Florida Power
CORPORATION

bcc: David Voigts
Mike Kennedy

File: Crystal River Salt Drift Study

May 24, 1995

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Mr. Hamilton S. Oven, Jr.
Florida Department of Environmental Protection
Douglas Building, Room 953AA
2900 Commonwealth Blvd., MS 48
Tallahassee, FL 32399-3000

Dear Mr. Oven:

Re: Crystal River Salt Drift Study
Permit Number PSD-FL-007

Enclosed is the Annual Report of the Crystal River Salt Drift Study 1993-1994 study year, the 13th year of the study. As noted in the conclusions, the vegetation generally continued to be in good condition. Accordingly, Florida Power again formally requests that DEP approve the discontinuation of the Crystal River salt drift study.

Florida Power Corporation (FPC) has been conducting this salt drift deposition study since 1981 to assess the effects of the two natural draft cooling towers which serve Units 4 and 5 at FPC's Crystal River plant. In addition, the study has, for the past two years, been used to determine whether any vegetation damage is occurring due to salt deposition from the new mechanical helper cooling towers for Units 1, 2, and 3.

The study, originally a part of the NPDES permit and the Site Certification for Units 4 and 5, was incorporated into the PSD permit referenced above on November 30, 1988. Condition 5.c. contains language regarding changes to the monitoring program, which includes the following:

> *Should the data indicate that no significant impacts are occurring to the surrounding area, the permittee, after consultation with and approval by the Director of the EPA Region IV Air, Pesticides, and Toxics Management Division and FDER, may reduce or eliminate the monitoring program.*

In past correspondence and at a November 2, 1994, meeting in Crystal River, FPC has presented its rationale for stopping the study. However, since FPC has not been allowed to end the study, and in response to questions that have been asked, FPC offers the following information that gives additional reasons and documentation to support the request to end the salt drift study. Discussed are a June 1988 deposition modeling study for the Crystal River cooling towers by KBN Engineering, the results and subsequent ending of a three-year salt drift study for the St. Johns River Power Park, and the questionable scientific validity of such studies.

KBN Study

In 1988, as part of the permitting effort for the helper cooling towers, KBN Engineering performed a detailed deposition modeling analysis to assess the total effects of the two natural draft cooling towers for Units 4 and 5 and the four mechanical draft helper cooling towers for Units 1, 2, and 3. The enclosed Figure 3-2, which is from that KBN report, shows the total predicted salt deposition during the summer months resulting from permitted levels of salt drift from the natural draft and helper cooling towers. The summer season was modeled because the helper cooling towers do not operate from November through April.

The maximum total combined deposition over a naturally vegetated area was predicted to occur near the helper cooling towers, and was approximately 400 g/m^2. The vegetation in this area is mainly comprised of salt marsh, which is very tolerant of atmospheric salt deposition. The predicted deposition levels fall rapidly with distance from the helper cooling towers to a level of approximately 10 g/m^2 at the north property line. Sections 3 and 4 from the KBN report, which discuss the modeling analysis, are also enclosed.

Actual deposition levels are likely much lower than those predicted by the conservative modeling analysis. The drift rate measured from the helper cooling towers was at 8% of the permitted level during the most recent stack test. Indeed the salt deposition at the Open Hammock site, the closest monitoring site to the helper cooling towers, was measured during the 1993-1994 study year to be about 146 kg/ha (14.6 g/m^2, Figure 4-1). In addition, the amount of salt collected at this site during the months that the helper towers were operating was not significantly different than the amount collected during the months when the towers were not operating.

St. Johns River Power Park Study

A salt deposition study was conducted by the Jacksonville Electric Authority and Florida Power and Light to assess the effects of the salt drift from the cooling towers for two 600 MW coal-fired steam electric units at the St. Johns River Power Park (SJRPP). The study period was from February 1986 through September 1989. The study began prior to the operation of the first cooling tower and continued for 18 months after the second tower began operation. ~~As~~ with the Crystal River study, the SJRPP study involved the collection of deposition samples at multiple sites combined with a photographic record of the vegetative effects in the surrounding area.

The SJRPP study found no salt-related injury to the vegetation on or surrounding the plant site. The study was concluded after only 18 months of data were obtained while both cooling towers were in operation.

Scientific Validity

The scientific value of salt deposition studies in coastal areas is questionable. The salt drift from power plant cooling towers is only one variable in a complex system. At the Crystal River plant, natural deposition of salt from the Gulf of Mexico, coastal vegetative dieback from sea level rise, and damage due to disease confound the study results and subsequent data interpretation.

