment design, operating procedures, and personnel training will minimize the possibility of a fuel cask drop accident during the lifetime of the plant.

7.1.10.4.4 Radiological Effects

Using the above assumptions, offsite doses have been calculated and are given in Table 7.1-2.

7.1.11 CLASS 8: ACCIDENT INITIATION EVENTS CONSIDERED IN DESIGN BASIS EVALUATION IN THE SAFETY ANALYSIS REPORT

7.1.11.1 Introduction

Postulated Class 8 accidents are listed below:

a) a pipe break accident resulting in a small loss of coolant,

b) a pipe break accident resulting in a large loss of coolant,

c) a control rod ejection accident,

d) an instrument line break accident,

e) a small steamline break accident, and

f) a large steamline break accident.

7.1.11.2 Loss-of-Coolant Accident: Break in a Small Pipe

7.1.11.2.1 Description

A loss-of-coolant accident represents a malfunction of the reactor coolant system that interrupts normal cooling operations and results in the release of reactor coolant, containing radioactive fission products, to the containment. The activity is then released to the atmosphere via leakage from the containment.

7.1.11.2.2 Calculation Assumptions

a) The average radioactivity inventory in the primary coolant has been assumed to be released into the containment. This inventory has been calculated assuming operation with 0.5 percent failed fuel.

b) A shield building ventilation system (SBVS) filter efficiency of 99 percent has been assumed for the iodines.

c) A containment leak rate of 0.5 percent/day for the first 24 hours and 0.25 percent/day for the duration of the accident has been assumed.

d) Five percent of the halogens and all of the noble gases are assumed to remain airborne and available for leakage from the containment. The releases to the environment are presented in Table 7.1-5.

e) χ/Q values have been calculated using onsite data at the 50 percent probability level. Various wind directions and frequencies, from onsite meteorological data, have been used to determine the offsite population exposure (see Section 2.3).

7.1.11.2.3 Probability of Occurrence

The plant has been designed, fabricated and constructed under a comprehensive quality assurance program to assure compliance with all applicable specifications and codes. All reactor coolant system components are designed, fabricated and inspected in accordance with ASME Section III, Code Class 1 and Section XI.

The major reactor coolant system components are designed for a 40 year operating lifetime. Components are of materials that are compatible with coolant chemistry. Fatigue analyses based on conservative design cyclic transients and primary stress combinations have been evaluated in accordance with the applicable codes. Overpressure protection is assured by ASME Code III safety valves.

Technical specifications, operating procedures and other administrative controls assure plant operating conditions within limits previously determined to be acceptable.

The probability of this accident is considered remote.

7.1.11.2.4 Radiological Effects

Using the above assumptions offsite exposures have been calculated and are presented in Table 7.1-2.

7.1.11.3 <u>Loss-of-Coolant Accident: Large Pipe Break</u>

7.1.11.3.1 Description

This accident is postulated as an unspecified event that results in the break of a large reactor coolant pipe and subsequent release of the reactor coolant inventory. A portion of the core inventory from fuel rods that fail during the accident is also released to the containment atmosphere. Of this release, a portion of the halogens and all of the noble gases have been assumed to become airborne in the containment and available for leakage. This accident is analyzed using realistic values for containment leak rates, iodine removal efficiencies and atmospheric dispersion factors.

7.1.11.3.2 Calculation Assumptions

a) The average radioactivity inventory in the primary coolant (based on 0.5 percent failed fuel) plus two percent of the core inventory of halogens and noble gases have been assumed to be released into the containment.

b) A SBVS filter efficiency of 99 percent has been assumed for the iodines. However, no credit for filtration is taken in the initial two minutes following the accident when unfiltered releases to the environment may occur.

c) A primary containment leak rate of 0.5 percent/day for the first 24 hours and 0.25 percent/day for the duration of the accident has been assumed.

d) Five percent of the halogens and all of the noble gases are assumed to remain airborne and available for leakage from the containment.

The releases to the environment are presented in Table 7.1-6.

e) X/Q values have been calculated using onsite data at the 50 percent probability level. Various wind directions and frequencies from onsite meteorological data have been used to determine the offsite exposure (see Section 2.3).

7.1.11.3.3 Probability of Occurrence

The discussion concerning the small pipe break accident is equally applicable to a large pipe break accident. The probability of a large loss-of-coolant accident (LOCA) pipe break, however, is considered even lower than that of a small LOCA pipe break.

7.1.11.3.4 Radiological Effects

Using the above assumptions, offsite doses have been calculated and are given in Table 7.1-2.

7.1.11.4 Break in Instrument Line from Primary System that Penetrates the Containment (lines not provided with isolation capabilities inside containment)

There are no instrument lines from the primary system that penetrate the containment. This accident is therefore not applicable to this plant.

7.1.11.5 Control Rod Ejection Accident

7.1.11.5.1 Description

A typical control element assembly (CEA) ejection accident behaves in the following manner: after ejection of a CEA, the core power rises rapidly for a brief period. The rise is terminated by the Doppler effect. Reactor shutdown is initiated by the high linear power level trip and the power transient is then completed. The core is protected against severe fuel damage by the allowable CEA patterns and by the high power trip; the maximum enthalpy in the fuel during the transient is limited to an acceptable value.

The only significant doses due to this postulated accident would result from activity released via the SBVS, since the availability of offsite power is assumed for this analysis. The radioactivity released to the containment following this accident will consist of the radioactivity contained in the reactor coolant system prior to the accident, plus any radioactive gases released from the fuel rods initiated by fuel rod perforation. The noble gases released from the damaged fuel rods have been assumed to be immediately and completely released to the containment. The released iodines will volatilize and be partially scrubbed out by the reactor coolant.

Assumptions regarding containment leak rate, operation of the SBVS and meteorological diffusion are identical to those taken for the evaluation of the design basis LOCA.

7.1.11.5.2 Calculation Assumptions

a) The average radioactivity in the primary coolant based on 0.5 percent failed fuel and 0.2 percent of the core inventory is released instantaneously into the containment atmosphere.

b) A SBVS filter efficiency of 99 percent has been assumed for the halogens.

c) A containment leak rate of 0.5 percent/day for the first 24 hours and 0.25 percent/day for the duration of the accident has been assumed.

d) Five percent of the halogens and all of the noble gases are assumed to remain airborne and available for leakage from the containment. The releases are presented in Table 7.1-7.

e) X/Q values have been calculated using onsite data at the 50 percent probability level. Various wind directions and frequencies, from onsite meteorological data, have been used to determine the offsite exposure (see Section 2.3).

7.1.11.5.3 Probability of Occurrence

Rapid ejection of a control element assembly (CEA) from the core would require a complete circumferential break of the control element drive mechanism (CEDM) housing, or of the CEDM nozzle on the reactor vessel head. The CEDM housing and CEDM nozzle are an extension of the reactor coolant system boundary and are designed, fabricated and inspected to ASME Section III Code Class 1. Considering these design precautions, the occurrence of such a CEA ejection is considered highly unlikely.

7.1.11.5.4 Radiological Effects

Using the above assumptions, offsite doses have been calculated and are given in Table 7.1-2.

7.1.11.6 <u>Small Steamline Break Accident</u>

7.1.11.6.1 Description

A small steamline break is defined as the rupture of any main steamline no larger than the throat diameter of the main steam safety valves. The worst case assumption is such a valve upstream of the main steam isolation valve whereby the release is terminated only by stopping feedwater flow to a steam generator.

The release rates of radionuclides as a function of time have been considered to be proportional to the amount of steam released via the minor secondary system pipe break. The volume of one steam generator has been assumed to be released.

