Florida Power
CORPORATION

DEPARTMENT OF
ENVIRONMENTAL PROTECTION

SEP 1 9 1994

SITING COORDINATION

September 9, 1994

Marilyn M. Polson, Esq.
Fisher & Sauls, P.A.
Attorneys At Law
P. O. Box 387
St. Petersburg, FL 33731

Dear Ms. Polson:

Re: Salt Drift Study at Crystal River

Florida Power understands that you have objected to our request to end the Crystal River Salt Drift study as provided by Specific Condition 5.c. of the revised PSD permit for Crystal River Units 4 and 5 that was issued November 30, 1988, (Permit number PSD-FL-007). Since your objection was based on the short amount of time that the new mechanical cooling towers were monitored for the 1992-1993 annual report, we thought that it would be useful to provide you with some additional information.

We have recently completed the 1993-1994 study year, and even though the annual report has not been completed, we believe that some observations that are based on our experiences can be made. Most importantly, our sampling stations that were established to sample the deposition from the new mechanical draft towers do not seem to show any increase in salt deposition during those months when the new towers were operating. Since there was no increase in salt deposition, we did not anticipate, nor did we record, any increase in salt-related impacts other than the few isolated instances of suspected salt damage that have been reported in the past several annual reports. We have not observed any salt-related impacts to the off-site vegetation. We firmly believe that we have acted in good faith in this matter and that little meaningful information will be gained from additional study.

Florida Power hopes that you will concur that the time has come to terminate the salt drift study. If you have any questions or would like to discuss this matter in greater detail, please contact me at (813) 866-4387.

Sincerely,

W. Jeffrey Pardue, C.E.P., Manager
Environmental Programs

cc: Hamilton S. Oven (FDEP-Tallahassee)

ENVIRONMENTAL SERVICES DEPARTMENT
H2G • 3201 Thirty-fourth Street South • P.O. Box 14042 • St. Petersburg, Florida 33733 • (813) 866-5151
A Florida Progress Company

DEP ROUTING AND TRANSMITTAL SLIP

TO: (NAME, OFFICE, LOCATION) 10-5-94

1. ~~Bruce Mitchell~~
2. MS 5505
3. ~~Fehn~~
4. Kanani / File
5.

PLEASE PREPARE REPLY FOR:

___ SECRETARY'S SIGNATURE

___ DIV/DIST DIR SIGNATURE

___ MY SIGNATURE

___ YOUR SIGNATURE

___ DUE DATE ___

ACTION/DISPOSITION

___ DISCUSS WITH ME

___ COMMENTS/ADVISE

___ REVIEW AND RETURN

___ SET UP MEETING

___ FOR YOUR INFORMATION

___ HANDLE APPROPRIATELY

___ INITIAL AND FORWARD

___ SHARE WITH STAFF

✓ FOR YOUR FILES

COMMENTS:

RECEIVED

SEP 19 1994

Bureau of
Air Regulation

FROM: HP DATE: 9-19-94 PHONE: 7-0472

DEP 15-026 (12/93)

DEP ROUTING AND TRANSMITTAL SLIP

TO: (NAME, OFFICE, LOCATION)

1. ~~Clair Fancy~~
2. ~~MS 5505~~
3. ______
4. ______
5. ______

PLEASE PREPARE REPLY FOR:

____ SECRETARY'S SIGNATURE

____ DIV/DIST DIR SIGNATURE

____ MY SIGNATURE

____ YOUR SIGNATURE

____ DUE DATE ______

ACTION/DISPOSITION

____ DISCUSS WITH ME

____ COMMENTS/ADVISE

____ REVIEW AND RETURN

____ SET UP MEETING

____ FOR YOUR INFORMATION

____ HANDLE APPROPRIATELY

____ INITIAL AND FORWARD

____ SHARE WITH STAFF

____ FOR YOUR FILES

COMMENTS: Bruce 9/9
probably Cleve needs to look at this issue
Clair

RECEIVED
AUG 30 1994
Bureau of
Air Regulation

9-8-94
Cleve,
Call Bruce and see if we need to do anything on this.
Thanks,
Bruce
P.S. Let me know by the 12th