Natural deposition may be quite large from coastal storms. For example, the March 1993 storm deposited such a massive amount of salt on the coastal vegetation that it dwarfs the amount of salt deposited by the operation of the cooling towers. Also, some damage and dieback are occurring along the immediate coastline from the slow sea level rise that is taking place along the west coast of Florida. This coastal dieback is not confined to the Crystal River area, but is occurring along a large portion of the coastline.

Conclusion

FPC, for the following reasons, which have been discussed above, requests that the Crystal River salt drift study be terminated:

- No significant impacts are occurring to the area surrounding the Crystal River plant from the operation of the cooling towers. The study has recorded the effects of the Units 4 and 5 natural draft cooling towers since its inception in 1981. In addition, two full operating seasons of the helper cooling towers have been added to the study results.
- A KBN modeling study showed minimal deposition off FPC plant property from the permitted levels of salt drift. Actual drift is a fraction of the permitted amount.
- The SJRPP study yielded results similar to the Crystal River study, and it was terminated after 18 months of data from both cooling towers.
- The scientific value of the study is limited, and given the 13 year length of the Crystal River study, it has reached its limit in terms of providing additional meaningful data.

Termination of the study would be effective immediately upon approval.

Thank you for your consideration of this request. Please contact David Voigts at (813) 866-5166 or Mike Kennedy at (813) 866-4344 if you have any questions or if you need additional information.

Sincerely,

W. Jeffrey Pardue, C.E.P.
Director

Enclosures

cc: EPA Region IV
Ms. Marilyn Polson, Esq.
Mr. Clair Fancy, DEP - Tallahassee

Department of Environmental Protection

Lawton Chiles
Governor

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Virginia B. Wetherell
Secretary

March 20, 1996

MAR 25 1996
Department

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. W. Jeffrey Pardue, Director
Environmental Services Department H2G
Florida Power Corporation
Post Office Box 14042
St. Petersburg, Florida 33733

Re: Crystal River Salt Drift Study
PA 77-09, PSD-FL-007

Dear Mr. Pardue:

The Department has reviewed the recent status reports and your requests to discontinue the salt drift impact study in the vicinity of the Florida Power Corporation (FPC) Crystal River Power Plant. Based on the information provided to the Department and the site visit conducted by department personnel on January 23, the Department has concluded that damage to nearby vegetation has occurred primarily due to natural phenomena rather than by salt drift from the plant.

The Department considers Specific Condition 5 (Ambient Monitoring) of the PSD permit modification dated November 30, 1988 to have been fulfilled. In accordance with Specific Condition 5.c., the Department approves the elimination of the monitoring program contingent on no objections in the next thirty days from EPA. Please note that the plant is still required to monitor particulate matter from the cooling towers.

We have supplied EPA with a copy of all the correspondence related to this intended action. Please note that the authority to eliminate the program applies only to the PSD permit and not to the Site Certification. The parties to the original certification were advised directly and through the notice published in the Florida Administrative Weekly of FPC's request.

If you have any questions regarding this matter, please call Mr. Cleve Holladay at (904)488-1344 or Trudie Bell at (904)921-9886.

Sincerely,

Howard L. Rhodes

Howard L. Rhodes, Director
Division of Air Resources
Management

HLR/aal/l

cc: Winston Smith, EPA
John Bunyak, NPS
Hamilton Oven, DEP
Trudie Bell, DEP
Bill Thomas, SWD

Attachment 1

KBN Modeling Study Results

3.0 EXISTING AND PREDICTED DEPOSITION LEVELS AT THE CRYSTAL RIVER POWER PLANT

3.1 MONITORING RESULTS

As part of the environmental permits, FPC was required to perform pre- and post- operational monitoring of salt deposition and its effects to nearby vegetation (NPDES Permit No. FL0036366 Part III M, and Florida Conditions of Certification, Case No. PA77-09,I.B.7. Special Conditions). The pre- and post- operational monitoring studies were initiated in 1981 and consisted of a series of activities to assess the condition of local plant communities, and to monitor deposition levels prior to and after cooling tower operation. Currently, six years of deposition and vegetation monitoring has been performed for a series of sites previously predicted to receive maximum salt deposition impact, as well as natural background salt deposition from the Gulf of Mexico.