7.1.11.6.2 Calculation Assumptions

a) Primary reactor coolant activities prior to the incident have been assumed to be based on 0.5 percent failed fuel.

b) Secondary system equilibrium radionuclide concentrations prior to the incident have been calculated assuming a 20 gal/day steam generator leak rate and a 10 gpm steam generator blowdown rate.

c) During the course of the accident, a reduction factor of 0.1 has been applied to the primary coolant source in the steam generator.

d) The total integrated pounds of steam leaving the break during the duration of the accident are 1.305×10^5 lb, with an iodine partition factor of 0.1. The activity released is given in Table 7.1-8, Part I.

e) X/Q values have been calculated using onsite data at the 50 percent probability level. Various wind directions and frequencies, from onsite meteorological data, have been used to determine the offsite population exposure (see Section 2.3).

7.1.11.6.3 Probability of Occurrence

Applicable components of the main steam system are designed, fabricated and inspected in accordance with ASME Section III, Code Class 2 and Section XI. In addition, components of the main steam system have been designed, fabricated and constructed under a comprehensive quality assurance program to assure compliance with all applicable specifications and codes. Technical specifications, operating procedures and other administrative controls assure plant operating conditions within limits peviously determined to be acceptable.

For the reasons discussed, the probability of a small steamline accident is considered remote.

7.1.11.6.4 Radiological Effects

Using the assumptions stated above, offsite exposures have been calculated and are given in Table 7.1-2.

7.1.11.7 <u>Large Steamline Break Accident</u>

7.1.11.7.1 Description

This analysis postulates that a circumferential rupture of a steam line occurs upstream of the main steam isolation valve outside the containment. All of the mass leaving the break is assumed to be in the steam phase. Flow from the intact steam generator stops with closure of both the intact and faulted steam generator isolation valves, either of which is capable of stopping flow. Flow from the faulted steam generator stops with termination of feedwater flow to the faulted steam generator.

7.1.11.7.2 Calculation Assumptions

a) Primary reactor coolant activities prior to the incident have been assumed to be based on 0.5 percent failed fuel.

b) Secondary system equilibrium radionuclide concentrations prior to the incident have been calculated assuming a 20 gal/day steam generator leak rate and a 10 gpm steam generator blowdown rate.

c) During the course of the accident, a reduction factor of 0.5 has been applied to the primary coolant source in the steam generator.

d) The total integrated pounds of steam leaving the break during the duration of the accident are 1.305×10^5 lb, with an iodine partition factor of 0.1. The activity released is given in Table 7.1-8, Part II.

e) X/Q values have been calculated using corrected onsite data at the 50 percent probability level. Various wind directions and frequencies, from onsite meteorological data, have been used to determine the offsite population exposure (see Section 2.3).

7.1.11.7.3 Probability of Occurrence

The discussion concerning the small steamline break is equally applicable to a large steamline break. The probability of a large steamline break, however is considered even lower than that of small steamline break.

7.1.11.7.4 Radiological Effects

Using the assumptions stated above, offsite exposures have been calculated and are given in Table 7.1-2.

TABLE 7.1-1

ACCIDENT CLASSIFICATION

Class	Description
1.0	Trivial Incidents
2.0	Small Release Outside Containment
3.0	Radwaste System Failure
3.1	Equipment Leakage or Malfunction (Waste Gas Decay Tank)
3.2	Equipment Leakage or Malfunction (Liquid Waste Storage Tank)
3.3	Rupture of a Waste Gas Decay Tank
3.4	Rupture of a Liquid Waste Storage Tank
4.0	Fission Products to Primary System (BWR)
5.0	Fission Products to Primary and Secondary Systems (PWR)
5.1	Fuel Cladding Defects and Steam Generator Leak
5.2	Off-Design Transient that Induces Fuel Failure above that Expected and Steam Generator Leak
5.3	Steam Generator Tube Rupture
6.0	Refueling Accidents
6.1	Fuel Bundle Drop
6.2	Heavy Object Drop Onto Fuel in Core
7.0	Spent Fuel Handling Accident
7.1	Fuel Assembly Drop in Fuel Storage Pool
7.2	Heavy Object Drop Onto Fuel Rack
7.3	Fuel Cask Drop

TABLE 7.1-1 Sheet 2 of 2

ACCIDENT CLASSIFICATION

Class	Description
8.0	Accident Initiation Events Considered in Design Basis Evaluation in the Safety Analysis Report
8.1	Small Loss-of-Coolant Accident, Pipe Break
8.2	Large Loss-of-Coolant Accident, Pipe Break
8.3	Break in Instrument Line from Primary System that Penetrates the Containment (lines not provided with isolation capability inside containment)
8.4	Rod Ejection Accident
8.5	Small Steamline Break
8.6	Large Steamline Break

TABLE 7.1-2

SUMMARY OF CALCULATED OFFSITE DOSES FROM PLANT ACCIDENT

Accidents	Whole Body Dose (rems) at Exclusion Area Boundary	Thyroid Dose (rems) at Exclusion Area Boundary	Whole Body Population Dose (man-rems)	Thyroid Population Dose (man-rems)
1) Equipment Leakage or Malfunction (Waste Gas Decay Tank)	4.0(-6)*	8.5(-7)	5.8(-2)	1.2(-2)
2) Equipment Leakage or Malfunction (Liquid Waste Storage Tank)	4.0(-5)	2.5(-6)	5.8(-1)	3.6(-2)
3) Rupture of a Waste Gas Decay Tank	1.6(-5)	3.4(-6)	2.3(-1)	4.9(-2)
4) Rupture of a Liquid Waste Holdup Tank	1.6(-4)	1.0(-5)	2.3	1.4(-1)
5) Off-Design Transient that Induces Fuel Failure above that Expected and Steam Generator Leak	1.1(-5)	4.7(-6)	1.6(-1)	6.8(-2)
6) Steam Generator Tube Rupture	5.0(-4)	8.3(-7)	7.2	1.2(-2)
7) Fuel Bundle Drop Onto the Fuel in Core	1.1(-5)	2.0(-5)	1.6(-1)	2.9(-1)
8) Heavy Object Drop Onto the Fuel in Core	2.4(-4)	3.7(-4)	3.4	5.4
9) Fuel Assembly Drop Onto the Fuel Storage Pool	1.1(-5)	1.0(-5)	1.6(-1)	1.5(-1)
10) Heavy Object Drop Onto the Fuel Rack	7.8(-6)	2.0(-5)	1.1(-5)	2.8(-1)
11) Fuel Cask Drop	1.0(-6)	0.0	1.5(-2)	0.0
12) Small Loss-of-Coolant Accident	1.2(-6)	1.3(-6)	1.0(-1)	7.1(-2)
13) Large Loss-of-Coolant Accident	3.9(-3)	5.9(-2)	1.3(2)	2.9(2)
14) Rod Ejection Accident	3.9(-4)	5.9(-4)	1.3(1)	2.8(1)
15) Small Steamline Break	1.8(-7)	1.6(-5)	2.6(-3)	2.3(-1)
16) Large Steamline Break	2.2(-7)	6.3(-5)	3.2(-3)	9.0(-1)

* ( ) Denotes power of 10.

