FPL - SANFORD PLANT
DAY 30 : 6/21/90

3.0 AIR QUALITY MODELING RESULTS

3.1 SIGNIFICANT IMPACT ANALYSIS

The maximum impact of the proposed increase in SO_2 emissions from Sanford Unit 4 is presented in Tables 3-1 and 3-2. The results indicate that the maximum predicted SO_2 concentrations are above the significant impact levels, and, therefore, further modeling analysis is required for this pollutant to demonstrate compliance with PSD increments and AAQS. Additional modeling with a receptor grid extended out to 50 km indicated that the proposed test burn is significant out to 50 km.

Maximum impacts for other pollutants for which the proposed test burn had a significant increase in emissions (see Table 2-4) were determined by ratioing the proposed allowable increase in emissions with that for SO_2. The ratios are then converted to maximum concentrations by multiplying them against the maximum SO_2 impacts for each respective averaging time. The resulting maximum concentrations are presented in Table 3-3 for all significant pollutants. The table indicates that both PM and PM10 are below significant impact levels for the proposed fuel change to Unit 4.

Because maximum impacts for these pollutants do not exceed their significant impact levels, further modeling to determine compliance with allowable PSD increments and AAQS is required for SO_2 only.

As a result, an inventory of other SO_2 sources out to 50 km was evaluated for interaction with the Sanford plant. The maximum predicted PM concentrations were below the significant impact levels at all modeled distances. Because the proposed impacts for the test burn are not significant for PM, further modeling analysis is not required for that pollutant.

Table 2-4. Modeling Parameters for SO_2 Facilities Interacting With FPL Sanford

Model. ID No.	Source	Name	Emissions lb/hr	Emissions (g/s)	Height ft	Height (m)	Velocity fps	Velocity (mps)	Temperature °F	Temperature (°K)	Diameter ft	Diameter (m)
20002	FPC	Turner #2	990	(124.7)	237	(72.3)	58	(17.7)	260	(400)	6.0	(1.83)
20003	FPC	Turner #3	2,255	(284.1)	237	(72.3)	79	(24.1)	315	(430)	6.0	(1.83)
20004	FPC	Turner #4	2,255	(284.1)	237	(72.3)	76	(23.2)	270	(405)	6.4	(1.95)
20012	Turner	GT 1&2	329	(40.6)	39	(11.9)	63	(19.2)	960	(789)	12.9	(3.93)
20034	Turner	GT 3&4	867	(109.0)	35	(10.7)	100	(30.5)	900	(755)	19.1	(5.82)
28012	FPC	Debary 1&2	143	(18.0)	30	(9.10)	20	(6.1)	320	(433)	2.5	(0.76)
28016	Debary	GT 1-6	1,764	(222.3)	30	(9.10)	70	(21.3)	750	(672)	7.8	(2.40)
99937	OUC	Stanton En[a]	9,430	(1188.2)	550	(167.6)	83	(25.3)	127	(326)	19.0	(5.79)
33001	C.A.Meyer	Pav	41	(5.2)	34	(10.4)	103	(31.4)	325	(436)	3.2	(0.98)
99903	New Symrma Beach[a]		873.5	(110.1)	29	(8.8)	78	(23.8)	650	(616)	2.2	(0.67)
64001	Martin	Asphalt	122.3	(15.4)	20	(6.1)	90	(27.4)	325	(436)	3.1	(0.94)

[a]PSD increment-consuming source.

Table 3-1. Maximum Predicted Impacts For Unit 4's Increase in SO_2 Emissions--Screening Analysis

Averaging Time	Year	Concentration ($\mu g/m^3$)	Dir. (°)	Dist. (m)	Day	Hour Ending
Annual	1982	3.0	360	5,000	-	-
	1983	3.1	240	4,000	-	-
	1984	3.4	240	5,000	-	-
	1985	3.2	260	5,000	-	-
	1986	3.1	240	4,000	-	-
3-Hour	1982	228	260	3,000	305	12
	1983	264	160	1,300	82	12
	1984	320	20	1,300	209	15
	1985	260	300	1,000	193	12
	1986	278	240	1,300	137	15
24-Hour	1982	45	60	3,000	237	-
	1983	43	300	4,000	130	-
	1984	53	230	1,300	82	-
	1985	55	200	1,300	148	-
	1986	51	300	3,000	273	-