Deposition monitoring for sodium, chloride and total particulates has been performed on an annual cycle with each study period, starting in September and continuing through the following August. During the first year of monitoring, 1981-1982, Crystal River Units 4 and 5 cooling towers were under construction; data collected during this period serve as the pre-operational or baseline data from which future deposition levels can be compared. Deposition data for this phase of the project were collected from four stations using a bulk collector design (ABI, 1984). For the second and third years of sampling, 1982-1984, only the cooling tower for Unit 4 was operating (ABI, 1985 and ABI, 1986). During the fourth year of monitoring, data were obtained while both the Unit 4 and Unit 5 cooling towers were in operation (FPC, 1986). For the second, third, and fourth years, deposition was collected from six sites. During the first 5 years of the study, the location of sampling stations were in areas of maximum predicted deposition.

Beginning with the fifth year study, the site location design was modified to facilitate complete sample coverage and minimize the potential for missing significant deposition events by establishing a broader, more encompassing directional grid around the towers. The pine, hardwood and control sites were abandoned as salt deposition monitoring sites in favor of establishing the Southwest, Northwest, and Northeast Open Test sites (see Section 2.1.1) in order to sample a broader spectrum of wind vectors.

These six monitoring sites were also kept during the start of the sixth year of study. However, the monitoring network was revaluated and several changes made. The primary changes included the elimination of the Switchyard site due to contamination by fugitive dust and the elimination of total settable particulates (TSP) due to lack of correlation with sodium and chloride concentrations. TSP analysis was eliminated in January 1987 and the Switchyard site was eliminated in June 1987.

In addition to the deposition monitoring, vegetation in the vicinity of the cooling towers was monitored during the same periods. This part of the study consisted of monthly inspections of approximately 50 specifically tagged plants within specified plots in the area of predicted maximum deposition, and 15 specifically tagged plants within a control area plot. These inspections were performed monthly. In addition, quarterly surveys were made by biologists experienced in salt-induced stress. In both surveys, photographs were taken of all plants inspected and a detailed log was made. Periodically, low altitude color infrared aerial photographs were used to assess the general condition of vegetation within a one-mile radius of the plant.

Results of the six years of monitoring have been summarized in previous reports (ABI, 1984; ABI, 1985; ABI, 1986; FPC, 1986 KBN, 1987 and KBN, 1988).

The results of the available deposition monitoring data for the latest two monitoring years are presented in Table 3-1. The results of the vegetation monitoring program indicated the following conclusions:

1. No vegetation damage attributable to, or typical of, airborne salt deposition was evident from the monthly on-site vegetation inspections and photographs;

Table 3-1. Total Sodium and Chloride Deposition ($g/m^2/yr$) in the Vicinity of Crystal River Units 4 and 5 (1985/86 and 1986/87 Study Years)

Site	Total Salt Deposition ($g/m^2/yr$)		Distance* (km)	Direction+ (°)
	1985/86	1986/87		
Open Control	7.9	4.1	1.40	150
Opent Test	11.1	7.5	0.24	230
NE Open Test	13.4	6.7	0.37	35
NW Open Test	10.3	6.0	0.42	315
SW Open Test	9.7	7.6	0.44	210

* From geographic center between cooling towers.

+ From North.

2. The lack of visible damage signs at the monitoring stations is consistent with the observed deposition levels and expected impacts calculated from vegetation models; and
3. No consistent evidence of salt drift damage to vegetation was observed during its quarterly surveys.

3.2 MODELING ANALYSIS

Estimates of salt deposition from Crystal River Units 4 and 5 cooling towers and from the proposed cooling tower configuration for Units 1, 2 and 3 were made by McVehil-Monnett Associates of Denver, Colorado (1987). A computerized mathematical model was used to simulate the expected transport, dispersion and deposition of drift aerosols emitted by the cooling towers. The bases for these estimates were the cooling tower design parameters and the average particle size distribution of aerosols presented in Tables 3-2 through 3-5. The meteorological data used for the modeling analysis consisted of joint frequency distribution of wind speed, wind direction and stability for the period 1965-1969 from Tampa, Florida. This data was obtained from the National Climatic Center in STAR format. Meteorological data from Tampa was considered representative of the Crystal River area because of the proximity and similar physiography. In addition, the previous deposition model estimates for Units 4 and 5, as well as the federal Prevention of Significant Deterioration analysis, used surface data obtained for Tampa.

The helper cooling towers for Crystal River Units 1, 2 and 3 were only modeled for the months of June, July, August and September, while the cooling towers for Units 4 and 5 were modeled on an annual basis. The annual deposition was determined by superimposing the individual modeling results for each tower configuration and drift rate over the receptor grid and summing calculated depositions. The results of the modeling analysis are shown in Figures 3-1 through 3-3.