TABLE 7.1-3

CORE INVENTORY AND ISOTOPE PROPERTIES

Isotope	Radioactive Decay Constant (per sec)	Total Core Activity (Ci)	Thyroid Dose Conversion Factor (rem/Ci - Inhaled)	Direct Dose Conversion Factor $\frac{(rems - m^3)}{(sec - Ci)}$*
Kr-85m	4.41(-5)**	1.70(7)	-	3.61(-2)
Kr-85	2.21(-9)	6.99(5)	-	6.11(-4)
Kr-87	1.48(-4)	3.07(7)	-	3.61(-1)
Kr-88	6.95(-5)	4.39(7)	-	4.17(-1)
Xe-131m	6.68(-7)	4.59(5)	-	7.78(-4)
Xe-133	1.52(-6)	1.45(8)	-	6.94(-3)
Xe-135m	7.42(-4)	3.00(7)	-	9.72(-2)
Xe-135	2.11(-5)	3.18(7)	-	5.83(-2)
Xe-138	8.04(-4)	1.13(8)	-	3.33(-1)
I-131	9.96(-7)	7.28(7)	1.48(6)	8.61(-2)
I-132***	2.6(-6)	1.05(8)	5.35(4)	5.56(-1)
I-133	9.20(-6)	1.45(8)	4.0(5)	1.22(-1)
I-134	2.20(-4)	1.55(8)	2.5(4)	5.56(-1)
I-135	2.86(-5)	1.35(8)	1.24(5)	4.17(-1)

* Atomic Energy Commission, Final Environmental Statement Concerning: Numerical Guides for Objectives and Limiting Conditions for Operation to Meet the Criterion "As Low As Practicable" For Light-Water Cooled Nuclear Power Reactor Effluents, Volume 2, Table A-4, Pg 3, F-53 (July 1973).

** ( ) Denotes power of 10.

*** Decay constant of precursor used.

TABLE 7.1-4 Sheet 1 of 5

PART I

ACTIVITY RELEASED TO THE ENVIRONMENT FOLLOWING A WASTE GAS DECAY TANK EQUIPMENT LEAKAGE OR MALFUNCTION ACCIDENT

Isotope	Activity Released (Ci)
Kr-85m	1.7(-2)
Kr-85	1.5(+1)
Kr-87	2.5(-3)
Kr-88	1.9(-2)
Xe-133	6.5(+1)
Xe-135	9.0(-2)
Xe-138	2.1(-4)
I-131	1.8(-4)
I-132	5.5(-7)
I-133	2.4(-5)
I-134	9.5(-8)
I-135	3.5(-6)

PART II

ACTIVITY RELEASED TO THE ENVIRONMENT FOLLOWING A LIQUID RADWASTE HOLDUP TANK LEAKAGE OR MALFUNCTION ACCIDENT

Isotope	Activity Released (Ci)
Kr-85m	5.3(-1)
Kr-85	1.9(+1)
Kr-87	8.5(-2)
Kr-88	6.0(-1)
Xe-133	6.3(+2)
Xe-135	1.6
Xe-138	5.5(-3)
I-131	5.[illegible](-4)
I-132	2.5(-6)
I-133	1.1(-4)
I-134	4.3(-7)
I-135	1.5(-5)

TABLE 7.1-4 Sheet 2 of 5

PART III

ACTIVITY RELEASED TO THE ENVIRONMENT FOLLOWING A RUPTURE OF A WASTE GAS DECAY TANK

Isotope	Activity Released (Ci)
Kr-85m	6.9(-2)
Kr-85	5.8(+1)
Kr-87	9.8(-3)
Kr-88	7.7(-2)
Xe-133	2.6(+2)
Xe-135	3.6(-1)
Xe-138	8.5(-4)
I-131	7.6(-4)
I-132	2.2(-6)
I-133	9.5(-5)
I-134	3.8(-7)
I-135	1.4(-5)

PART IV

ACTIVITY RELEASED TO THE ENVIRONMENT FOLLOWING A RUPTURE OF A LIQUID RADWASTE HOLDUP TANK

Isotope	Activity Released (Ci)
Kr-85m	2.1
Kr-85	7.7(+1)
Kr-87	3.4(-1)
Kr-88	2.4
Xe-133	2.5(+3)
Xe-135	6.4
Xe-138	2.2(-2)
I-131	2.2(-3)
I-132	9.8(-6)
I-133	4.3(-4)
I-134	1.7(-6)
I-135	6.1(-5)

TABLE 7.1-4

PART V

ACTIVITY RELEASED TO THE ENVIRONMENT FOLLOWING AN OFF-DESIGN TRANSIENT THAT INDUCES FUEL FAILURE ABOVE THAT EXPECTED ACCIDENT

Isotope	Activity Released (Ci)
Kr-85m	4.4(-1)
Kr-85	2.9(-2)
Kr-87	7.2(-1)
Kr-88	1.2
Xe-131m	4.1(-2)
Xe-133	4.7
Xe-135	2.2
Xe-138	1.3
I-131	6.6(-4)
I-132	6.2(-4)
I-133	1.2(-3)
I-134	1.1(-3)
I-135	9.8(-4)

PART VI

ACTIVITY RELEASED TO THE ENVIRONMENT FOLLOWING A STEAM GENERATOR TUBE RUPTURE ACCIDENT

Isotope	Activity Released (Ci)
Kr-85m	1.6(+1)
Kr-85	3.3(+1)
Kr-87	1.3(+1)
Kr-88	4.0(+1)
Xe-131m	6.5(+1)
Xe-133	4.3(+3)
Xe-135	1.0(+2)
Xe-138	7.5
I-131	1.4(-4)
I-132	2.5(-5)
I-133	1.7(-4)
I-134	1.6(-5)
I-135	8.2(-5)

TABLE 7.1-4 Sheet 4 of 5

PART VII

ACTIVITY RELEASED TO THE ENVIRONMENT FOLLOWING A FUEL ASSEMBLY DROP ACCIDENT IN REFUELING POOL

Isotope	Activity Released (Ci)
Kr-85	2.4
Xe-131m	8.3(-1)
Xe-133	2.0(+2)
I-131	4.7(-3)
I-133	7.7(-5)

PART VIII

ACTIVITY RELEASED TO THE ENVIRONMENT FOLLOWING A HEAVY OBJECT DROP ACCIDENT

Isotope	Activity Released (Ci)
Kr-85	3.4(+1)
Xe-131m	1.4(+1)
Xe-133	4.1(+3)
Xe-135	3.6
I-131	8.5(-2)
I-133	1.0(-2)

PART IX

ACTIVITY RELEASED TO THE ENVIRONMENT FOLLOWING A FUEL ASSEMBLY DROP ACCIDENT IN SPENT FUEL POOL

Isotope	Activity Released (Ci)
Kr-85	2.4
Xe-131m	8.3(-1)
Xe-133	2.0(+2)
I-131	2.3(-3)
I-133	3.9(-5)

TABLE 7.1-4

PART X

ACTIVITY RELEASED TO THE ENVIRONMENT FOLLOWING A HEAVY OBJECT DROP ACCIDENT

Isotope	Activity Released (Ci)
Kr-85	3.4(+1)
Xe-131m	3.0
Xe-133	1.3(+2)
I-131	4.6(-3)
I-133	6.7(-12)

PART XI

ACTIVITY RELEASED INTO THE FUEL HANDLING BUILDING FROM A FUEL CASK DROP ACCIDENT

Isotope	Activity Released (Ci)
Kr-85	2.0(+2)
Xe-131m	9.2(-2)
Xe-133	6.0(-3)

TABLE 7.1-5

ACTIVITY RELEASED TO THE ATMOSPHERE FROM A LOSS OF COOLANT ACCIDENT - SMALL PIPE BREAK

Duration of Release

Isotope	0-4 hr	8-24 hr	1-4 day	4-30 day
Kr-85m	*	*	*	*
Kr-85	*	*	1.6	1.4(+1)
Kr-87	*	*	*	*
Kr-88	*	*	*	*
Xe-131m	*	1.4	2.8	1.1(+1)
Xe-133	4.7(+1)+	8.7(+1)	1.5(+2)	3.0(+2)
Xe-135	*	*	*	*
Xe-138	*	*	*	*
I-131	4.6(-4)	6.2(-4)	1.2(-3)	3.5(-3)
I-132	*	1.0(-4)	1.6(-4)	1.8(-4)
I-133	5.2(-4)	4.8(-4)	3.1(-4)	*
I-134	*	*	*	*
I-135	2.1(-4)	*	*	*

+ ( ) Denotes power of 10.

