VISIBILITY MODELING ANALYSIS

RAYONIER PERFORMANCE FIBERS, LLC
JESUP, GEORGIA

Submitted For:

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EXECUTIVE SUMMARY

Section 40 Code of Federal Regulations (CFR) Part 51.302 requires Best Available Retrofit Technology (BART) on stationary emission units constructed between August 7, 1962 and August 7, 1977 if they have the potential to emit more than 250 tons per year of any visibility impairing pollutant. A Modeling Protocol was developed and conformed to comments from GA EPD and the Federal Land Managers having Class I areas within 300 kilometers of the Rayonier Jesup Mill. The CALPUFF modeling results show the impact of all BART eligible emission units is less than 0.5 deciviews on all Class I areas within 300 kilometers and thereby qualify these emission units for the Exemption for BART pursuant to Section 40 CFR Part 51.303.

SECTION 1. INTRODUCTION

Under the regional haze rule, the Environmental Protection Agency (EPA) has issued final guidelines dated July 6, 2005 for Best Available Retrofit Technology (BART) determinations. The regional haze rule includes a requirement for BART for certain large stationary sources. Sources are BART-eligible if they have potential emissions of at least 250 tons per year of a visibility-impairing pollutant, were installed between August 7, 1962 and August 7, 1977, and fall within one of the 26 listed source categories listed in 40 CFR Part 52.21.

A state may exempt facilities in the State Implementation Plan from being subject to BART if those facility demonstrate insignificant impact on any Class I Federal area. Subsequent to a State Implementation Plan any facility subject to BART may apply for an exemption from that requirement under 40 CFR Part 51.303, provided they can demonstrate that the existing stationary source does not by itself or in combination with other sources, emit air pollutants that will cause or contribute to a significant impairment of visibility in any of the mandatory Class I Federal areas.

A BART engineering evaluation using five statutory factors – 1) existing controls; 2) cost; 3) energy and non-air environmental impacts; 4) remaining useful life of the source; 5) degree of visibility improvement expected from the application of controls – is required for any BART-eligible source that can be reasonably expected to cause or contribute to impairment of visibility in Class I areas. States must develop their implementation plans by December 2007. States will first identify the facilities that will have to reduce emissions under BART and then set BART emissions limits for those facilities.

As part of this process, the Visible Improvement State and Tribal Association of the Southeast (VISTAS) members agreed to develop a common BART Modeling Protocol[1] for use by the states and facilities subject to BART. The VISTAS recommended process for evaluating the BART-eligible sources are:

- Identify the BART eligible sources based on source category, when it was put in service, and the magnitude of emissions of one or more "visibility-impairing pollutants".
- Determine whether the BART eligible source can be excluded from BART controls by demonstrating that the source cannot be reasonably expected to cause or contribute to visibility impairment in a Class I area.
- Determine BART controls for the source by considering various control options and selecting the "best" alternative.
- Incorporate the BART determination into the State Implementation Plan (SIP).

The Rayonier Performance Fibers, LLC (Rayonier) Mill, a pulp and paper mill located in Jesup, Georgia has several BART eligible sources. Pulp and paper is listed as one of the 28 source categories in 40 CFR Part 52.21. The BART eligible sources at the Rayonier mill are the No. 5 Recovery Furnace, the No. 5 Smelt Dissolving Tank, wastewater treatment system, C-mill (digesters, brownstock washers and bleach plant), D-evaporators and the No. 3 Power Boiler.

[1] "Protocol for the Application of the CALPUFF Modeling for Analyses of Best Available Retrofit Technology (BART)", Visibility Improvement State and Tribal Association of the Southeast, July 18, 2006.

However, only the No. 5 Recovery Furnace, the No. 5 Smelt Tank and the No. 3 Power Boiler emit visibility impairing pollutants and were the only sources considered in the modeling analysis presented in this report.