Table 3-2. Maximum Predicted Impacts For Unit 4's Increase in SO_2 Emissions--Refined Analysis

Averaging Time	Year	Concentration ($\mu g/m^3$)	Dir. (°)	Dist. (m)	Day	Hour Ending
Annual	1984	3.4	240	4900	-	-
3-Hour	1984	348	22	1200	209	15
24-Hour	1984	56	226	1300	259	-
	1985	59	202	1100	148	-

Table 3-3. Maximum Impact of Proposed Unit 4 Test Burn As Compared To Significant Impact Levels

Pollutant/ Averaging Time	Modeling Applicability: Maximum Impact ($\mu g/m^3$)	Modeling Applicability: Significant Impact Level ($\mu g/m^3$)	Modeling Applicability: Further Analysis Required?	Monitoring Applicability: De Minimus Air Quality Levels ($\mu g/m^3$)	Monitoring Applicability: Monitoring Data Required?
Sulfur Dioxide					
Annual	3.4	1	YES		
3-Hour	348	25	YES		
24-Hour	59	5	YES	13	YES
Particulates-TSP					
Annual	0.2	1	NO	NA	
24-Hour	3.9	5	NO		
Particulates-PM10					
Annual	0.3	1	NO		
24-Hour	4.6	5	NO	NA	
Sulfuric Acid Mist					
Annual	0.03	NA[a]		NA[b]	

[a]Significant impact levels do not exist for Sulfuric Acid Mist.
[b]No ambient air measurement method exists.

3.2 AAQS ANALYSIS

The SO_2 impacts for the screening analysis due to all sources in the vicinity of the Sanford plant are presented in Table 3-4. The maximum SO_2 impacts for the refined analysis due to all sources in the vicinity of the Sanford plant are presented in Table 3-5. The maximum refined 3-hour, 24-hour, and annual average concentrations are 895, 254, and 31 micrograms per cubic meter ($\mu g/m^3$), respectively, which are below the AAQS of 1300, 260, and 60 $\mu g/m^3$, respectively. Source contributions at each of these maximum modeled concentration are shown in Table 3-6. The Sanford plant's contributions to the maximum 3-hour, 24-hour, and annual concentrations are 23, 24, and 16 percent of the total concentration (including background) for each respective averaging time.

3.3 PSD ANALYSIS

The screening analysis results for SO_2 Class II increment consumption for the proposed Orimulsion test burn at the Sanford plant and other PSD sources in the Sanford plant's vicinity are presented in Table 3-7. Results from the refined analysis are presented in Table 3-8. The maximum 3-hour, 24-hour, and annual average concentrations are 348, 59, and 4.8 $\mu g/m^3$, respectively, which are 68, 65, and 24 percent of the allowable increments, respectively.

3.4 COMPARISON OF CURRENT AND PROPOSED PREDICTED IMPACTS

A comparison of maximum impacts for the current and proposed SO_2 emission scenarios for Sanford are presented in Table 3-9. Maximum impacts for the current emissions limit of 1.65 $lb/10^6$ Btu for Units 3, 4, and 5 are 6.3, 85, and 484 $\mu g/m^3$, for the annual, 24-hour, and 3-hour averaging times, respectively. The corresponding State of Florida AAQS are 60, 260, and 1,300 $\mu g/m^3$, respectively.

The proposed emissions produced slightly higher impacts. The maximum proposed impacts due to Sanford are 7.5, 115, and 667 $\mu g/m^3$. The increases in the maximum impact are 19 percent for annual averaging, 35 percent for 24-hour averaging, and 37 percent for 3-hour averaging.