FROM: [illegible] DATE: 8-29-94 PHONE: ______

DEP 15-026 (12/93)

Department of Environmental Protection

Lawton Chiles
Governor

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

Virginia B. Wetherell
Secretary

August 29, 1994

last application Nov 30, 1977
received to Came in to
get around
scrubbers

Ms. Marilyn M. Polson
Fisher & Sauls, P.A.
Post Office Box 387
St. Petersburg, Florida 33731

Re: Florida power corporation Permit No. PSD-FL-007
Salt Drift Study for Crystal River Power Plant

Dear Ms. Polson:

I have forwarded your letter of July 29, 1994 to the Bureau of Air regulation in the Division of Air Resources Management. That bureau is responsible for acting on amendments to PSD permits. I have also advised Florida Power Corporation that they also need to request a modification of the Conditions of Certification for Crystal River units 4 & 5, and have notified them of your objection. Florida Power has not formally applied for a modification of the Conditions to delete the salt drift monitoring.

An Environmental Specialist on my staff is reviewing the salt drift data. We in the Power Plant Siting program have not reached a decision as to whether discontinuing the salt drift monitoring program is advisable.

If FPC should choose to pursue the modification over your objection, they will have to file a petition pursuant to ss. 403.516(1)(c), F.S.

Trudy Bell wildlife biologist is looking at.

Sincerely,

Hamilton S. Oven

Hamilton S. Oven, P.E.
Administrator, siting
Coordination Office

cc: Richard Donelan
Clair Fancy
Pam Smith
Jeff Pardue

DEPARTMENT OF
ENVIRONMENTAL PROTECTION

AUG 29 1994

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BYRON T. SAULS (1904-1979)

OF COUNSEL
JOHN H.W. COLE
LAURIE W. VALENTINE

PLEASE REPLY TO ST. PETERSBURG

August 25, 1994

Hamilton S. Oven, Jr.
Department of Environmental
Protection
Douglas Building, Rm. 953AA
3900 Commonwealth Blvd.
M.S. #48
Tallahassee, FL 32399-3000

Re: Florida Power Corporation Permit No. PSD-FL-007
Termination of Salt Drift Study at Crystal River

Dear Mr. Oven:

Please advise whether any action has been taken by the Department of Environmental Protection regarding Florida Power Corporation's request to terminate the salt drift study at the Crystal River Power Plant.

In connection with this matter, enclosed is a copy of my July 29, 1994, correspondence advising your department of the objection of Hollins Corporation, the adjacent landowner, to Florida Power Corporation's request to terminate salt drift studies which are required by Specific Condition 5.c of Revised PSD Permit No. PSD-FL-007.

I appreciate your assistance in this matter.

Very truly yours,

FISHER & SAULS, P.A.

Marilyn M. Polson

Marilyn M. Polson

MMP:lba
Enclosure
cc: Louie N. Adcock, Jr.
Dixie M. Hollins

0472
487-044

51174.1

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PLEASE REPLY TO ST. PETERSBURG

July 29, 1994 *lbg*

Hamilton S. Oven, Jr.
Department of Environmental
Protection
Douglas Building, Rm. 953AA
3900 Commonwealth Blvd.
M.S. #48
Tallahassee, FL 32399-3000

Re: Florida Power Corporation Permit No. PSD-FL-007
Termination of Salt Drift Study at Crystal River

Dear Mr. Oven:

This office represents Hollins Corporation, a Citrus County landowner whose property is adjacent to property owned by Florida Power Corporation.

Hollins Corporation, a family corporation, conducts cattle, timber, nursery and mining operations on the Hollinswood Ranch in Crystal River, Florida.

Hollins Corporation objects to Florida Power Corporation's request to terminate salt drift studies which are required by specific condition 5.c. of revised PSD Permit No. PSD-FL-007. Salt drift monitoring was expanded in 1991-92 to provide for the study of potential effects of the new mechanical draft saltwater cooling towers which were at that time proposed for construction. The new mechanical draft cooling towers became operational on June 16, 1993, and ran through the end of the study period (September 15, 1993) of the current report. Therefore, salt drift studies have been completed with the new saltwater helper cooling towers in operation for only a four-month period.

