

Technical Evaluation  
and  
Preliminary Determination

Florida Power & Light Company  
Orimulsion Test for Sanford Power Plant Unit 4  
Volusia County, Florida

Permit Number: PSD-FL-150  
AC64-180842

Florida Department of Environmental Regulation  
Division of Air Resources Management  
Bureau of Air Regulation

August 2, 1990

## I. Application

### A. Applicant

Florida Power & Light Company (FPL)  
P. O. Box 078768  
West Palm Beach, FL 33407-0768

### B. Project and Location

The applicant proposes to conduct a pilot test program for burning Orimulsion fuel at its Sanford power plant's existing Unit 4 boiler located in Volusia County, Florida. Orimulsion is an emulsion of 71 percent bitumen in 29 percent water and is being marketed by the Petroleos de Venezuela, national petroleum company of Venezuela. The test burn will evaluate the performance of air emissions control equipment as well as the economic and operational performance of using Orimulsion as a fuel. The test will temporarily increase Unit 4's emissions of particulate matter (PM), particulate matter less than 10 micrometers in diameter (PM10), sulfur dioxide (SO<sub>2</sub>), and opacity.

The UTM coordinates of the facility are Zone 17, 408.3 km east and 3190.3 km north.

### C. Facility Category

The Sanford facility is major in accordance with Rule 17-2.100 of the Florida Administrative Code (F.A.C.). It is classified in accordance with Standard Industrial Classification (SIC) Code as Industry No. 4911.

The source is classified best by NEDS Source Classification Code (SCC) 1-01-004-01.

FPL's application was received on May 22, 1990, and was deemed complete on August 1, 1990.

## II. Project Description

The Orimulsion test burn at Sanford Unit 4 will demonstrate the practicality of firing Orimulsion fuel in a large, front wall-fired utility boiler. Sanford Unit 4 has a maximum heat input of  $4,050 \times 10^6$  Btu/hour and fires No. 6 fuel oil. This unit has a net summer capacity of 362 MW and was commercially in-service in July 1972. The purpose will be to evaluate the performance of air emissions control equipment and to generate a technical database for the engineering and design of the potential future conversion to Orimulsion of the Sanford plant and several other large generating units in FPL's system.

Test burning of Orimulsion at Sanford Unit 4 will provide the opportunity to evaluate the technical and operational features under utility operating conditions. Various technical uncertainties will be clarified or resolved during this test burn period. Fuel handling, storage and combustion, properties of the flue gas, removal efficiency of gaseous and particulate pollution control devices, solid waste handling and disposal, and equipment performance and operating characteristics will be tested and evaluated. The knowledge and experience gained during the test burn will assess the feasibility of full conversion. Figure 1 shows a diagram of the test burn.

### III. Rule Applicability

The Sanford facility is located in Volusia County, which is in an attainment area for all criteria pollutants (F.A.C. Rule 17-2.420), therefore, Rule 17-2.500 applies.

The proposed project will emit the pollutants PM/PM10 and SO<sub>2</sub> at levels above that currently permitted.