Table 3-4. Maximum Predicted Total SO_2 Concentrations From the Screening Analysis for Comparison to AAQS

Averaging Period	Concentration ($\mu g/m^3$) Total	Total Due To: Modeled Sources	Total Due To: Background	Receptor Location[a]: Direction (°)	Receptor Location[a]: Distance (km)	Period: Julian Day	Period: Hour Ending	Period: Year
3-hour[b]	895	795	100	60	7.0	165	12	1982
	850	750	100	60	7.5	136	15	1983
	885	785	100	60	6.5	225	15	1984
	879	779	100	60	7.0	285	15	1985
	850	750	100	70	6.5	142	15	1986
24-hour[b]	254	226	28	60	7.0	165	24	1982
	174	146	28	50	6.0	122	24	1983
	209	181	28	70	6.5	155	24	1984
	193	165	28	60	7.0	73	24	1985
	204	176	28	70	7.0	118	24	1986
Annual	30	26	4	350	4.0	--	--	1982
	30	26	4	350	5.0	--	--	1983
	31	27	4	340	3.0	--	--	1984
	29	25	4	360	3.0	--	--	1985
	29	25	4	340	3.0	--	--	1986

Note: AAQS are 1,300 $\mu g/m^3$, 3-hour
260 $\mu g/m^3$, 24-hour
60 $\mu g/m^3$, annual

[a]Relative to the location of the Sanford plant.
[b]Highest, second-highest concentrations predicted for this averaging period.

Table 3-5. Maximum Predicted Total SO_2 Concentrations From the Refined Analysis for Comparison to AAQS

Averaging Period	Concentration ($\mu g/m^3$) Total	Total Due To: Modeled Sources	Total Due To: Background	Receptor Location[a]: Direction (°)	Receptor Location[a]: Distance (km)	Period: Julian Day	Period: Hour Ending	Period: Year
3-hour[b]	895	795	100	60	7.0	165	12	1982
24-hour[b]	254	226	28	60	7.2	165	24	1982
Annual	31	27	4	346	3.0	--	--	1984

Note: AAQS are 1,300 $\mu g/m^3$, 3-hour
260 $\mu g/m^3$, 24-hour
60 $\mu g/m^3$, annual

[a]Relative to the location of the Sanford plant.
[b]Highest, second-highest concentrations predicted for this averaging period.

Table 3-6. Source Contributions to the Maximum SO_2 Concentrations Predicted in the Refined Analysis

Source	Concentration ($\mu g/m^3$)		
	Annual	24-hour	3-hour
Sanford	4.9	61.4	202.6
Turner	9.1	163.6	588.2
DeBary	7.3	0.4	4.3
OUC Stanton Energy Center	0.5	0.0	0.0
C.A. Meyer	0.2	0.2	0.0
New Smyrna Beach Utility	1.0	0.0	0.0
Martin Asphalt	4.3	0.1	0.0
Total	27.3	225.7	795.1

Table 3-7. Maximum Predicted SO_2 Concentrations From the Screening Analysis for Comparison to PSD Class II Increments

Averaging Period	Maximum Concentration ($\mu g/m^3$)	Receptor Location[a] Direction (°)	Receptor Location[a] Distance (km)	Period Julian Day	Period Hour Ending	Period Year
3-hour[b]	228	260	3.0	305	12	1982
	264	160	1.3	82	12	1983
	320	20	1.3	209	15	1984
	260	300	1.0	193	12	1985
	279	240	1.3	137	15	1986
24-hour[b]	45	260	4.0	305	24	1982
	44	300	4.0	130	24	1983
	54	230	1.3	82	24	1984
	55	200	1.3	148	24	1985
	51	300	3.0	273	24	1986
Annual	4.3	360	4.0	--	--	1982
	4.1	240	4.0	--	--	1983
	4.7	300	4.0	--	--	1984
	4.7	120	5.0	--	--	1985
	4.7	120	4.0	--	--	1986

[a]Relative to the location of the Sanford plant.
[b]Highest, second-highest concentrations predicted for this averaging period.