3.3 EFFECTIVE DEPOSITION

The annual average deposition levels predicted in the previous section are based upon the annual frequency of wind speed and direction, atmospheric

Table 3-2. Crystal River Units 1, 2 and 3 Tower Specifications and Design Parameters Used in Modeling Analysis of Helper Cooling Towers.

Parameter	Helper Cooling Towers	
	Rectangular	Round
No. Towers/Fans per Tower	4/10	3/12
Fan Height	60 ft. (18.3m)	82 ft.(25.0m)
Fan diameter	28 ft. (8.54m)	28 ft.(8.54m)
Fan Velocity	26.24 ft./s (8.0 m/s)	29.4 ft./s (8.96 ms)
Exit Temperature	91°F (306K)	91°F (306 K)
Tower Plow Rate	687,000 gpm	687,000 gpm
Draft Rate	0.002%	0.002%
Total Dissolved Solids	29,100 ppm	29,100 ppm

Source: McVehil-Monnett Associates, Inc., 1987

Table 3-3. Particle Distribution Used in Deposition Modeling from Helper Cooling Towers for Units 1, 2 and 3.

Particle Size			
Diameter			Mass
Range	Average	Radius (um)	Dist. (%)
0-40	20	10	4.8
40-60	50	25	5.4
60-100	80	40	3.6
100-200	150	75	9.2
200-300	250	125	13.0
300-400	350	175	26.0
400-500	450	225	23.5
500-700	600	300	11.5
700-1000	850	425	1.9
1000-1750	1425	713	1.1

Source: McVehil-Monnett Associates, Inc., 1987

Table 3-4. Crystal River Units 4 and 5 Cooling Tower Design Parameters Used in Deposition Modeling Analysis

Parameter	Units 4, 5
Number per Unit	1
Height (ft)	443
Base Diameter (ft)	380
Exit Diameter (ft)	214
Range (deg F)	22.5
Approach (deg F)	17.7
Flow Rate, each (gpm)	331,000
Annual Capacity Factor (%)	81
Circulating Water Total Dissolved Solids Content (mg/l)	32,000

Source: McVehil-Monnett Associates (1988)

Table 3-5. Particle Distribution Used in Deposition Modeling of Crystal River Units 4 and 5 Cooling Towers

Range of Droplet Radii (um)	Mean Radius (um)	Percent of Total Drift Mass (%)	Cumulative Percent (%)
5-10	7.5	0.0	0.0
10-15	12.5	0.0	0.0
15-20	17.5	0.08	0.08
20-25	22.5	4.23	4.31
25-30	27.5	7.02	11.33
30-35	32.5	8.86	20.19
35-45	40.0	15.95	36.14
45-55	50.0	14.59	50.73
55-65	60.0	10.44	61.17
65-75	70.0	7.48	68.65
75-90	82.5	7.41	76.06
90-105	97.5	5.12	81.18
105-120	12.5	4.19	85.37
120-135	127.5	3.16	88.53
135-150	142.5	2.61	91.14
150-175	162.5	3.45	94.59
175-200	187.5	2.13	96.72
200-225	212.5	1.42	98.14
225-250	237.5	0.80	98.94
250-300	275.0	0.70	99.64
300-350	325.0	0.11	99.75
350-400	375.0	0.25	100.00