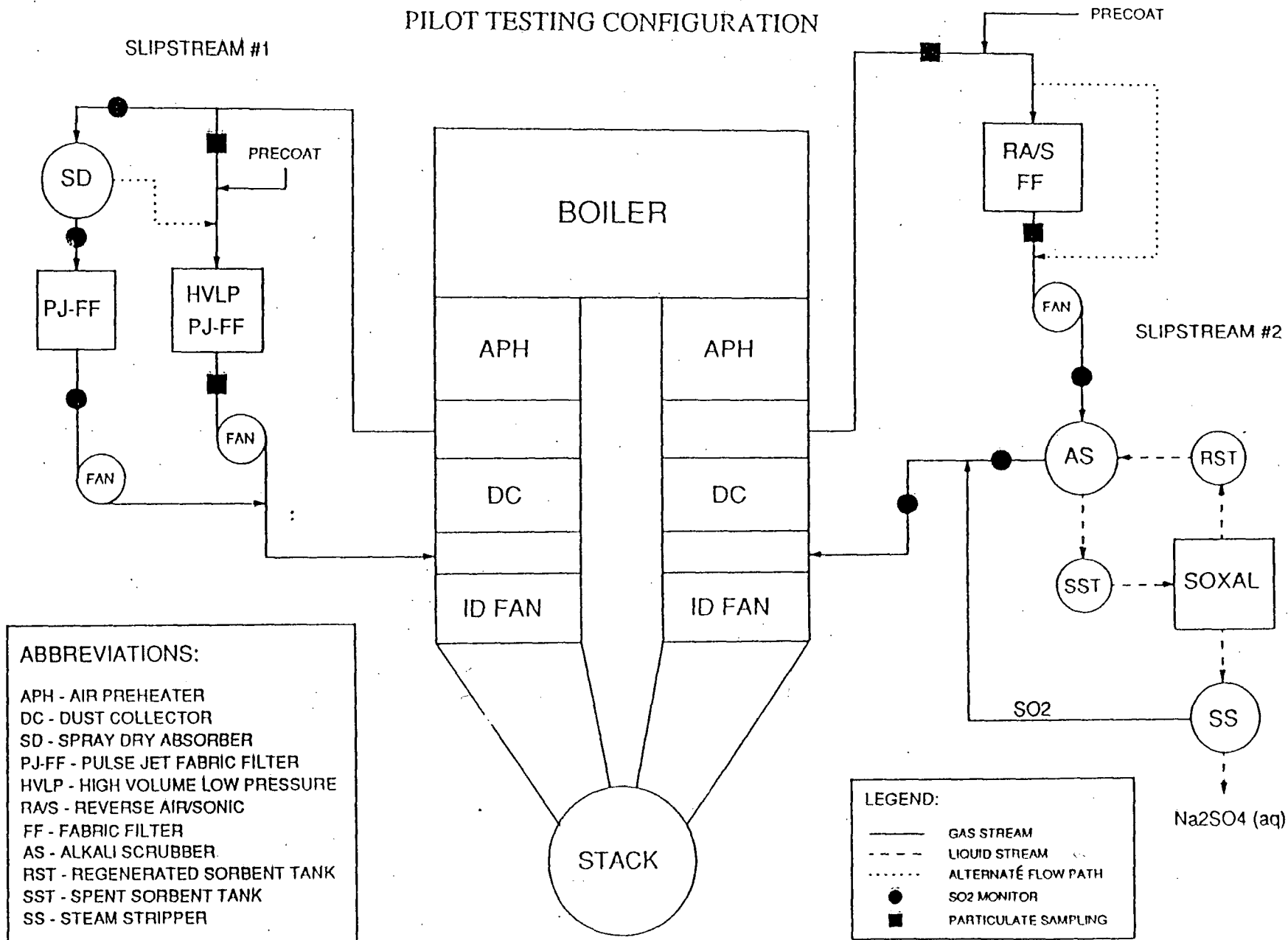
Only minimal plantwide changes are required for the fuel switch. Best Available Control Technology (BACT), F.A.C. Rule 17-2.630, will not apply.

The proposed test burn will not be subject to NSPS in accordance with 40 CFR 60, Section 60.14, since the unit is capable of accommodating Orimulsion fuel with only minimal changes to the burners.

The proposed testing will be performed in accordance with Rule 17-103.120, F.A.C., "Department Approval of Testing and Research Programs for Air Pollution Sources", and a PSD Permit after the State Implementation Plan has been revised. The tests will require the allowance of exceedances for Sanford Unit 4 of FDER limitations for PM emissions [Rule 17-2.600 (5)(a)2], visible emissions [Rule 17-2.600(5)(a)1.], and SO<sub>2</sub> emissions [Rule 17-2.600(5)(a)3a.(xi)]. Table 1 presents the proposed emission limits. Emissions of other regulated pollutants are not expected to increase. The applicant has agreed to limit total plant SO<sub>2</sub> emission to the maximum currently allowed under current emission limits of 2.75 lb/10<sup>6</sup> Btu. This will be accomplished by limiting emissions from Unit Nos. 3 and 5 to 1.1 lb/10<sup>6</sup> Btu.

The increase in PM, PM10, and SO<sub>2</sub> emissions will consume PSD increment over that currently permitted. Dispersion modeling has been performed to demonstrate compliance with these limits.