Due to the short time in which the new mechanical saltwater helper cooling towers have been in operation and the lack of information available on the impacts which may occur with the additional salt drift, Hollins Corporation objects to the termination of the salt drift studies.

If you have any questions or require any additional information on this objection, please feel free to contact me at (813) 822-2033.

Very truly yours,

FISHER & SAULS, P.A.

for Marilyn M. Polson

MMP:lba

cc: Louie N. Adcock, Jr.
Dixie M. Hollins
W. Jeffrey Pardue
Ellen Cunningham

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV
345 COURTLAND STREET
ATLANTA, GEORGIA 30365

EPA 904/9-81-056
NPDES Application Number:
FL 0036366

Final
Environmental Impact Statement

for

Proposed Issuance of a New Source National Pollutant Discharge Elimination System Permit

to

Florida Power Corporation
Crystal River Units 4&5
Citrus County, Florida

U.S. Environmental Protection Agency
Region IV, Atlanta, Georgia 30365

Florida Power Corporation proposes to construct and operate two 695 MW (gross) capacity coal-fired electric generating plants at the existing Crystal River complex in northwest Citrus County, Florida. The EIS examines project alternatives, impacts, and mitigative measures related to groundwater, air, surface water, ecological, and socioeconomic and cultural systems.

Comments will be received until MAR 30 1981

Comments or inquiries should be directed to:

John E. Hagan, III
Chief, EIS Branch
U.S. Environmental Protection Agency
Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365
(404) 881-7458

Approved by

Rebecca W. Hanmer

Rebecca W. Hanmer
Regional Administrator

January 20, 1981
Date

the manatee be protected by imposing navigation limitations on coal barge transport.

OPERATION

The artificial landform created by solid wastes should not detract from the aesthetic character of the area so long as the tree cover is maintained on land to the east. However, the ash storage will preclude many potential future uses of the land and will represent a long-term commitment of resources.

Solid wastes generated by the operation of Units 4 and 5 will include office wastes, trash, garbage, and scrap lumber and metal. Scrap lumber and metal will be recycled. Other wastes will be landfilled in approved areas near the new units, or disposed of by an outside contractor.

Some impacts on vegetation near the storage areas may occur if pollutants such as heavy metals reach the root zone. There could be reductions in plant growth, community productivity, and detrital production. If concentrations reach toxic levels, there might be an elimination of various floral components of the community, and a situation in which new seedlings could not become established. However, this eventuality is considered unlikely to occur over a large area, since leachate concentrations will decrease with distance and will be diluted by groundwater flow.

Heavy metals could pass into faunal organisms through ingestion of detritus or vegetation. Accumulation could occur at the higher trophic levels, although this effect would be insignificant for organisms with wide feeding ranges. Overall, the ecological impacts of leachate should have low significance because of the limited area of leachate interaction with surface conditions.

Salt drift from cooling towers that are fed by saline water involves the escape of drift droplets that contain roughly the same concentrations of chemicals as found in the circulating water. The drift is deposited in the form of droplets or solid particles, and leaves chemical precipitants on surfaces downwind from the tower. Salt drift from the proposed cooling towers should have minimal influence on off-site land uses because of the isolation of the site, but nearby vegetation could be affected. Based on mathematical modeling, the maximum salt deposition expected is 10.6 kilograms per hectare per month (114 pounds per acre per year), occurring at a point 0.3 kilometers (0.2 miles) west of the cooling towers. Salt deposition will exceed 2.6 kilograms per hectare per month (28.1 pounds per acre per year) on a total of approximately 200 hectares (500 acres) of land, but will become minor at distances greater than 1.3 kilometers (0.8 miles) from the towers. The most extensive study of vegetative response to salt drift identified only one species (dogwood) that was highly sensitive to drift conditions (Curtis, et al., 1976). Injuries occurred in about 5 percent to 40 percent of the leaves at a deposition rate of 20 kilograms per hectare per month (216 pounds per acre per year). The threshold leaf injury level was placed at 7.46 kilograms per hectare per month (80.6 pounds per acre per year) (Curtis, et al., 1978). Florida Power Corporation will conduct monitoring of salt drift to determine impacts.