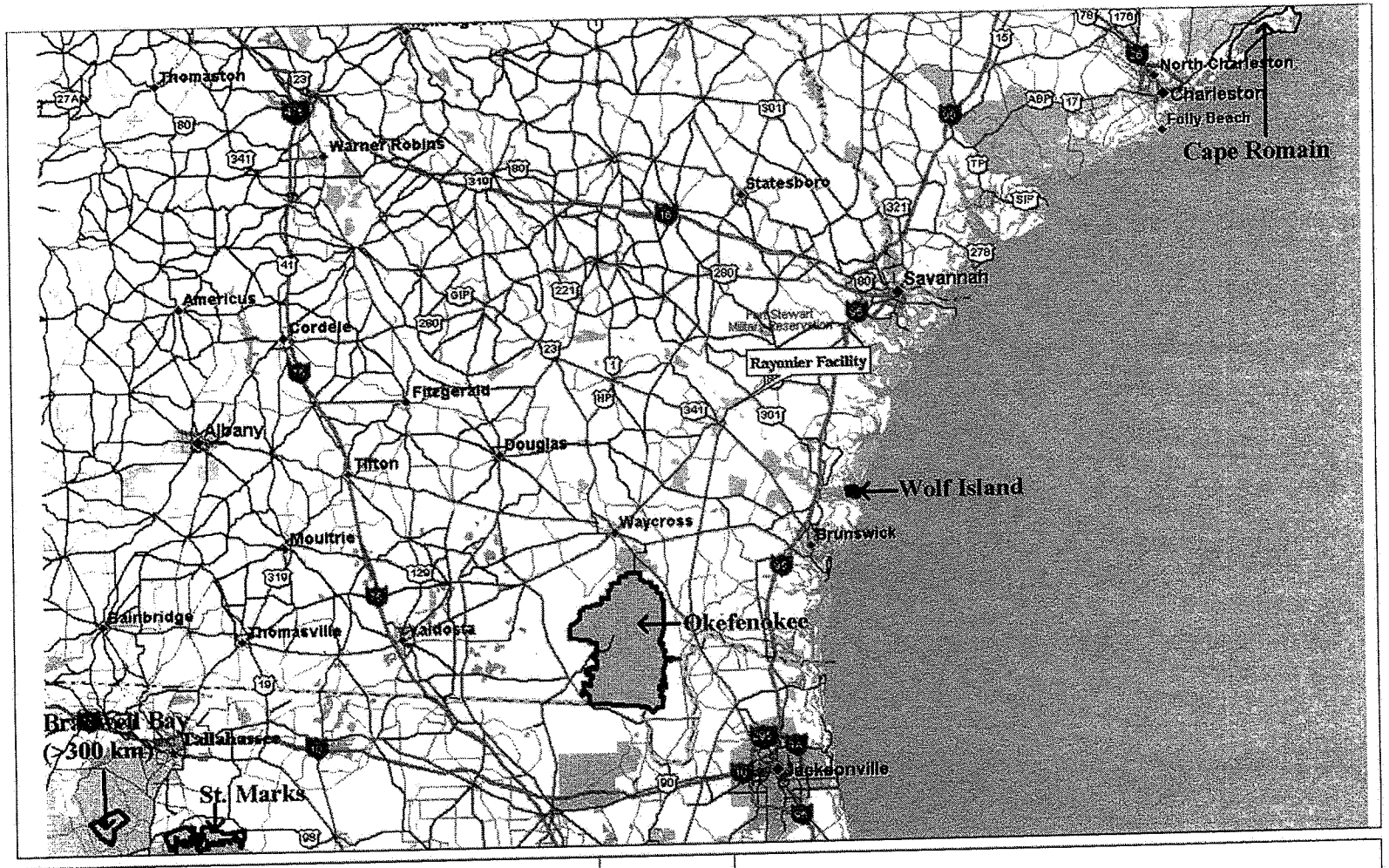
This report presents the approach and results of the Class I area visibility modeling analysis for Rayonier.

SECTION 2. MILL LOCATION

The Rayonier mill is located northeast of downtown Jesup, Georgia in Wayne County at approximate Universal Transverse Mercator (UTM) coordinates 420,019 meters Easting and 3,502,929 meters Northing, NAD83, Zone 17. Modeling for BART–eligible sources must be evaluated for Class I areas located within 300 km of the facility. Figure 2-1 shows the nearby Class I areas. Table 2-1 lists the Class I areas within 300 km of the Jesup mill. The distances given in Table 2-1 are the approximate distance from the mill to the nearest boundary of each Class I area.