* Indicates release is less than 1.0 Ci for noble gas and 10^{-4} for iodine

TABLE 7.1-6

ACTIVITY RELEASED TO THE ATMOSPHERE FROM A LOSS OF COOLANT ACCIDENT - LARGE PIPE BREAK

	Duration of Release			
Isotope	0-8 hr	8-24 hr	1-4 day	4-30 day
Kr-85m	5.6(+2)+	2.0(+2)	8.5	*
Kr-85	2.5(+1)	5.0(+1)	1.1(+2)	9.4(+2)
Kr-87	4.4(+2)	6.3	*	*
Kr-88	1.2(+3)	1.8(+2)	1.7	*
Xe-131m	1.4(+1)	2.6(+1)	5.3(+1)	2.1(+2)
Xe-133	5.0(+3)	9.3(+3)	1.6(+4)	3.2(+4)
Xe-135	3.6(+3)	3.0(+3)	6.3(+2)	2.6
Xe-138	1.9(+2)	*	*	*
I-131	1.5	2.1	4.0	1.2(+1)
I-132	2.2	2.8	4.3	4.7
I-133	3.3	3.0	2.0	2.0(-1)
I-134	1.8	8.3(-4)	*	*
I-135	2.6	1.0	1.2(-1)	*

+ ( ) Denotes power of 10.

* Indicates release is less than 1.0 Ci for noble gas and 10^{-4} for iodine.

TABLE 7.1-7

ACTIVITY RELEASED TO THE ATMOSPHERE FROM A CONTROL EJECTION ACCIDENT

	Duration of Release			
Isotope	0-8 hr	8-24 hr	1-4 day	4-30 day
Kr-85m	5.6 (+1)	2.0 (+1)	*	*
Kr-85	2.8	5.7	1.3 (+1)	1.1 (+2)
Kr-87	4.4 (+1)	*	*	*
Kr-88	1.2 (+2)	1.8 (+1)	*	*
Xe-131m	2.0	3.8	7.7	3.1 (+1)
Xe-133	5.4 (+2)	1.0 (+3)	1.8 (+3)	3.5 (+3)
Xe-135	3.6 (+2)	3.0 (+2)	6.3 (+1)	*
Xe-138	1.9 (+1)	*	*	*
I-131	1.5 (-1)	2.1 (-1)	4.0 (-1)	1.2
I-132	2.2 (-1)	2.8 (-1)	4.3 (-1)	4.7 (-1)
I-133	3.3 (-1)	3.0 (-1)	2.0 (-1)	2.0 (-2)
I-134	1.7 (-1)	*	*	*
I-135	2.6 (-1)	1.0 (-1)	1.2 (-2)	*

+ ( ) Denotes power of 10

* Indicates release is less than 1.0 Ci for noble gas and 10^{-4} for iodine.

TABLE 7.1-8

PART I

ACTIVITY RELEASED TO THE ATMOSPHERE AS A RESULT OF A SMALL STEAMLINE BREAK ACCIDENT

Isotope	Accident Released (Ci)
Xe-133	1.5
I-131	2.7 (-3)*
I-133	3.2 (-3)
I-135	1.5 (-3)

PART II

ACTIVITY RELEASED TO THE ATMOSPHERE AS A RESULT OF A LARGE STEAMLINE BREAK ACCIDENT

Isotope	Activity Released (Ci)
Xe-133	1.5
I-131	1.1 (-2)
I-133	1.3 (-2)
I-135	6.1 (-3)

* Denotes power of ten

TABLE 7.1-9

50 PERCENTILE X/Q VALUES AT THE ST LUCIE UNIT 2 EXCLUSION BOUNDARY

INTERMITTENT AVERAGING PERIODS
DATA PERIOD: 9/1/76 to 8/31/78

DATA SOURCE: ON-SITE DATA
SENSOR HEIGHT: 10 METERS

AFFECTED SECTOR	DISTANCE (KM)	RELATIVE CONCENTRATIONS (SEC/CUBIC METER) AVERAGING PERIOD (HOURS) 8	16	72	624
NNE	1.56	8.1E-06	2.1E-06	1.1E-06	1.0E-06
NE	1.56	9.9E-06	2.6E-06	1.3E-06	1.0E-06
ENE	1.56	1.1E-05	2.5E-06	1.1E-06	9.7E-07
E	1.56	1.1E-05	2.5E-06	1.1E-06	8.9E-07
ESE	1.56	1.2E-05	2.7E-06	1.2E-06	9.9E-07
SE	1.56	1.1E-05	2.8E-06	1.4E-06	8.5E-07
SSE	1.56	9.9E-06	2.5E-06	1.1E-06	6.8E-07
S	1.56	6.7E-06	1.7E-06	8.0E-07	6.2E-07
SSW	1.56	6.1E-06	1.4E-06	5.6E-07	5.2E-07
SW	1.56	4.8E-06	1.2E-06	5.7E-07	5.1E-07
WSW	1.56	5.6E-06	1.6E-06	7.7E-07	6.4E-07
W	1.56	5.3E-06	1.4E-06	6.8E-07	6.0E-07
WNW	1.56	8.3E-06	2.2E-06	1.2E-06	1.1E-06
NW	1.56	9.5E-06	2.3E-06	1.4E-06	1.3E-06
NNW	1.56	8.6E-06	2.3E-06	1.3E-06	1-1E-06
N	1.56	7.1E-06	1.0E-06	8.6E-07	7.6E-07
ALL	1.56	8.3E-06	2.1E-06	1.0E-06	8.1E-07