# ORIMULSION TEST BURN AIR EMISSIONS CONTROL PILOT TESTING CONFIGURATION



**ABBREVIATIONS:**

APH - AIR PREHEATER  
 DC - DUST COLLECTOR  
 SD - SPRAY DRY ABSORBER  
 PJ-FF - PULSE JET FABRIC FILTER  
 HVLP - HIGH VOLUME LOW PRESSURE  
 RA/S - REVERSE AIR/SONIC  
 FF - FABRIC FILTER  
 AS - ALKALI SCRUBBER  
 RST - REGENERATED SORBENT TANK  
 SST - SPENT SORBENT TANK  
 SS - STEAM STRIPPER

**LEGEND:**

— GAS STREAM  
 - - - LIQUID STREAM  
 ····· ALTERNATE FLOW PATH  
 ● SO2 MONITOR  
 ■ PARTICULATE SAMPLING

FIGURE 1

Table 1. Proposed Unit 4 Emissions (Page 1 of 2)

Parameters

Boiler Heat Input, Btu/hr	4,050
Stack Height, ft (m)	400 (121.9)
Stack Diameter, ft (m)	19.2 (5.84)
Stack Gas Velocity, ft/sec (m/sec)	73.4 (22.38)
Stack Gas Exit Temperature, °F (K)	313 (429)

Current Emission Limits and Rates

SO <sub>2</sub> Limit	
lb/10 <sup>6</sup> Btu	2.75 <sup>a</sup>
lb/hr (g/sec)	11,137.5 (1403.3)

	<u>Steady-State</u>	<u>3 hrs/24 hrs Excess Emissions</u>
PM Limit		
lb/10 <sup>6</sup> Btu	0.1	0.3
lb/hr (g/sec)	405.0 (51.0)	1215.0 (153.1)
PM10 Rate		
lb/10 <sup>6</sup> Btu	0.09	0.09
lb/hr (g/sec)	359.0 (45.2)	359.0 (45.2)
Visible Emission Limit		
Opacity	40%	60% with up to four 6-minute periods of up to 100% if unit has an operational opacity CEM (continuous emissions monitor)

Table 1. Proposed Unit 4 Emissions (Page 2 of 2)

Projected Emission Rates

SO <sub>2</sub>		
lb/10 <sup>6</sup> Btu		4.3 <sup>b</sup>
lb/hr (g/sec)		17,415 (2,194)
	<u>Steady-State</u>	<u>3 hrs/24hrs Excess Emissions</u>
PM		
lb/10 <sup>6</sup> Btu	0.3	0.6
lb/hr (g/sec)	1215.0 (153.1)	2430.0 (306.2)
PM10		
lb/10 <sup>6</sup> Btu	0.3	0.6
lb/hr (g/sec)	1215.0 (153.1)	2430.0 (306.2)
Visible Emissions		
Opacity	60%	100%

Note: Btu/hr = British thermal units per hour.  
 ft/sec = feet per second.  
 g/sec = grams per second.  
 K = degrees Kelvin.  
 lb/10<sup>6</sup> Btu = pounds per million British thermal units.  
 lb/hr = pounds per hour.  
 m = meters.  
 m/sec = meters per second.

<sup>a</sup>Baseline emission rates are 1.1 lb SO<sub>2</sub>/10<sup>6</sup> Btu; 4,455 lb/hour (561.3 g/sec).

<sup>b</sup>Based on 13,000 Btu/lb and 2.8 percent sulfur.

The proposed temporary increase in PM, SO<sub>2</sub>, and visible emission limits must be approved by the Environmental Protection Agency (EPA) as part of Florida's State Implementation Plan.

The proposed project is subject to the compliance testing and reporting requirements in accordance with F.A.C. Rule 17-2.700. Testing for PM, visible emissions, and SO<sub>2</sub> will be performed to demonstrate compliance with the proposed emission limits. Testing for Sulfuric Acid Mist, Nitrogen Oxides (NO<sub>x</sub>), Volatile Organic Compounds (VOCs), and metals will be performed for informational purposes only. Stack tests will be conducted using the following test methods:

- a. 40 CFR 60 Appendix A, EPA Method 5 or 17 for PM
- b. 40 CFR 60 Appendix A, EPA Method 8 for Sulfuric Acid Mist
- c. 40 CFR 60 Appendix A, EPA Method 7E for NO<sub>x</sub>
- d. 40 CFR 60 Appendix A, EPA Method 6C for SO<sub>2</sub>
- e. 40 CFR 60 Appendix A, EPA Method 25A for VOCs
- f. EMTIC Interim Test Method for Metal Emissions
- g. 40 CFR 61 Appendix B, EPA Method 101 for mercury
- h. Continuous Emission Monitor for opacity

#### IV. Source Impact Analysis

##### A. Emission Limitations

The emission limitations for this project are shown in Table 1.