Table 2-1
Class I Areas Within 300 Kilometers
Rayonier, Jesup, Georgia

Class I Area	State	Distance (kilometers)	Direction From Plant
Wolf Island	Georgia	58	Southeast
Okefenokee	Georgia	76	Southwest
Cape Romaine	South Carolina	246	Northeast
Saint Marks	Florida	264	Southwest



Scale In Kilometers

0 100 200

Source: Base Map Delorme Xmap 4.5, 2004, Version 4.5.0 - F2.1 - R1.115.1336.0079

Figure 2-1
Nearby Class I Areas

Rayonier Specialty Pulp Products
Wayne County
Jesup, Georgia

SECTION 3. MODELING APPROACH

According to 40 CFR Part 51, Appendix Y, dispersion modeling can be used to determine that an individual BART-eligible source can reasonably be anticipated to cause or contribute to visibility impairment in a Class I area and thus not be subject to BART control requirements. A BART-eligible source that is responsible for a 1.0 deciview (dv) change or more at a Class I area is considered to "cause" visibility impairment. A BART-eligible source that is responsible for a 0.5 dv change or more at a Class I area is considered to "contribute" to visibility impairment in a Class I area. Sources determined to cause or contribute to visibility impairment in a Class I area are subject to BART control requirements.

Since the distance to each of these Class I areas shown in Figure 2-1 is greater than 50 km, the use of CALPUFF (Version 5.574) to determine visibility impacts is acceptable. The CALMET/CALPUFF (as provided by VISTAS) modeling system was used to evaluate the impacts from the Rayonier BART eligible sources on the four Class 1 areas shown in Figure 2-1 and listed in Table 2-1. The analysis followed guidance provided in the VISTAS protocol guidance document dated July 18, 2006. Features of the CALPUFF modeling system include:

- A Gaussian puff dispersion formulation: Plumes are treated as a series of Gaussian puffs that move and disperse according to local meteorological conditions that vary in time and space.
- Three-dimensional meteorology: Wind and other meteorological variables are allowed to vary three-dimensionally.
- Aerosol chemistry: Secondary aerosol formation is treated according to a first-order mechanism that depends on the time of day, relative humidity, meteorology, background ozone concentration, and background ammonia concentration.
- Post-processing by CALPOST (Version 5.6393) specifically to assess regional haze: Visibility is characterized using extinction coefficients that vary with the concentrations of the aerosol species present, extinction characteristics of each aerosol species, and relative humidity.

Based on the VISTAS guidance, if the BART eligible potential emissions of SO_2 in tons per year (Q, based on the actual emissions for 2002) divided by the distance to each Class I boundary (d, in kilometers) is greater than 10, the source is subject to BART and no further exemption modeling will be performed by VISTAS. The facility either can proceed with using CALPUFF to evaluate BART control options or the facility can conduct its own modeling to determine impacts on the nearby Class I areas. If Q/d is less than 10, then VISTAS will conduct further modeling of the facility.

For Rayonier the 2002 actual emissions of SO_2 from the BART-eligible sources is 1,715 tons per year (based on information received from EPD). Table 3-1 shows the calculation for the four Class I areas located within 300 km of Rayonier. Since Q/d exceeds 10 for one of the Class 1 areas, all four Class 1 areas were evaluated.

Table 3-1
Class I Modeling

Class I Area	Distance from Rayonier (km)	Q/d
Wolf Island	58	30
Okefenokee	76	23
Cape Romain	246	7.0
Saint Marks	264	6.5

To further determine if a BART-eligible source is subject to BART, a two tier approach is recommended by VISTAS. The first step is to model the facility (sources) with CALPUFF using a 12-km grid CALMET file {this is available from Georgia Environmental Protection Division (EPD)}. If the facility modeling shows twenty-four hour impacts less than 0.5 dv, then no further modeling is required. If the facility modeling impacts are greater than 0.5 dv, then further modeling can be conducted using a more refined 4 km CALMET input file. If the impacts using the 4 km CALMET input file are less than 0.5 dv, then the source is exempted from further BART evaluation. If the impacts exceed 0.5 dv, then the Rayonier sources are required to implement BART.