TABLE 7.1-10

50 PERCENTILE X/Q VALUES ST LUCIE UNIT 2

PERIOD OF RECORD: 9/1/76 to 8/31/78
17101 HOURS OF DATA. AVERAGE INTERVAL - 8 HOURS

AFFECTED	Distance from Site (Miles)									
SECTOR	.5	1.5	2.5	3.5	4.5	7.5	15	25	35	45
NNE	1.8E-05	4.1E-06	2.1E-06	1.3E-06	9.2E-07	4.9E-07	1.9E-07	[illegible].0E-07	6.8E-08	5.0E-08
NE	2.2E-05	5.0E-06	2.7E-06	1.6E-06	1.2E-06	6.2E-07	2.5E-07	1.4E-08	9.0E-08	6.6E-08
ENE	2.3E-05	5.5E-06	2.9E-06	1.8E-06	1.3E-06	6.7E-06	2.8E-07	1.5E-07	1.0E-07	7.4E-08
E	2.3E-05	5.5E-06	2.9E-06	1.8E-06	1.3E-06	6.5E-07	2.8E-07	1.5E-07	9.8E-08	7.2E-08
ESE	2.4E-05	6.0E-06	3.1E-06	1.9E-06	1.3E-06	7.0E-07	3.0E-07	1.6E-07	1.0E-07	7.9E-08
SE	2.4E-05	5.7E-06	3.1E-06	1.8E-06	1.3E-06	6.8E-07	3.8E-07	1.5E-07	1.0E-07	7.6E-08
SSE	2.1E-05	5.1E-06	2.6E-06	1.6E-06	1.1E-06	6.1E-07	2.5E-07	1.4E-07	8.9E-08	6.5E-08
S	1.5E-05	3.3E-06	1.7E-06	1.1E-06	7.5E-07	3.9E-07	1.6E-07	8.9E-08	6.0E-08	4.4E-08
SSW	1.3E-05	3.0E-06	1.4E-06	9.8E-07	6.8E-07	3.6E-07	1.4E-07	8.2E-08	4.9E-08	3.8E-08
SW	1.2E-05	2.4E-06	1.2E-06	7.5E-07	5.0E-07	2.7E-07	1.0E-07	5.8E-08	3.8E-08	2.8E-08
WSW	1.3E-05	2.8E-06	1.4E-06	8.9E-07	6.0E-07	3.3E-07	1.3E-07	7.2E-08	4.6E-08	3.3E-08
W	1.2E-05	2.7E-06	1.4E-06	8.4E-07	5.8E-07	3.1E-07	1.2E-07	7.1E-08	4.4E-08	3.2E-08
WNW	1.9E-05	4.1E-06	2.1E-06	1.8E-06	9.4E-07	5.1E-07	2.0E-07	1.1E-07	6.9E-08	5.1E-08
NW	2.1E-05	4.9E-06	2.6E-06	1.5E-06	1.1E-06	5.8E-07	2.3E-07	1.2E-07	8.4E-08	6.3E-08
NNW	1.9E-05	4.4E-06	2.3E-06	1.4E-06	9.8E-07	5.4E-07	2.1E-07	1.1E-07	7.6E-08	5.7E-08
N	1.6E-05	3.7E-06	1.9E.06	1.1E-06	8.2E-07	4.5E-07	1.8E-07	9.5E-08	6.3E-08	4.7E-08

TABLE 7.1-11

50 PERCENTILE X/Q VALUES ST LUCIE UNIT 2

PERIOD OF RECORD: 9/1/76 to 8/31/78
17101 HOURS OF DATA. AVERAGE INTERVAL - 16 HOURS

AFFECTED SECTOR	Distance from Site (Miles) .5	1.5	2.5	3.5	4.5	7.5	15	25	35	45
NNE	6.5E-06	9.9E-07	4.9E-07	2.8E-07	1.9E-07	9.3E-08	3.3E-08	1.7E-08	1.0E-08	7.4E-09
NE	8.0E-06	1.2E-06	6.1E-07	3.5E-07	2.3E-07	1.1E-07	4.2E-08	2.1E-08	1.3E-08	9.3E-09
ENE	7.8E-06	1.1E-06	5.8E-07	3.4E-07	2.3E-07	1.1E-07	4.1E-08	2.2E-08	1.3E-08	9.5E-09
E	7.8E-06	1.1E-06	5.7E-07	3.4E-07	2.3E-07	1.1E-07	4.1E-08	2.2E-08	1.3E-08	9.4E-09
ESE	8.5E-06	1.2E-06	6.3E-07	3.7E-07	2.4E-07	1.2E-07	4.5E-08	2.4E-08	1.4E-08	1.0E-08
SE	8.9E-06	1.3E-06	6.6E-07	3.8E-07	2.5E-07	1.2E-07	4.6E-08	2.4E-08	1.5E-08	5.1E-08
SSE	7.8E-06	1.1E-06	5.8E-07	3.3E-07	2.3E-07	1.1E-07	4.1E-08	2.1E-08	1.3E-08	9.6E-09
S	5.6E-06	8.3E-07	4.0E-07	2.4E-07	1.6E-07	7.9E-08	2.8E-08	1.5E-08	9.2E-09	6.0E-09
SSW	4.4E-06	6.5E-07	3.2E-07	1.8E-07	1.3E-07	6.3E-08	2.4E-08	1.2E-08	7.5E-09	5.2E-09
SW	4.1E-06	5.8E-07	2.8E-07	1.6E-07	1.1E-07	5.4E-08	1.9E-08	1.0E-08	6.2E-09	4.3E-09
WSW	5.2E-06	7.4E-07	3.6E-07	2.1E-07	1.4E-07	7.0E-08	2.4E-08	1.2E-08	7.7E-09	5.4E-09
W	4.6E-06	6.7E-07	3.4E-07	1.9E-07	1.3E-07	6.3E-08	2.2E-08	1.1E-08	7.1E-09	4.4E-10
WNW	7.1E-06	1.0E-06	5.2E-07	3.0E-07	2.0E-07	1.0E-07	3.5E-08	1.8E-08	1.1E-08	7.9E-09
NW	7.7E-06	1.1E-06	5.6E-07	3.2E-07	2.2E-07	1.1E-07	3.9E-08	2.0E-08	1.2E-08	6.8E-09
NNW	7.2E-06	1.1E-06	5.3E-07	3.1E-07	2.1E-07	1.0E-07	3.7E-08	1.9E-08	1.2E-08	8.5E-09
N	5.3E-06	8.1E-07	4.1E-07	2.3E-07	1.6E-07	7.8E-08	2.8E-08	1.4E-08	8.9E-09	5.3E-10

TABLE 7.1-12

50 PERCENTILE X/Q VALUES ST LUCIE UNIT 2

PERIOD OF RECORD: 9/1/76 to 8/31/78
17101 HOURS OF DATA. AVERAGE INTERVAL - 72 HOURS

AFFECTED SECTOR	Distance from Site (Miles) .5	1.5	2.5	3.5	4.5	7.5	15	25	35	45
NNE	3.4E-06	5.2E-07	2.6E-07	1.4E-07	9.8E-08	4.8E-08	1.8E-08	9.1E-09	5.9E-09	4.3E-09
NE	4.0E-06	6.4E-07	3.1E-07	1.7E-07	1.2E-07	6.0E-08	2.2E-08	1.1E-08	7.0E-09	4.9E-09
ENE	3.5E-06	5.5E-07	2.8E-07	1.5E-07	1.1E-07	5.4E-08	2.0E-08	1.0E-08	6.3E-09	4.4E-09
E	3.2E-06	5.1E-07	2.6E-07	1.4E-07	9.6E-08	5.0E-08	1.8E-08	9.3E-09	6.0E-09	4.3E-09
ESE	3.9E-06	5.9E-07	2.9E-07	1.6E-07	1.1E-07	5.7E-08	2.1E-08	1.1E-08	6.8E-09	4.8E-09
SE	4.4E-06	6.5E-07	3.2E-07	1.8E-07	1.2E-07	6.2E-08	2.2E-08	1.2E-08	7.2E-09	5.1E-09
SSE	3.3E-06	5.2E-07	2.6E-07	1.4E-07	9.9E-08	5.1E-08	1.9E-08	9.8E-09	6.1E-09	4.3E-09
S	2.5E-06	3.6E-07	1.8E-07	1.1E-07	7.0E-08	3.5E-08	1.3E-08	6.7E-09	4.4E-09	3.2E-09
SSW	1.8E-06	2.6E-07	1.3E-07	7.3E-08	5.2E-08	2.5E-08	8.5E-09	3.9E-09	2.3E-09	1.6E-09
SW	1.7E-06	2.7E-07	1.4E-07	7.5E-08	5.1E-08	2.6E-08	9.3E-09	5.0E-09	3.3E-09	2.5E-09
WSW	2.4E-06	3.5E-07	1.7E-07	1.0E-07	6.8E-08	3.3E-08	1.2E-08	6.4E-09	4.2E-09	3.1E-09
W	2.0E-06	3.1E-07	1.5E-07	8.7E-08	5.9E-08	2.9E-08	1.1E-08	5.4E-09	3.5E-09	2.5E-09
WNW	3.5E-06	5.5E-07	2.8E-07	1.5E-07	1.0E-07	5.3E-08	1.9E-08	9.6E-09	6.1E-09	4.3E-09
NW	4.3E-06	6.5E-07	3.2E-07	1.7E-07	1.2E-07	6.2E-08	2.2E-08	1.2E-08	7.4E-09	5.3E-09
NNW	3.9E-06	6.0E-07	3.0E-07	1.6E-07	1.1E-07	5.7E-08	2.1E-08	1.1E-08	6.7E-09	4.7E-09
N	2.7E-06	4.0E-07	2.0E-07	1.1E-07	7.6E-08	3.8E-08	1.4E-08	6.9E-09	4.4E-09	3.2E-09