Source: McVehil-Monnett Associates, 1986

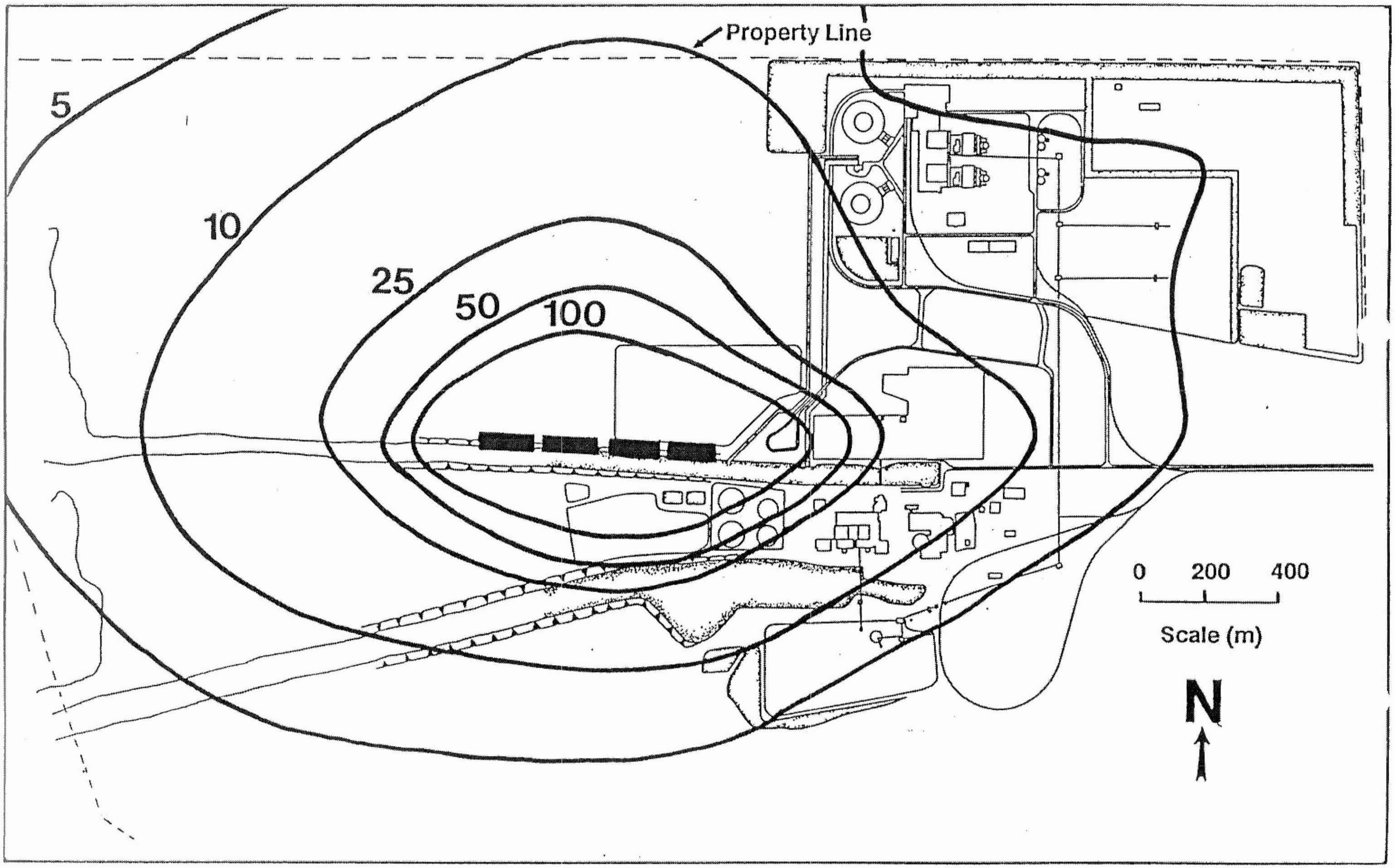

Figure 3-2. Total Summer Deposition of Cooling Tower Drift (g/m^2) - Four Rectangular Draft Towers (Case 1)

stability and temperature. The effect of rainfall is, however, extremely important because rainfall can cleanse the leaves and mitigate salt accumulation. Thus, by taking into account rainfall frequency, the actual or effective deposition that impacts vegetation can be evaluated.

To determine the significance of rainfall frequency or accumulated deposition, five years (1974, 1975, 1978, 1979 and 1981) of Tampa surface observations were processed to determine the number of days between rainfall events greater than 0.11 inch/hour (2.5 mm/hour). Five years of meteorological data were used to develop a range of rainfall frequency distributions. In addition, the five years selected (1974, 1975, 1978, 1979 and 1981) for analysis are representative of current meteorological conditions as well as a random sampling of a larger database (i.e., 10 years). A rainfall amount of greater than 0.11 inch/hour (2.5 mm/hour) was selected since this rainfall rate would be sufficient to physically wash accumulated deposition from leaves and is considered by the National Weather Service to be a moderate rainfall event (in contrast to a light rain or drizzle).