For the 12-km initial modeling exemption test, the highest single 24-hour average value across the receptors in the Class I area are compared to the threshold value of 0.5 dv. The 12-km modeling results can be used to focus finer grid modeling on only those Class I areas where impacts greater than 0.5 dv are projected in the 12-km modeling. If required, the 4 km analyses uses either the 8th highest day in each year or the 22nd highest day in the 3-year period, whichever is more conservative, for comparison to the exemption threshold.

3.1 Model Configuration And Settings

The 12-km CALPUFF visibility modeling was conducted using the settings specified in Section 4 of the VISTAS protocol document (Revision 3 – July 18, 2006). CALPUFF control file settings were as follows:

- Map Projection: Lambert Conic Conformal
- Datum: NWS-84
- Projection Origin: 40°N, 97°W
- Matching Parallels: 33°N, 45°N
- False X,Y at Projection Origin: X=0.0, Y=0.0
- Grid Origin: X = 137.973 km, Y = 1625.974 km
- Number of grid cells: NX = 160, NY = 172, grid spacing: 12 km
- Number of vertical layers: 10
- Cell face heights (m): 0, 20, 40, 80, 160, 320, 640, 1200, 2000, 3000, 4000
- Base time zone : 5
- Chemical transformation: Mesopuff II
- Transitional Plume Rise Modeled
- Partial Plume Penetration Modeled
- Plume Element Modeled as Puff

- Used Pasquill-Gifford Dispersion Coefficients

The CALPOST control file settings were as follows:

- Visibility Method 6
- Species considered in visibility analysis: SO_4, NO_3, Elemental Carbon (EC), Secondary Organic Aerosols (SOA), soil, coarse PM
- Single average natural background concentration that represents the haze index, based upon 20% best natural conditions days (See Section 3-4)
- f(RH) curve: FLAG (2000)
- FLAG (2000) Method: Bext change = 24 hr ave. source Bext / 24 hr ave. background Bext
- Extinction efficiencies (1/Mm per $\mu g/m^3$):
  - Ammonium Sulfate : 3
  - Ammonium Nitrate: 3
  - Organic Carbon: 4
  - Soil: 1
  - Elemental Carbon: 10
  - PM Coarse: 0.6
  - PM fine: 1

3.2 Emissions And Stack Parameters

The maximum 24-hour actual emissions of SO_2, H_2SO_4, NO_x, and PM_{10} were modeled. PM_{10} emissions were broken down further into the appropriate filterable and condensable portions and further into elemental carbon (soot), soil, coarse particulate and organics. The emission rate and PM_{10} speciation calculations are provided in Appendix A.

Table 3-2 shows the stack parameters to be used for the BART-eligible Rayonier sources. All Class I areas are greater than 50-km from the Jesup facility, therefore building downwash was not considered.

Table 3-2
Stack Parameters[a]

Source	UTM Easting (m)	UTM Northing (m)	Height (m)	Diameter (m)	Temperature (°K)	Exit Velocity (m/s)
No. 3 Power Boiler[b]	420,178	3,502,693	57.0	2.58	521	27.7
No. 5 Recovery Furnace	420,163	3,502,648	78.8	3.81	475	15.5
No. 5 Smelt Dissolving Tank	420,156	3,502,671	78.8	1.38	339	19.2

a Visibility impairing pollutants (PM, SO_2, NO_x and H_2SO_4) are not emitted from the BART-eligible wastewater treatment plant, C-mill, and D-evaporators and were not be included in the BART modeling analysis.
b A new scrubber has recently been installed on the No. 3 Boiler. The modeling was conducted based on the configuration of the stack when it was originally installed. To represent normal operation, the No. 3 Boiler was modeled firing on approximately 66% wood and 34% oil.

3.3 Receptors

Receptor location and elevation information for each of the four Class I areas modeled were obtained from the Federal Land Manager (FLM) website: http://www2.nature.nps.gov/air/Maps/Receptors/index.cfm.