##### B. Air Quality Analysis

Preliminary modeling of the Sanford plant's increase in emissions indicated that the predicted SO<sub>2</sub> concentration were above the significant impact levels. The predicted PM concentrations were predicted to be below the significant impact levels. Therefore, the modeling analysis considered only the potential interaction of SO<sub>2</sub> emissions between the Sanford plant and other sources.

An emission inventory for other SO<sub>2</sub> sources was developed from the FDER's AIR10 and APIS inventories, permits, and prior modeling studies. These databases were used to obtain a list of all sources within 50 km of the Sanford plant. The counties included in this inventory were Volusia, Orange, Seminole, and Lake. For the FPL Sanford and the FPC Turner and DeBary plants, source parameters were obtained from permits and previous air dispersion modeling analyses. The AIR10 and APIS inventories were used to obtain stack parameters for other sources.

All facilities located within 50 km of the Sanford site with SO<sub>2</sub> emissions greater than 25 tons per year (TPY) were included for consideration in the modeling analysis. A listing of facilities, locations, relative position with respect to the Sanford plant, and maximum allowable emissions is enclosed with the application.

The air quality impact analysis required by the PSD regulations for SO<sub>2</sub> includes:

- An analysis of existing air quality;
- A PSD increment analysis;
- An Ambient Air Quality Standards (AAQS) analysis;
- An analysis of impacts on soils, vegetation, visibility, and growth-related air quality impacts; and
- A Good Engineering Practice (GEP) stack height determination.

The analysis of existing air quality generally relies on FDER monitoring data collected in accordance with EPA-approved methods. The PSD increment and AAQS analysis depend on air quality dispersion modeling carried out in accordance with EPA guidelines.

Based on these required analyses, the Department has reasonable assurance that the proposed facility, as described in this permit and subject to the conditions of approval proposed herein, will not cause or contribute to violation of any PSD increment or ambient air quality standard.

#### a. Modeling Methodology

All modeling completed by the applicant followed the EPA Guideline on Air Quality Models (Revised), w/Supplement A (1987). The Industrial Source Complex Short-Term (ISCST) model (version 6-88207) was used to predict the current and proposed impacts of the fuel switch on the surrounding ambient air. The model determines ground-level concentrations of inert gases and small particles emitted into the atmosphere by point, area, or volume-type sources. It incorporates elements for plume rise, transport by the mean wind, and Gaussian dispersion. In addition, the model allows for the separation of sources, building wake downwash, adjustment for calm conditions, and various other input and output features.



Five years of sequential hourly meteorological data (1982-1986) from the National Weather Service (NWS) office in Orlando was used in the model. The model uses each hour of meteorology separately to calculate short-term concentrations. Since 5 years of data was used, the highest, second-high short-term predicted concentrations are compared with the appropriate ambient standards. For the annual averages, the highest predicted yearly average was compared to the standards.

The stack and emission characteristics used in the ISCST modeling are listed in Table 1. All other major SO<sub>2</sub> sources within 50 kilometers (km) of FPL Sanford were included in the analysis. A background value taken from air quality measurements, was added to the modeling impacts for the AAQS analysis. Building wake downwash effects were included in the modeling by inputting the appropriate building characteristics for Units 4 and 5. Unit 3, being below GEP, was affected by downwash. Unit 4 is within 2% of GEP stack height.

For the screening phase, receptors were located in radial grids that consisted of 36 radials with radials located at 10° increments. Two sets of receptor grids were used. The first set consisted of receptors located along each radial at distances of 1,000, 2,000, 3,000, 5,000, 7,500, 10,000, 20,000, 30,000, 40,000, and 50,000 meters (m) to determine the significant impact area. The second set of receptors, which were used to determine maximum impacts, were input at distances of 100, 400, 700, 1,000, 1,300, 1,600, 2,000, 3,000, 4,000, and 5,000 m along each radial. For both grids, the Sanford plant was assumed to be at the center of the grids. Modeling with the latter receptor grid indicated that maximum short-term impacts were occurring at the 5,000-m distance in the direction of the FPC Turner plant. Therefore, additional receptors located at distances of 5,500, 6,000, 6,500, 7,000, and 7,500 m were modeled for directions from 50° to 70° from the Sanford plant.