TABLE 7.1-13

50 PERCENTILE X/Q VALUES ST LUCIE UNIT 2

PERIOD OF RECORD: 9/1/76 to 8/31/78
17101 HOURS OF DATA. AVERAGE INTERVAL - 624 HOURS

AFFECTED SECTOR	Distance from Site (Miles) .5	1.5	2.5	3.5	4.5	7.5	15	25	35	45
NNE	2.7E-06	4.6E-07	2.2E-07	1.3E-07	8.9E-08	4.2E-08	1.6E-08	8.3E-09	5.5E-09	4.0E-09
NE	3.2E-06	5.0E-07	2.4E-07	1.4E-07	9.7E-08	4.6E-08	1.7E-08	8.9E-09	5.9E-09	4.3E-09
ENE	2.2E-06	4.7E-07	2.2E-07	1.3E-07	8.8E-08	4.4E-08	1.6E-08	8.5E-09	5.5E-09	4.0E-09
E	2.3E-06	4.2E-07	2.0E-07	1.2E-07	8.3E-08	3.9E-08	1.5E-08	7.9E-09	5.3E-09	3.9E-09
ESE	3.4E-06	5.0E-07	2.4E-07	1.3E-07	9.3E-08	4.7E-08	1.7E-08	8.9E-09	5.7E-09	4.1E-09
SE	2.2E-06	5.0E-07	2.3E-07	1.1E-07	7.6E-08	4.3E-08	1.5E-08	7.0E-09	4.1E-09	2.9E-09
SSE	2.1E-06	3.6E-07	1.7E-07	9.2E-08	6.3E-08	3.0E-08	1.1E-08	5.8E-09	3.9E-09	2.8E-09
S	1.8E-06	2.9E-07	1.4E-07	8.0E-08	5.6E-08	2.7E-08	9.9E-09	5.1E-09	3.3E-09	2.4E-09
SSW	1.6E-06	2.5E-07	1.1E-07	6.6E-08	4.7E-08	2.3E-08	7.7E-08	3.4E-09	4.3E-10	9.3E-11
SW	1.5E-06	2.5E-07	1.1E-07	6.5E-08	4.5E-08	2.2E-08	7.9E-08	3.7E-09	5.0E-10	1.1E-10
WSW	2.0E-06	3.0E-07	1.3E-07	8.0E-08	5.6E-08	2.7E-08	9.6E-09	5.3E-09	3.6E-09	2.7E-10
W	1.8E-06	2.9E-07	1.2E-07	7.5E-08	5.3E-08	2.7E-08	9.2E-09	5.3E-09	3.6E-09	2.7E-09
WNW	2.6E-06	6.0E-07	2.7E-07	1.4E-07	9.8E-08	5.3E-08	1.9E-08	1.0E-08	6.4E-09	4.5E-09
NW	5.0E-06	6.7E-07	3.1E-07	1.7E-07	1.2E-07	6.2E-08	2.2E-08	1.1E-08	7.2E-09	5.3E-09
NNW	3.5E-06	6.0E-07	2.7E-07	1.4E-07	9.9E-08	5.5E-08	2.0E-08	1.0E-08	3.4E-09	8.4E-09
N	2.4E-06	3.8E-07	1.8E-07	1.0E-07	6.9E-08	3.5E-08	1.2E-08	6.3E-09	4.0E-09	2.9E-09

7.2 OTHER ACCIDENTS

St Lucie Unit 2, like any other large industrial plant, could experience industrial accidents during its lifetime. Typical accidents that might occur include small electrical fires and chemical spills. The procedures and equipment will limit accidents of this type, so that their environmental consequences will be trivial.

The chemicals stored on site are listed in Table 7.2-1. The failure of the tanks containing pressurized gases will not result in adverse environmental effects. Most of these gases are asphyxiants and are stored in relatively small quantities. Liquified or gaseous chlorine will not be used on site; the plant circulating cooling water will be treated by sodium hypochlorite generated on site.

TABLE 7.2-1

CHEMICALS STORED ONSITE

	Quantity	Location
Acetylene	25 bottles	Gas Storage Bldg
Ammonium Hydroxide	110 gal	Turbine Bldg (NW corner, ground level)
CO_2	80 bottles	Gas Storage Bldg.
Cyclohexylamine	110 gal	Turb. Bldg (NE corner)
Hydrazine-Amer Zinc Chemical Feed System	400 gal	Turb. Bldg (NE corner)
Hydrazine-Iodine Removal	550 gal	RAB (El-.5)
H_2	75,000 scf tube trailer plus 80 bottles	Yard Area
N_2-Gas	40,000 scf tube trailer plus 40 bottles	Yard Area
N_2-Liquid	1100 gal	Yard Area
O_2	25 bottles	Gas Storage Bldg
Potassium Dichromate-TCCWS	100 gal	On top of RAB
Potassium Dichromate-CCWS	50 gal	Component Cooling Water Bldg
Sodium Hydroxide	10,000 gal	Yard Area
Sulfuric Acid	10,000 gal	Yard Area

BENEFITS AND COSTS

CHAPTER 8

TABLE OF CONTENTS

BENEFITS AND COSTS

CHAPTER 8

LIST OF TABLES

8.1 BENEFITS

NRC Regulatory Guide 4.2 R2(1976) categorizes benefits as either primary (direct) or secondary (indirect). Primary benefits derived from St Lucie Unit 2 include the expected average annual generation of electricity, and the importance of providing an adequate reserve margin for the FP&L system. Secondary benefits produced by operation of St Lucie Unit 2 include the effect the facility will have upon various local, state and federal revenue systems, its impact upon regional employment and income, the annual savings in the consumption of imported crude oil and increased knowledge of the environment as a result of research and monitoring.

Economic base employment multipliers were incorporated in this analysis to determine the level of non-basic (indirect and income-induced) jobs that would be generated by every new basic (operational) job created by St Lucie Unit 2. The multipliers were derived by identifying both the total employment and the total export activity employment within the region[1]. The total export activity employment for the region was determined by the use of the location quotient sectoring method. The employment multiplier developed for the analysis was 1.72 for operational employment.

The productive life of St Lucie Unit 2 is 40 years. All monetary values from 1975 to 1983 are expressed in current dollars for the specific year. All future monetary values, 1984 to 2023, are discounted to 1983 dollars by a 10.04 percent discount rate[2].

8.1.1 PRIMARY BENEFITS

St Lucie Unit 2 will generate a net of 802 MW(e). Assuming a 72 percent capacity factor, it will generate 5.0584 billion kilowatt hours of electrical energy annually. Table 8.1-1 illustrates the distribution of electrical energy by user class. The revenues produced during the first full year of operation (1984) will be about $234.9 million (discounted 1983 dollars). Chapter 1 provides detailed information on FP&L's system and load demands.