Table 3-8. Maximum Predicted SO_2 Concentrations From the Refined Analysis for Comparison to PSD Class II Increments

Averaging Period	Maximum Concentration ($\mu g/m^3$)	Receptor Location[a] Direction (°)	Receptor Location[a] Distance (km)	Period Julian Day	Period Hour Ending	Period Year	PSD Class II Increment
3-Hour[b]	348	22	1.2	209	15	1984	512
24-Hour[b]	59	202	1.1	148	24	1985	91
Annual	4.8	126	4.4	-	-	1984	20

[a]Relative to the location of the Sanford plant.
[b]Highest, second-highest concentrations predicted for this averaging period.

Table 3-9. Comparison of Maximum SO_2 Predicted Impacts For Various Emission Strategies--Refined Analysis

Emission Scenario	Averaging Time	Year	Concentration ($\mu g/m^3$)	Direction (°)	Distance (m)	Day	Hour Ending
Current Emissions:	Annual	1984	6.3	240	3,700	–	–
Units 3, 4, and 5 at	24-Hour	1985	85	202	1,100	148	–
1.65 lb/10^6 Btu	3-Hour	1984	484	20	1,100	209	15
Proposed Emissions:	Annual	1984	7.5	240	4,300	–	–
Units 3, 5, at 1.1	24-Hour	1985	115	202	1,100	148	–
lb/10^6 Btu, Unit 4 at 4.3 lb/10^6 Btu	3-Hour	1984	667	22	1,200	209	15
Maximum PSD Increment	Annual	1984	1.5	302	5,300	–	–
Consumed from	24-Hour	1985	32	202	1,200	148	–
Current to Proposed Emission Scenario	3-Hour	1984	188	22	1,200	209	15

The maximum increments consumed in going from the current to proposed emission scenario are 1.5 $\mu g/m^3$ for annual averaging, 32 $\mu g/m^3$ for 24-hour averaging, and 188 $\mu g/m^3$ for 3-hour averaging. The allowable PSD increments are 20, 19, and 512 $\mu g/m^3$, respectively.

3.5 CONCLUSIONS

The proposed Orimulsion test burn in Sanford Unit 4 will produce maximum predicted SO_2 and PM concentrations that are expected to comply with the AAQS and PSD Class II increments. These results are based on PM emission rates for the proposed test burn that include excess emissions occurring for 3 hours during a 24-hour period at all three units.

For PM, the maximum concentration due to the test burn alone is predicted to be less than the significant impact levels. For SO_2, the maximum concentrations due to emissions from the Sanford plant and other sources are predicted to be below the AAQS and PSD Class II increments.

4.0 ADDITIONAL IMPACT ANALYSIS

4.1 IMPACTS ON VEGETATION

The response of vegetation to atmospheric pollutants is influenced by the concentration of the pollutant, duration of the exposure and the frequency of exposures. The pattern of pollutant exposure expected from the facility is that of a few episodes of relatively high ground-level concentration which occur during certain meteorological conditions interspersed with long periods of extremely low ground-level concentrations. If there are any effects of stack emissions on plants they will be from the short-term higher doses. A dose is the product of the concentration of the pollutant and the duration of the exposure. The impact of the Sanford Unit 4 test burn on regional vegetation was assessed by comparing pollutant doses that are predicted from modeling with threshold doses reported from the scientific literature which could adversely affect plant species typical of those present in the region.

4.1.1 SULFUR DIOXIDE

The maximum total 3-hour average SO_2 concentration resulting from the test burn is predicted to be 448 $\mu g/m^3$ [348 $\mu g/m^3$ (Table 3-2) plus 100 $\mu g/m^3$ background]. This concentration is predicted to occur about 1.2 km (0.75 mile) north-northeast of the stacks and represents the concentration that would occur during the worst-case meteorological conditions of the past five years. The maximum 3-hour average ground-level concentration predicted for the other four years are 85 percent or less of the maximum concentration. Concentrations decrease with distance beyond the location of the maximum concentration.