The refinement phase of the modeling used receptor grids with a radial receptor spacing of 100 m and a 2° spacing centered on the receptor at which the highest, second-highest maximum concentration was produced in the screening grid. The refined grids were bordered by the adjacent screening grid receptors. To ensure that a valid highest, second-highest concentration was calculated, concentrations were predicted for the entire year with the refined grid.

The nearest PSD Class I area to the Sanford plant is the Chassahowitzka National Wilderness Area, located 125 km west-southwest of the Sanford plant. Since this area is over 100 km from the plant, impact analyses are not required. In addition, impacts are not expected to be significant.

A more detailed description of the modeling analysis, along with the model output, is contained in the Sanford application.

#### b. Analysis of Existing Air Quality

Volusia County had one continuous SO<sub>2</sub> monitor located in DeBary, but it was removed January 19, 1989. Ambient air quality data from the year 1988 are summarized in Table 2. The highest measured concentrations reported by FDER in 1988 were assumed to represent the background SO<sub>2</sub> levels in the vicinity of the Sanford plant. These concentrations are 100, 28, and 4 µg/m<sup>3</sup> for the 3-hour, 24-hour, and annual averaging periods, respectively. It should be noted that the highest measurements most likely include contributions from the nearby DeBary and Turner plants. Because these plants are also modeled in the analysis, the background values are considered to provide a conservative estimate of total air quality.

#### c. PSD Increment Analysis

The results for SO<sub>2</sub> 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. The maximum 3-hour, 24-hour, and annual average concentrations are 348, 59, and 4.8 µg/m<sup>3</sup>, respectively, which are 68, 65, and 24 percent of the allowable increments, respectively.

Table 2. Summary of Ambient SO<sub>2</sub> Data, Volusia County, 1988

Site No.	Site Name	Time Period	No. Obs.	Sulfur Dioxide Concentration ( $\mu\text{g}/\text{m}^3$ )				
				Max. 3-hr	2nd Max. 3-hr	Max. 24-hr	2nd Max. 24-hr	Arith. Mean
0930001F02	DeBary	Jan-Dec	8425	100	90	28	25	4

Source: FDER, 1988.

Table 3. Maximum Predicted SO<sub>2</sub> Concentrations From the Refined Analysis for Comparison to PSD Class II Increments

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

<sup>a</sup>Relative to the location of the Sanford plant.

<sup>b</sup>Highest, second-highest concentrations predicted for this averaging period.

#### d. Ambient Air Quality Standards (AAQS) Analysis

The maximum SO<sub>2</sub> impacts due to all sources in the vicinity of the Sanford plant are presented in Table 4. The maximum refined 3-hour, 24-hour, and annual average concentrations are 895, 254, and 31 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ), respectively, which are below the AAQS of 1300, 260, and 60  $\mu\text{g}/\text{m}^3$ , respectively. 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.

#### e. Additional Impacts Analysis

##### 1. Impacts on Soils and Vegetation

The total ground-level ambient concentration of SO<sub>2</sub> is predicted to be less than the secondary air quality standard. The secondary standard for SO<sub>2</sub> is equal to the primary standard and is designed to protect public welfare-related values. As such, SO<sub>2</sub> is not expected to have a harmful effect on soils and vegetation.

##### 2. Growth-Related Air Quality Impacts

The proposed Sanford facility is not expected to significantly change employment, population, housing, or commercial/industrial development in the surrounding area to the extent that a significant air quality impact will result.

##### 3. GEP Stack Height Determination

Good Engineering Practice (GEP) stack height is defined as the greater of: (1) 65 meters or (2) the maximum nearby building height plus 1.5 times the building height or projected width, whichever is less. Applicants cannot take credit for additional pollutant dispersion from stacks built higher than GEP stack height. Unit 4 is 2% taller than GEP stack height, but the overall effect of this difference on model-predicted ambient air concentrations is insignificant (1  $\mu\text{g}/\text{m}^3$ , 3-hour PSD concentration).

Table 4. Maximum Predicted Total SO<sub>2</sub> Concentrations From the Refined Analysis for Comparison to AAQS

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

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

<sup>a</sup>Relative to the location of the Sanford plant.

<sup>b</sup>Highest, second-highest concentrations predicted for this averaging period.

## V. Conclusion

The proposed Orimulsion test burn in Sanford Unit 4 will produce maximum predicted SO<sub>2</sub> 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<sub>2</sub>, 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.