There may be some possibility of injury to sensitive plant species at the Crystal River site due to salt drift, but widespread damage is unlikely. The experience of the two existing power plants in the United States with salt water cooling towers suggests that the significance of this impact will be low; however, monitoring of drift impacts is required by the NPDES permit.

Drawdown of the water table as a result of withdrawals at the proposed Florida Power Corporation well field could affect those biological communities associated with freshwater marshes. Present aquifer characteristics indicate a separation of water table and water source aquifers. However, changes such as transition from permanent marshes (pickerelweed, waterlily) to seasonally flooded marshes (smartweed, arrowhead, sawgrass) to wet prairies may occur where the water table drops below ground surface temporarily due to water withdrawal. The consequence would be changes in species composition, productivity, food web relations, wildlife habitat, and possibly habitat for rare and endangered plants (e.g. sundews). Minor effects on wildlife could result from a reduction in seasonal wetlands. If the character of the marshes and ponds is changed, a shift from aquatic species (turtle, pig frog) to prairie forms (cranes, rails) will occur. The significance of such changes will depend upon the area of wetland affected, which is presently uncertain. It appears likely that long-term changes such as those just described will be limited in extent and therefore low in overall significance because the drawdowns are predicted to be relatively small.

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/m²/yr) in the Vicinity of Crystal River Units 4 and 5 (1985/86 and 1986/87 Study Years)

Site	Total Salt Deposition ($g/m^2/yr$) 1985/86	Total Salt Deposition ($g/m^2/yr$) 1986/87	Distance* (km)	Direction+ (°)
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			Mass Dist. (%)
Diameter		Radius (um)	
Range	Average		
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