3.4 Background

Background information for ammonia was set to 0.5 part per billion (ppb) for each Class I area modeled. The hourly ozone data files used in the 12-km modeling were extracted from the VISTAS standard ozone datasets using the SUBDOMN utility supplied in the CALPUFF PROfessional System Beta 5.0.306. The extraction domain was set as follows:

- Extraction Range
  X(km) Easting : Xmin = 668.0, Xmax = 1768.0
  Y(km) Northing: Ymin = -1164.0, Ymax = 264.0

The CALPOST monthly background concentrations of soil (BKSOIL) are shown in Table 3-3. The following outlines the method used in the calculation of BKSOIL for each Class I area modeled. The total background light extinction (b_{back}) for hygroscopic and non-hygroscopic particulates was calculated using the Haze Index (HI) given in *Appendix B of the Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Rule (2003).* Table 3-4 shows the Haze Index (HI) for each Class I area modeled. The b_{back} for the best days in each Class I area was calculated using the following equation:

$$b_{back} = 10 \cdot e^{HI/10}$$

Where HI is expressed in units of deciviews (dv).

The total b_{back} is the sum of the Rayleigh scattering coefficient (b_{ray}) and the extinction of all particulates in the background (b_{soil}).

$$b_{back} = b_{ray} + b_{soil}$$

Where $b_{ray} = 10\ Mm^{-1}$ and $b_{soil} = C_{soil} \cdot BKSOIL$, with $C_{soil} = 1.0$.

Unity monthly f(RH) values were used as input to the CALPOST control file, as recommended for this option in the VISTAS protocol document.

Table 3-3
CALPOST Background Soil Concentrations

Class I Area	BKSOIL ($\mu g/m^3$)
Wolf Island	4.54
Okefenokee	4.58
Cape Romain	4.45
Saint Marks	4.67

Table 3-4
Haze Index

Class I Area	Haze Index (HI) Best Days (dv)
Wolf Island	3.74
Okefenokee	3.77
Cape Romain	3.68
Saint Marks	3.83

SECTION 4. MODELING RESULTS

The 12-km screening visibility modeling results is presented in Table 4-1. As shown in Table 4-1, the maximum 24-hr change in deciview (dv) for each Class I area is less than 0.5 dv, therefore the BART eligible sources at the Rayonier Jesup facility are not subject to additional BART evaluation.

Table 4-1
Summary of Results for CALPUFF Modeling in VISTAS' 12-km Modeling Domain

Class I Area	Approximate Distance to Class I Area (km)	Number of days Exceeding 0.5 dv 2001	Number of days Exceeding 0.5 dv 2002	Number of days Exceeding 0.5 dv 2003	Number of days Exceeding 0.1 dv 3-yr period	Maximum 24-hr impact over 3 yr period (dv)
Wolf Island, GA	58	0	0	0	0	0.319
Okefenokee, GA	76	0	0	0	0	0.254
Cape Romain, SC	246	0	0	0	0	0.132
Saint Marks, FL	264	0	0	0	0	0.151

APPENDIX A

Emission Rate and PM_{10} Speciation Calculations

RAYONIER PERFORMANCE FIBERS, LLC
JESUP MILL
SO_2, NO_x and PM_{10} EMISSION RATE CALCULATIONS

No. 5 Recovery Furnace

Typical operation of the No. 5 Recovery Furnace is firing with Black Liquor solids (BLS), with a very small amount of oil being fired simultaneously to keep a constant flame. Stack Test data was available to determine the emission factor (EF) during typical operation for PM_{10} and NO_x. The ratio of the total heating value of the annual usage of oil to BLS in the No. 5 Recovery Furnace was used to calculate the emissions of SO_2. The percentage of oil fired compared to BLS during the year was only 0.26%, therefore the emissions of SO_2 from the No. 5 Recovery furnace was based upon firing only BLS.

No. 5 Smelt Dissolving Tank

PM_{10} emissions from the No. 5 Smelt Dissolving Tank are based upon stack test results. No other pollutants of concern are emitted.