If FP&L's generating capability is not maintained, sporadic interruptions and shortages in the availability of electricity to customers would result. The social and economic consequences of these interruptions and shortages will impact both the resident population and tourist growth in FP&L's service area. It is projected that FP&L's service area resident population will increase from about 4.9 million people in 1979 to about 9.3 million in 2023[3], a 90 percent population increase.

8.1.2 SECONDARY BENEFITS

During operation, St Lucie Unit 2 will generate about $443.4 million (discounted 1983 dollars) in revenue for local, state and federal governments. Table 8.1-1 indicates the various individual revenue components that will be affected by St Lucie Unit 2.

During the productive life of St Lucie Unit 2, the major revenue will be the franchise fee, a fee paid by FP&L to local municipalities within its service area. This will total $174.6 million (discounted 1983 dollars).

Property tax revenue during this period, which will go to St Lucie County, will total $127.3 million (discounted 1983 dollars). Other major revenues during the operational phase will be $72.6 million (discounted 1983 dollars) in state sales tax and $42.9 million (discounted 1983 dollars) in state gross receipts tax.

During St Lucie Unit 2 operation, the total staff requirement will be about 150 operational workers, which will generate an estimated additional 257 non-basic jobs for the region, resulting in a total employment impact of an estimated 407 job opportunities. The operation of St Lucie Unit 2 will generate about $106.8 million (discounted 1983 dollars) in operational and non-basic worker income for the region.

The operation of St Lucie Unit 2 will result in an annual saving of an estimated 8.5 million barrels of crude oil per year. This annual saving translates into a dollar saving of $137 million per year (1978 delivered price).

FP&L is funding several environmental research programs related to the operation of St Lucie Unit 2. These programs include aquatic biology and water quality surveillance, radiological sampling and meteorological monitoring. The radiological sampling and meteorological monitoring will be continued throughout the remainder of the operation of St Lucie Unit 2. These programs will contribute to an increase in knowledge of the environment and the plant's interaction with it.

SECTION 8.1: REFERENCES

1. The employment data are from a special computer run of the U.S. Bureau of the Census, 1972 County of Business Patterns.

2. Based upon FP&L's 1979 capital structure and the rates of return for long term debt, common equity and preferred stock.

3. Based upon Envirosphere Company's population projections of FP&L's service area.

TABLE 8.1-1 Sheet 1 of 2

ESTIMATED BENEFITS OF ST LUCIE UNIT 2

Primary Benefits	
Expected Average Annual Generation @ 72% Capacity	5.0584×10^9 kWh
Capacity in kW	802,000 kW
Proportional Distribution of Energy[a]	
- Residential	2.2849×10^9 kWh
- Commercial	1.6986×10^9
- Industrial	0.3257×10^9
- Sales to Other Utilities	0.2583×10^9
- Sales to Public Authorities	0.0861×10^9
Annual Revenues from Delivered Benefits	
- Electrical Energy (Given for First Full Year of Operation - 1984)	$234,865,287[b]
Secondary Benefits	
Revenues (Taxes and Fees)	Operational[b] (Given for entire plant life)
- Property Tax - Local	$ 127,262,940
- Sales Tax - State	72,575,025
- Utility Tax - State	4,269,233
- Franchise Fee - Local	174,551,395
- Gross Receipts Tax - State	42,911,758
- Workmen's + Unemployment Compensation Tax - State (St Lucie 2 only)	$ 293,783
- Individual Federal Tax (Basic + Non-Basic)	21,569,176
TOTAL	443,433,310
Employment	
- Operational (Basic and Non-Basic)	407 jobs

TABLE 8.1-1 Sheet 2 of 2

ESTIMATED BENEFITS OF ST LUCIE UNIT 2

Secondary Benefits (Cont'd)	
Income (Given for entire plant life)	
- Operational (Basic and Non-Basic)	\$ 106,769,659[b]

(a) System energy loss is 8%.
(b) Discounted to 1983 dollars.

Sources: Florida Power and Light Company and Envirosphere Company.

8.2 COSTS

Internal costs are those which are directly and indirectly associated with the construction and operation of St Lucie Unit 2, while external costs refer to potential adverse effects on the natural and social environment.

8.2.1 INTERNAL COSTS

The total estimated costs to FP&L for the construction of St Lucie Unit 2 are $925 million (1983 dollars). The construction costs are itemized in Table 8.2-1.

The estimated costs of electrical generation by specific components for St Lucie Unit 2 during its initial year of operation are shown in Table 8.2-2 and are expressed in 1983 dollars. During the initial year of operation, the total cost of electrical generation will be about $239.7 million or 49.28 mills per kilowatt hour (mills/kWh). More specifically, the fixed charges for St Lucie Unit 2, during its initial year will be about $178.4 million (35.27 mills/kWh). The nuclear fuel cycle costs for St Lucie Unit 2 during the initial year will be $42 million (10.00 mills/kWh), in comparison to a comparable oil fired facility which will have fuel costs of 34.76 mills/kWh. The operation and maintenance costs for St Lucie during its initial year of operation will be about $19.3 million (4.01 mills/kWh).

Estimates of decommissioning costs are presented in Section 5.8.

8.2.2 EXTERNAL COSTS

External costs are the short and long term costs associated with the operation of St Lucie Unit 2 to the natural and social environment. These effects are discussed in detail in Chapter 5.

There will be no major long term adverse impact on the region's communities resulting from the influx of the 150 operational personnel and their induced population (343 people)[1]. It is assumed that most of the operational workers and their induced population will reside in Fort Pierce, Stuart and Palm Beach in settlement patterns similar to those of the construction worker population[2]. Based upon these settlement patterns, the communities of Fort Pierce, Stuart and Palm Beach will have enough excess capacities within most of their public services functions to adsorb the immigrant public service demands at little additional public service cost.

Most other long term external impacts associated with the operation of St Lucie Unit 2 are difficult to quantify in terms of dollars. These impacts have been analyzed and are described in Section 2.6 and Chapter 5.

SECTION 8.2: REFERENCES

1. Based upon an Envirosphere Company estimation of the operational workers' induced population.

2. Immigrant construction worker settlement patterns are as follows: 32.3 percent of all immigrant construction workers will reside in Ft. Pierce; 30.9 percent will reside in Stuart and 23.6 percent will reside in Palm Beach. Proportions based upon the Envirosphere Company Construction Worker Model.

TABLE 8.2-1

COST INFORMATION FOR ST LUCIE UNIT 2

1.	Interest During Construction	7.025%
2.	Length of Construction Workweek	40 hours/week
3.	Estimated Site Labor Requirement[a]	19.50 man-hours/kW(e)
4.	Average Site Labor Pay Rate (including fringe benefits) Effective at Month and Year of NSSS Order (1972)	$ 9.25/hour
5.	Escalation Rates	
	Site Labor	8.00%/year
	Material	10.90%/year
	Composite Escalation Rate	9.16%/year

6. St Lucie Unit 2 Costs[b]

Direct Costs ($1000's)

a.	Land and land Rights	$ 1,300
b.	Structures and Site Facilities	$ 219,427
c.	Reactor (boiler) Plant Equipment	$ 84,500
d.	Turbine Plant Equipment, not Including Heat Rejection Systems	$ 61,800
e.	Heat Rejection System	$ 43,148
f.	Electric Plant Equipment	$ 80,000
g.	Miscellaneous Equipment	$ 1,631

Indirect Costs ($1000's)

a.	Construction Facilities Equipment	$ 31,582
b.	Engineering and Construction Management Services	$ 110,500
c.	Other Costs	$ 0
d.	Interest During Construction (@ 7.025%/year)	$ 203,000

Escalation

Escalation During Construction	$ 59,443

TABLE 8.2-1

Direct Costs ($1000's)		Indirect Costs ($1000's)	
h. Spare Parts Allowance	$ 0		
i. Contingency Allowance	$ 28,649		
Subtotal	$ 520,475		
		Total Cost St Lucie 2 @ Started Commercial Operation (1983$)	$ 925,000

(a) The "Estimated Site Labor Requirement" is based upon the construction of a facility which will generate 802 MW(e).