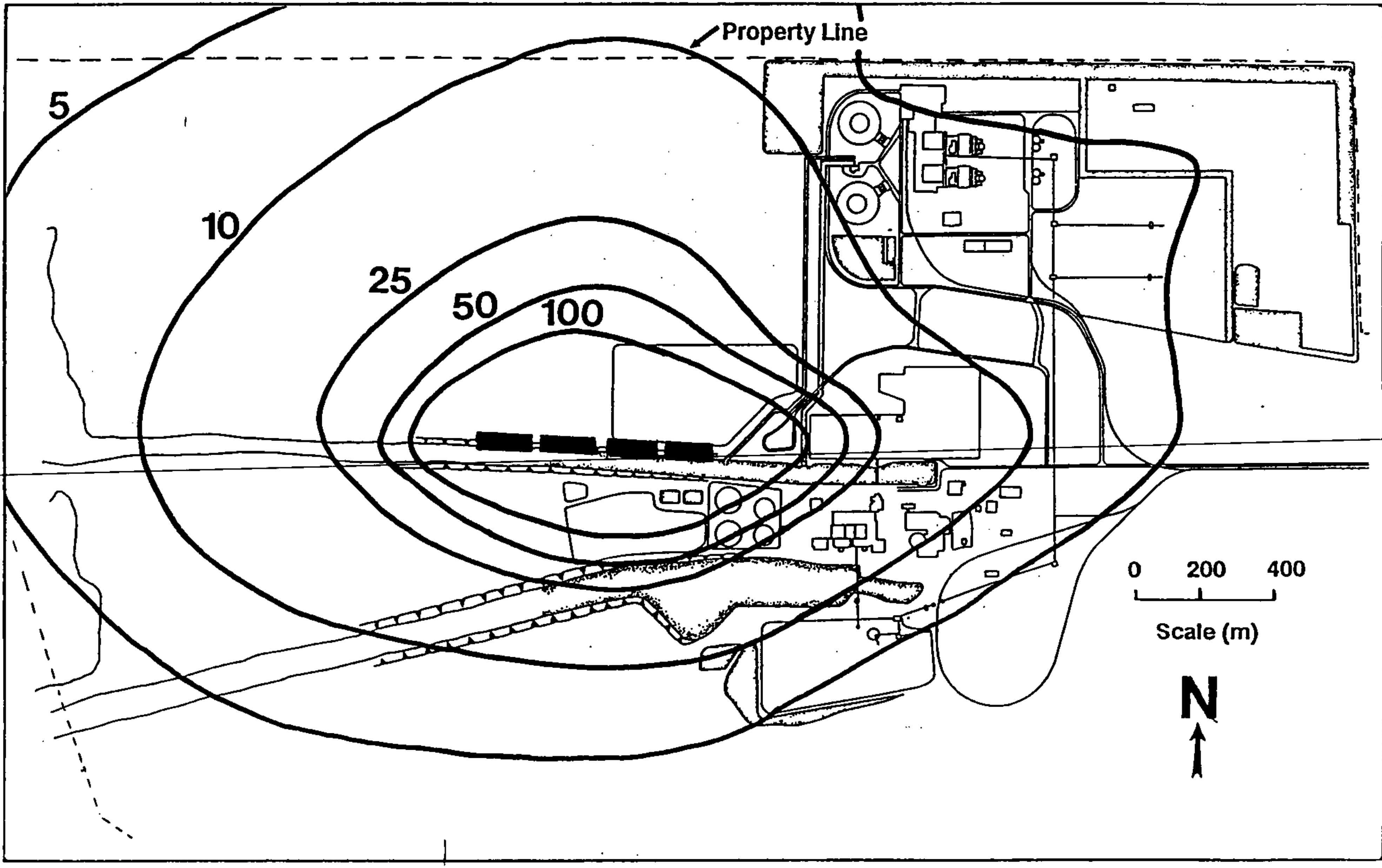

Figure 3-2. Total Summer Deposition of Cooling Tower Drift (g/m^2) - Four Rectangular Draft Towers (Case 1)

KBN

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 (<u>Sabal palmetto</u>), yaupon, American holly, wax myrtle, winged sumac, saltbush, and southern red cedar (<u>Juniperus silicicola</u>). 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

Using the period of ten days between rainfall events, as developed in Section 3.3, as a "worst case" summer condition assumption, an accumulation of 33.67 g/m^2 (300 lbs/ac) would result at the point of maximum deposition in the salt marsh, and an accumulation of 7.42 g/m^2 (66 lbs/ac) would occur at the point of maximum deposition in the coastal hydric hammock. Calculations by Davis (1979) based on the data of Francis (1977) and Lauver, et al. (1978) indicate that such a level of deposition could result in leaf chloride concentrations of 6,000 to 8,000 ppm and visible damage on 50-100% of the leaves of the sensitive species, such as dogwood.

Such levels probably would not significantly affect the salt marsh vegetation, but they would be expected to result in 80-100% leaf damage to sensitive hammock species and significant damage to moderately resistant species. For this ten-day impact event, about 25-40% of the leaf material along the southern edge of the coastal hydric hammock west of Units 4 and 5 has the potential to be impacted. Potential effects would also be possible for a small amount of the pine flatwoods and freshwater marsh areas both onsite and offsite. Such impacts would comprise a long-term injury event that would persist throughout the year and could destroy the integrity of the southern part of the coastal hydric hammock, leading to a progressive retreat of the community to the north and northeast. An opening of this canopy potentially could expose understory plants to additional natural salt spray.

As Table 3-5 indicates, an average of 12 rainfall events occurred during each of the summer months during a five-year period, indicating that the number of days between rainfall events is commonly less than 10 days, with an average period of less than three days between events.

Salt accumulation on leaves during the period of operation is likely to be substantially below the values predicted above for 10 day intervals. Such reduced levels of accumulation would result in proportionally less effect on vegetation. Based upon an average of 3 days between rainfall events, salt accumulation would be 2.25 g/m^2 in the southern end of the hammock. This level is still sufficient to induce significant effects (potentially 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