No. 3 Power Boiler

Typical operation of the No. 3 Power Boiler uses a combination of wood and oil. Stack test data was available to determine the EF during typical operation for PM_{10} and NO_x. The ratio of the total heating value of the annual usage of wood to oil in the No. 3 Power Boiler was used to calculate the emissions of SO_2. The percentage of wood fired compared to oil during the year was 65.6%, therefore the emissions of SO_2 from the No. 3 Power Boiler was based upon firing 65.6% wood and 34.4% oil.

The stack parameters and modeled emission rates are shown in Tables 1 and 2.

Rayonier Performance Fibers, LLC
Jesup Mill
Sources Subject to BART

Table 1
Stack Parameters

Emission Unit	Easting (m)	Northing (m)	Stack Ht (m)	Stack Dia (m)	Exit Temp (K)	Velocity (m/s)
Recovery No. 5	420163	3502648	78.8	3.81	474.8	15.5
Smelter No. 5	420156	3502671	78.8	1.38	338.7	19.2
Power Boiler No. 3	420178	3502693	57.0	2.58	520.9	27.7

Table 2
Modeled Emission Rates

Emission Unit	PM_{10}			NO_x			SO_2		
	tpy	lb/hr	g/s	tpy	lb/hr	g/s	tpy	lb/hr	g/s
Recovery No. 5	136	31.1	3.92	329	75.1	9.47	201	45.8	5.77
Smelter No. 5	17.5	4.0	0.50	0	0	0	0	0	0
Power Boiler No. 3	203	46.4	5.84	276	63.1	7.94	1,098	250.6	31.58

BART Emission Calculations

RF01 - No. 5 Recovery Furnace

PM-10

Given: Worst Case PM-10 emission from firing Black Liquor solids (BLS)
Highest Stack Test ('03, '04) PM = 0.582 lb/tons black liquor solids (TBLS)
AP-42 Table 10.2-3, 1/95, PM-10 fraction = 74.8% of PM
Potential processing rate 626,754 TBLS/yr
Potential operating schedule 8,760 hr/yr

Conversions: 1 lb/hr = 0.126 gm/sec

Calculations:

$$\text{PM-10 (tons/yr)} = \frac{0.582\text{lbs PM}}{\text{TBLS}} X \frac{626{,}754 TBLS}{yr} X \frac{1 ton}{2{,}000 lbs} X \frac{74.8}{100} = 136 TPY$$

$$\text{PM-10 (lb/hr)} = \frac{136\text{tons}}{\text{yr}} X \frac{1 yr}{8{,}760 hr} X \frac{2{,}000 lbs}{ton} = 31.1 lb/hr$$

$$\text{PM-10 (gms/sec)} = \frac{31.1\text{ lbs}}{\text{hr}} X \frac{0.126 gms/\text{sec}}{1 lb/hr} = 3.92 gms/\text{sec}$$

RF01 - No.5 Recovery Furnace

NO_x

Given: Worst case emissions from firing BLS

Stack Test of No.6 RF (1990)	PM = 1.05 lb/TBLS
Potential processing rate	626,754 TBLS/yr
Potential operating schedule	8,760 hr/yr

Conversions: 1 lb/hr = 0.126 gm/sec

Calculations:

$$\text{NOx (tons/yr)} = \frac{1.05 \text{ lbs NOx}}{\text{TBLS}} X \frac{626{,}754 TBLS}{yr} X \frac{1 ton}{2{,}000 lbs} = 329 TPY$$

$$\text{NOx (lb/hr)} = \frac{329 \text{ tons}}{\text{yr}} X \frac{1 yr}{8{,}760 hr} X \frac{2{,}000 lbs}{ton} = 75.1 lb/hr$$

$$\text{NOx (gms/sec)} = \frac{75.1 \text{ lbs}}{\text{hr}} X \frac{0.126 gms/\text{sec}}{1 lb/hr} = 9.47 gms/\text{sec}$$

RF01 - No.5 Recovery Furnace

SO_2

Given: Normal operating conditions - firing BLS
Emission Factor = 0.64 lb SO_2 / TBLS
BLS Fuel heating value 6,000 Btu/lb
Potential BLS firing rate 71.5 Tons/hr
Potential operating schedule 8,760 hr/yr