(b) All direct and indirect costs are expressed in 1983 dollars, first year of commercial operation.

Source: Florida Power and Light Company and Envirosphere Company.

TABLE 8.2-2

ESTIMATED COST OF ELECTRICAL ENERGY GENERATION[a,b]

Fixed Charges[c]	Mills/Kilowatt-Hour
Cost of Capital	18.36
Depreciation	0.37
Interim Replacements	1.15
Property Insurance	0.18
Income Taxes	4.92
State & Local Taxes	10.29
Subtotal	35.27
Fuel Cycle Costs[d]	
Fossil Fueled Plant (oil)	34.76
St Lucie Unit 2 (Nuclear)	
Cost of U_3O_8 (Yellowcake)	3.70
Cost of Conversion and Enrichment	3.20
Cost of Conversion and Fabrication of Fuel Elements	0.90
Carrying Charge on Fuel Inventory	0.80
Cost of Waste Disposal	1.40
Subtotal	10.00
Operation and Maintenance Costs	
Staff Costs	1.01
Operational Costs	1.34
Maintenance Costs	1.14
Insurance and Fee Costs	0.04
Administration and General Costs	0.48
Subtotal	4.01
TOTAL	49.28

(a) The cost of electrical generation is for the first (initial) year of operation and is expressed in 1983 dollars.

(b) The operational characteristics of St Lucie are 802 MW(e) net at a 72% capacity factor.

(c) The fixed charge rate for St Lucie Unit 2 is a levelized rate of 19.29%.

(d) No recycle costs have been computed for the St Lucie Unit 2 fuel cycle.

Source: Florida Power and Light Company and Envirosphere Company.

ALTERNATIVE ENERGY SOURCES AND SITES

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9.0 ALTERNATIVE ENERGY SOURCES AND SITES

Alternate energy sources and sites have been presented in the Environmental Report - Construction Permit for St Lucie Unit 2. A discussion of these matters appears in Chapter 9 of the US Atomic Energy Commission's Final Environmental Statement Related to Construction of St Lucie Plant Unit 2.

In 1976, the USNRC Regulatory Staff performed a subsequent alternate site analysis, which confirmed the Hutchinson Island site for St Lucie Unit 2. Alternate site hearings were held before the Atomic Safety and Licensing Board (ASLB) in December 1976. In its initial decision (April 19, 1977), the ASLB found that the St Lucie site was acceptable for St Lucie Unit 2. This decision was upheld by the ASLB Appeals Board on October 7, 1977 (ALAB-435).

DESIGN ALTERNATIVES

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10.0 STATION DESIGN ALTERNATIVES

Station design alternatives considered for St Lucie Unit 2 have been identified and described in the Environmental Report - Construction Permit. A discussion of alternate station designs is presented in Chapter 9 of the Final Environmental Statement Related to Construction of St Lucie Plant Unit 2, prepared by the US Atomic Energy Commission.

SUMMARY COST-BENEFIT ANALYSIS

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11.0 SUMMARY COST-BENEFIT ANALYSIS

The cost-benefit analyses utilized to demonstrate the benefit of St Lucie Unit 2 are presented in the St Lucie Unit 2 Environmental Report - Construction Permit. This section is not applicable at the Operating License stage.

APPROVALS AND CONSULTATIONS

CHAPTER 12

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APPROVALS AND CONSULTATIONS

CHAPTER 12

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12.0 STATUS OF LICENSES, PERMITS AND APPROVALS

Table 12.0-1 summarizes the licenses, permits and other approvals required by Federal, state and local agencies to ensure protection of the environment during the construction and operation of St Lucie Plant Unit 2. The status of each application is also indicated in that table.

Various state of Florida and St Lucie County permits certifications, required for construction, and granted prior to the submission of the St Lucie Unit 2 Environmental Report - Construction Permit Stage are listed in Table 12.0-1 of that document.

TABLE 12.0-1

LICENSES, PERMITS AND OTHER APPROVALS REQUIRED FOR ST LUCIE UNIT 2

Agency	Authority Required	Impact	Statue or Authority	Status
U S Nuclear Regulatory Commission	Limited work authorization	Air, Land, Water	68 Stat. 919; 10CFR50	LWA received - 3/75
	Construction permit	Air, Land, Water	68 Stat. 919; 10CFR50	Permit received - 5/77
	Operating License	Air, Land, Water	68 Stat. 919; 10CFR50	Application to be submitted - 3/80
	Special Nuclear Mat'l License	Air, Land, Water	68 Stat. 919; 10CFR70	Application to be submitted - 9/81
	Source Nuclear Mat'l License	Air, Land, Water	68 Stat. 919; 10CFR40	Application to be submitted - 9/81
	By-product Nuclear Mat'l License	Air, Land, Water	68 Stat. 919; 10CFR30	Application to be submitted - 9/81
U S Environmental Protection Agency	National Pollutant Discharge Elimination System Permit	Water	P L 92-500 Section 402	Application to be submitted - 3/80
	Approval of State Certification of Compliance with Effluent Limitations	Water	P L 92-500 Section 401	Permit obtained - 5/76
U S Army Corps of Engineers	Permit for Dredge - Fill for Discharge Pipeline	Water	River and Harbors Act Secton 10 33CFR209	Application submitted - 7/79
U S Coast Guard	Permit to Establish Private Aid to Navigation	Water	80 Stat. 932; 14CFR77	Permit to be requested - 1/80
Advisory Council on Historic Preservation	Determination that Site does not Infringe on Federal Landmarks	Land	Historic Preservation Act of 1966	See Section 2.6 of this Document
	Determination that Site is not Archeologically Significant	Land	Archeological Conservation Act of 1974	See Section 2.6 of this Document
National Marine Fisheries Service/ Fish & Wildlife Service	Collection of Threatened and Endangered Species of Sea Turtles	Water	Endangered Species Act of 1973	Permit obtained - 6/79
Florida Dept of Natural Resources	Beaches and Shores	Land	Chapter 161 Florida Statutes	Not required

TABLE 12.0-1

Agency	Authority Required	Impact	Statute or Authority	Status
	Biological Survey	Water	Chapter 253 Florida Statutes	Not required
Florida State Planning Board	Certification of Site Suitability	Water, Land, Air	Power Plant Siting Act of 1972; Sections 403.501 et.seq.	Certification obtained 5/76, modified - 4/80
State of Florida Trustees of the Internal Improvement Fund	Construction of Discharge Line	Water	Chapter 253 Florida Statues	Permit applied for 8/79
Florida Dept of Environmental Regulation	Variance from State Water Quality Standards	Water	Ch 17-3, Florida Administrative Code	Not required, permitted under Power Plant Siting Act
	State Certification that Discharge Complies with Sections 301, 302, 306, and 307 of P L 92-500	Water	P L 92-500 Sect. 401	Certification obtained 5/76
	Certification to Construct and Operate Pollution Service	Land, Water	Power Plant Siting Act of 1972	Certification obtained 5/76
Federal Aviation Agency	Air Navigation Approval	Air	80 Stat. 932; 14CFR77	Permit requested 12/79