The maximum total predicted 24-hour average SO_2 concentration resulting from the test burn is 87 $\mu g/m^3$ [59 $\mu g/m^3$ (Table 3-2) plus 28 $\mu g/m^3$ background] and is located approximately 1.1 km (0.70 mile) south-southeast of the stacks. The maximum total predicated annual SO_2 concentration is 7.4 $\mu g/m^3$ [3.4 $\mu g/m^3$ (Table 3-2) plus 4 $\mu g/m^3$ background]. This concentration is predicted to occur 4.9 km (3.1 miles) to the southwest of the stacks.

These concentrations and averaging times can be compared with SO_2 doses known to adversely affect plant species that are presented in Table 4-1. The expected doses from the test burn combined with background sources are much lower than doses known to cause a detrimental effect on vegetation.

4.1.2 PARTICULATE MATTER--TSP AND PM10

Predicted impacts of these pollutants are less than the significant impact levels (see Table 3-3). As a result, no impacts are expected to occur to vegetation as a result of temporarily increasing PM/PM10 emissions.

4.2 IMPACTS TO SOILS

SO_2 that reaches the soil by deposition from the air is converted by physical and biotic processes to sulfates. (Particulates have no affect on soils at the levels predicted.) The effects can be beneficial to plants if sulfates in native soils are less than plant requirements for optimum growth. However, sulfates can also increase acidity of unbuffered soils, causing adverse effects due to changes in nutrient availability and cycling. The predicted concentrations of SO_2 from stack emissions are not expected to have a significant adverse effect on soils in the vicinity because:

1. The predicted concentrations are low;
2. Fertilizer and ground limestone is generally applied to lands being used for crops, pasture, and citrus; and
3. Emissions of SO_2 from the proposed test burn are equivalent to or less than quantities previously emitted and permitted for.

Therefore, the facility is not expected to have a significant adverse impact on regional vegetation or soils.

4.3 IMPACTS DUE TO ADDITIONAL GROWTH

A limited number of additional personnel will be temporarily added to the current plant personnel complement. These additional personnel are expected to have an insignificant effect on the residential, commercial, and industrial growth in Volusia County.

Table 4-1. SO_2 Doses Reported to Affect Plant Species Similar to Vegetation in the Region of the Sanford Plant

Pollutant	Species	Dose and Effect	Reference
SO_2	Strawberry	1,040 $\mu g/m^3$ for 6 hours per day for 3 days had no affect on growth	Rajput et al., 1977
SO_2	Citrus	2,080 $\mu g/m^3$ for 23 days with 10 day interruption reduced leaf area	Matsushima and Brewer, 1972
SO_2	Ryegrass	42 $\mu g/m^3$ for 26 weeks or 367 $\mu g/m^3$ for 131 days reduced dry weight	Bell et al., 1979 Ayazaloo and Bell, 1981
SO_2	Tomato	1,258 $\mu g/m^3$ for 5 hours per day, for 57 days, reduced growth	Kohut et al., 1983
SO_2	Duckweed	390 $\mu g/m^3$ for 6 weeks reduced growth	Fankhauser et al., 1976
SO_2	Lichens (Parmotrema and Ramalina spp.)	400 $\mu g/m^3$ 6 hours per week for 10 weeks reduced CO_2 uptake and biomass gain of Ramalina, not Parmotrema	Hart et al., 1988
SO_2	Bald Cypress	1,300 and 2,600 $\mu g/m^3$ for 48 hours. Only 2,600 $\mu g/m^3$ reduced leaf area.	Shanklin and Kozlowski, 1985
SO_2	Green Ash	210 $\mu g/m^3$ for 4 hours per day, 5 days per week for 6 weeks reduced growth	Chappelka et al., 1988

Orimulsion will be delivered by truck every week to the facility in the same manner as residual oil. As a result, no additional impacts will occur.

Therefore, no air quality related impacts associated with residential, commercial and industrial growth are anticipated.

4.4 IMPACTS TO VISIBILITY

The Sanford Plant is located greater than 100 km from a Class I area; pursuant to Chapter 17-2.500(5)(d)1.e., F.A.C., a visibility impact analysis is not required.