The results of this analysis are presented in Tables 3-6 and 3-7. As seen from these data, for the number of days between rainfall events of greater than 0.11 inch/hour (2.5 mm/hour) appears to be generally similar from year to year. As would be expected, the number of days between rainfall events decreases as a function of increasing number of days between those events. For example, in 1974 rain events occurred 38 times during the next day while only 7 times did the number of days between events exceed 10 days. Over the course of a year, about 16 percent of the time a rainfall event of greater than 0.11 inch/hour could be expected to occur at least every other day. About 40 percent of the time over a year a rainfall event of greater than 0.11 inch/hour would be expected at least every 5 days. Ten days or more between rainfall events greater than 0.11 inch/hour is expected only about 9 times in any year. Rarely do the number of days between rainfall events exceed 14 days or more (Table 3-6). Indeed, only about 3 times in any year does the days between rainfall events equal or exceed 14 days. The longest period between rainfall events of greater than 0.11 inch/hour occurred in

Table 3-6. Number of Days (24-hour periods) Between Rainfall Events Greater than 0.11 inch/hour for 1974, 1975, 1978, 1979 and 1981 (Tampa Surface Observations)

Days Between Rain Events Greater Than 0.11 inches/hour	Number of Occurrences in the Year				
	1974	1975	1978	1979	1981
0	38	14	37	51	39
1	12	4	18	10	10
2	8	4	11	7	10
3	7	5	8	3	2
4	2	4	5	4	3
5	5	5	5	5	3
6	3	1	3	1	6
7	2	5	4	2	1
8	0	1	1	2	3
9	1	0	1	2	2
10	2	2	1	1	1
11	2	1	0	0	2
12	1	1	1	1	3
13	1	1	1	3	0
14	0	0	1	1	1
15	0	0	1	3	0
16	0	2	0	0	0
17	0	0	0	0	0
18	0	0	0	0	1
19	0	1	0	1	0
20	0	0	0	0	0
21	0	0	0	0	0
22	0	0	0	0	0
23	0	0	0	0	0
24	0	1	0	0	0
25	0	0	0	0	1
26	0	1	0	0	0
27	0	0	1	0	0
28	0	0	0	0	0
29	0	0	0	0	0
30	0	0	0	0	0
31	0	0	0	0	0
32	0	1	0	0	0
33	0	0	0	0	0
34	0	0	0	0	0
35	0	0	0	0	0
36	0	0	0	0	0
37	0	0	0	0	0
38	0	0	0	0	0
39	0	0	0	0	0
40	0	0	0	0	0
41	0	0	0	0	0
42	0	0	0	0	0
43	0	0	0	0	0
44	0	0	0	0	0
45	1	0	0	0	0

Table 3-7. Number of Rainfall Events Greater Than 0.11 inch/hour by Month for 1974, 1975, 1978, 1979, and 1981 (Tampa Surface Observations)

MONTH	Number of Occurrences in the Year				
	1974	1975	1978	1979	1981
JANUARY	4	1	8	8	2
FEBRUARY	2	3	6	5	7
MARCH	3	4	6	6	4
APRIL	3	1	2	5	2
MAY	6	4	7	7	2
JUNE	18	10	14	6	13
JULY	10	8	15	11	14
AUGUST	18	8	17	23	17
SEPTEMBER	13	6	6	16	11
OCTOBER	1	6	8	3	5
NOVEMBER	1	1	2	4	5
DECEMBER	6	2	8	3	6
TOTAL	85	54	99	97	88

1974 with a duration of 45 days. For all other years the longest period between rainfall events was 32 days or less.

The months with the greatest number of rainfall events (greater than 0.11 inches/hour) are June, July and August while the months with the least number of rainfall events are November and April (Table 3-7). The implications of this result and the coincident operation of the Units 1, 2 and 3 cooling towers to vegetation impacts are discussed in Section 4.4.

4.0 ANALYSIS OF IMPACTS

4.1 BACKGROUND DEPOSITION

Pre-operational or ambient baseline values ranged from 3.49 to 6.67 g/m^2-yr. These ambient deposition levels include inputs form both rainfall and non-rainfall (i.e., dry) periods. Since rainfall concentrations of sea salt are extremely dilute (volume weighted mean concentration of less than 5 mg/l even in coastal sites in Florida) and rainfall effectively washes leaves of accumulated deposition, dry salt deposition is more important in determining total salt accumulation. Subtracting the estimates by 2.5 g/m^2-yr inputed through rainfall (developed from Florida Acid Deposition Study, FCG, 1986), this implies an ambient dry deposition load in the pine flatwoods and coastal hydric hammock of 1.0 to 4.2 g/m^2-yr due to natural wind driven salts from the coastal zone.

4.2 MAXIMUM POTENTIAL EFFECTS

The natural deposition level supports the premise that salt deposition up to ambient levels is not a limiting factor in this ecosystem naturally, and also supports the fact that the Crystal River area of the Gulf coast is a lower energy system than that of the east coast with less wind, wave, and storm action, and less resultant salt spray. This fact is also evidenced by the physiognomic profile of the coastal forest, in which a shear effect is not seen in the canopy. A survey of salt content in soil and leaves in the area also showed no correlation to distance from the Gulf (Dames and Moore, 1974).

The coastal hammock and coastal hydric hammocks of Crystal River are dominated by many of the same species that dominate in the high salt environment of these maritime forests, including live oak, cabbage palm (Sabal palmetto), yaupon, American holly, wax myrtle, winged sumac, saltbush, and southern red cedar (Juniperus silicicola). Therefore, salt spray or deposition would not appear to be a natural limiting factor in the areas most impacted by the cooling towers. Many of the dominant species determining the nature of the community have shown adaptations in other regions to salt deposition levels up to ten times higher than the naturally occurring levels at Crystal River, and should be capable of withstanding substantial additional deposition rates from the cooling towers. The same is true of the salt marsh community.

However, assuming the model prediction of a maximum cooling tower deposition from three round mechanical draft towers of 45.0 g/m^2-yr on natural forest vegetation (see Section 3.2), a maximum deposition of 51.7 g/m^2-yr (461 lbs/ac-yr) (45 + 6.7 g/m^2 from natural background or about 461 lbs/ac-yr) for all sources, including wet deposition from rainfall, might occur at Crystal River during operation of the cooling towers. This level is close to ten times the background level at Crystal River and the upper limit in which maritime forests and coastal hammocks normally occur. Many of the same species are dominant in the Crystal River area. Therefore, this level of deposition may be close to the upper limit to which the dominant species of the region are capable of acclimating (refer to Section 2.0) without showing some degree of damage and long-term effects on growth. Consequently, the vegetative growth and composition of a portion of the natural coastal forest communities could be altered under some alternatives.

4.3 AREAS OF IMPACT

4.3.1 Alternative 1 - Three Round Towers

The estimated point of maximum deposition falls over a developed area devoid of natural vegetation. The point of maximum deposition over a naturally vegetated area [about 90 g/m^2-yr (802 lbs/ac-yr)] lies approximately 0.6 km (1,800 ft) northwest of the Units 1-3 cooling tower site. This point is within the salt marsh north of the discharge canal. Approximately 8 acres of this salt marsh will receive a calculated deposition loading above 45.0 g/m^2-yr (401 lbs/ac-yr); 150 acres will be exposed to rates from 10.0 g/m^2-yr (89 lbs/ac-yr) to 45.0 g/m^2-yr.

A portion (40 acres) of coastal hydric hammock will be exposed to annual deposition levels of 20.0 g/m^2-yr (178 lbs/ac-yr) to 45.0 g/m^2-yr (401 lbs/ac-yr). An additional 70 acres will be exposed to deposition levels of 6.0 g/m^2-yr (53 lbs/ac-yr) to 20 g/m^2-yr. The point of maximum deposition within the coastal hydric hammock community is about 0.6 km

(1,800 ft) north-northwest of the Units 1-3 cooling tower site. This location is on the north side of the fly ash pond for Units 1 and 2. Deposition levels decrease rapidly to the north and northwest.

A secondary zone of impact may occur in natural vegetation south of Units 1-3. Vegetation in this area consists of salt marsh on the west grading into a mix of salt marsh/fresh marsh/coastal hammock to the south of Unit 3. A coastal hydric hammock community occurs along the east side of the railroad loop and within the loop. Deposition in the this salt marsh complex will rapidly decrease from about 60 g/m^2-yr near the south side of the intake canal to about 5 g/m^2 (44 lbs/ac-yr) at the transition to brackish marsh at the southeast end of the rail loop. Maximum deposition in the coastal hydric hammock east of the rail loop will range from 5 g/m^2-yr to 10 g/m^2-yr (88 lbs/ac-yr). Within the rail loop, levels may range up to 15 g/m^2-yr (132 lbs/ac-yr).

Deposition levels in pine flatwoods and fresh marsh communities will be less than 15 g/m^2-yr, with an off-site maximum of about 7 g/m^2-yr (62 lbs/ac-yr) at the north property boundary. The mechanical draft cooling towers will account for only about 2 g of the total at this point. This alternative has the highest deposition to power plant areas. FPC (1988) has indicated that this alternative is the least desirable from an engineering perspective due to increased corrosion from drift.

built → 4.3.2 Alternative 2 - Four Rectangular Towers on North Side of Discharge Canal

The estimated point of maximum deposition falls over the discharge canal. The point of maximum deposition over a naturally vegetated area [over 400 g/m^2-yr (3,564 lbs/ac-yr)] lies immediately north of the Units 1-3 cooling tower site. This point is within the salt marsh on the north edge of the discharge canal. Approximately 9 acres of this salt marsh will receive a calculated deposition loading above 400 g/m^2-yr (3,560 lbs/ac-yr); 6 acres will be exposed to rates from 200 g/m^2-yr (1,780 lbs/ac-yr) to 400 g/m^2-yr. A total of approximately 75 acres of salt marsh will receive salt deposition loads greater than 60 g/m^2-yr (538 lbs/ac-yr).

A small amount (15 acres) of coastal hydric hammock will be exposed to annual deposition levels of over 50 g/m^2-yr. An additional 55 acres will be exposed to deposition levels of 20 g/m^2-yr to 50 g/m^2-yr. The point of maximum deposition within the coastal hydric hammock community is about 0.4 km (1,300 ft) north of the Units 1-3 cooling tower site. This location is on the north side of the fly ash pond for Units 1 and 2. Deposition levels decrease rapidly to the north and northeast.

A secondary zone of impact may occur in natural vegetation southwest of Units 1 and 2. Vegetation in this area consists of salt marsh on the west grading into a mix of salt marsh/fresh marsh/coastal hammock to the south of Unit 3. Deposition in the this salt marsh complex will rapidly decrease from about 15 g/m^2-yr (132 lbs/ac-yr) near the south side of the intake canal to about 5 g/m^2 (44 lbs/ac-yr) at the south side of the coal pile. Maximum deposition in the coastal hydric hammock within and east of the rail loop will be less than 5 g/m^2-yr.

Deposition levels in pine flatwoods and fresh marsh communities will be less than 12 g/m^2-yr (106 lbs/ac-yr), with an off-site maximum of about 7 g/m^2-yr (62 lbs/ac-yr) at the north property boundary. The mechanical draft cooling towers will account for only about 2 g of the total at this point.

4.3.3 Alternative 3 - Four Rectangular Towers on Both Sides of Discharge Canal

Impacts from this alternative are very similar to those for alternative 2. The main difference lies in a slight reduction of the extent of coastal hydric hammock subjected to severe depositional loads.

The estimated point of maximum deposition falls over the discharge canal. The point of maximum deposition over a naturally vegetated area [over 400 g/m^2-yr (3,564 lbs/ac-yr)] lies immediately north of the Units 1-3 cooling tower site. This point is within the salt marsh on the north edge of the discharge canal. Approximately 9 acres of this salt marsh will receive a calculated deposition loading above 400 g/m^2-yr (3,560 lbs/ac-yr); 6 acres affecting up to 10% of total leaf area) in an area of less than 15 acres in the coastal hydric hammock adjacent to the north side of the fly ash pond for Units 1 and 2. Potential damage should be confined to the less resistent species in all other areas of the FPC property, and no effects are expected outside of the FPC property.

4.4.3 Alternative 3 - Four Rectangular Towers on Two Sides of Discharge Canal

The effects and conditions for Alternative 3 are almost exactly like those for Alternative 2. The maximum monthly depositions in the salt marsh and coastal hydric hammock are about the same as for Alternative 2. The treatment and analysis are also identical.

The only difference is that the area of coastal hydric hammock which may experience significant effects (potentially affecting up to 10% of total leaf area) is reduced from about 15 acres to 5 acres in this alternative. The maximum accumulation would still be 2.25 g/m^2 in the southern end of the hammock, but the area of influence would be restricted to the west end of the ash pond. Potential damage should be confined to the less resistent species in all other areas of the FPC property, and no effects are expected outside of the FPC property.

Based on this evaluation of the maximum "effective deposition rate" due to washout by rainfall, significant injury is expected for low and moderate resistance and intolerant native species in the southern portion of the on-site coastal hydric hammock community during the summer months. Some minor effects could possibly be experienced by resistant species in this portion of the coastal hydric hammock next to the ash pond, depending on the alternative selected.

4.5 POTENTIAL INJURY MODEL

Freudenthal and Beals' (1978) method (refer to Section 2.0) for modeling botanical injury from saline drift was also used to analyze potential impacts. Their scale for injury evaluation was adjusted from a four level range to a five level range to allow for better evaluation of effects on