Conversions: 1 lb/hr = 0.126 gm/sec

Calculations:

$$\text{Boiler Input Rating} = \frac{71.5\ \text{Ton BLS}}{\text{hr}} X \frac{6{,}000 Btu}{lb} X \frac{2{,}000 lb}{ton} = 858 mmBtu/hr$$

$$\text{SO2 (lb/hr)} = \frac{0.64}{\text{TBLS}} X \frac{71.5 TBLS}{hr} = 45.8 lb/hr$$

$$\text{SO2 (tons/yr)} = \frac{45.76\ \text{lbs SO2}}{\text{hr}} X \frac{8{,}760 hr}{yr} X \frac{1 ton}{2{,}000 lbs} = 201 TPY$$

$$\text{SO2 (gms/sec)} = \frac{45.76\ \text{lbs}}{\text{hr}} X \frac{0.126 gms/\text{sec}}{1 lb/hr} = 5.77 gms/\text{sec}$$

RF02 - No.5 Smelt Dissolving Tank

PM-10

Given: Worst case emissions from processing BLS

2004 Compliance Stack Test	0.062 lbs PM-10/TBLS
Potential processing rate	626,754 TBLS/yr
Potential operating schedule	8,760 hr/yr

Conversions: 1 lb/hr = 0.126 gm/sec

Calculations:

$$\text{PM-10 (tons/yr)} = \frac{0.056\,\text{lbs}}{\text{TBLS}} X \frac{626{,}754 TBLS}{yr} X \frac{1 ton}{2{,}000 lbs} = 17.5 TPY$$

$$\text{PM-10 (lb/hr)} = \frac{17.5\text{tons}}{\text{yr}} X \frac{1 yr}{8{,}760 hr} X \frac{2{,}000 lbs}{ton} = 4.0 lb/hr$$

$$\text{PM-10 (gms/sec)} = \frac{4.0\,\text{lbs}}{\text{hr}} X \frac{0.126 gms/\text{sec}}{1 lb/hr} = 0.50 gms/\text{sec}$$

PB03 - No.3 Power Boiler

PM-10

Given: Stack test Results used as normal operation
Stack Test (2004) PM = 0.097 lb/mmBtu
AP-42 Table 1.6-1, PM-10 fraction = (0.065/0.066 ratio of PM10 to PM)
Boiler Input Rating 485 mmBtu/hr
Potential processing rate 4,248,600 mmBtu/yr
Potential operating schedule 8,760 hr/yr

Conversions: 1 lb/hr = 0.126 gm/sec

Calculations:

$$\text{PM-10 (tons/yr)} = \frac{0.097\text{lbs PM}}{\text{mmBtu}} X \frac{4{,}248{,}600 MMBtu}{yr} X \frac{1 ton}{2{,}000 lbs} X \frac{0.065\text{ lb PM-10}}{0.066\text{ lb PM}} = 203 TPY$$

$$\text{PM-10 (lb/hr)} = \frac{203\text{tons}}{\text{yr}} X \frac{1 yr}{8{,}760 hr} X \frac{2{,}000 lbs}{ton} = 46.4 lb/hr$$

$$\text{PM-10 (gms/sec)} = \frac{46.4\text{ lbs}}{\text{hr}} X \frac{0.126 gms/\text{sec}}{1 lb/hr} = 5.84 gms/\text{sec}$$

PB03 - No.3 Power Boiler

NO_x

Given: Normal emissions based on stack test results
Emission Factor = 0.13 lb/mmBtu
Boiler Input Rating 485 mmBtu/hr
Potential operating schedule 8,760 hr/yr

Conversions: 1 lb/hr = 0.126 gm/sec

Calculations:

$$\text{NOx (tons/yr)} = \frac{0.13 \text{ lbs NOx}}{\text{mmBtu}} X \frac{485 MMBtu}{hr} X \frac{8{,}760 hr}{yr} X \frac{1 ton}{2{,}000 lbs} = 276 TPY$$

$$\text{NOx (lb/hr)} = \frac{276 \text{ tons}}{\text{yr}} X \frac{1 yr}{8{,}760 hr} X \frac{2{,}000 lbs}{ton} = 63.1 lb/hr$$

$$\text{NOx (gms/sec)} = \frac{63.1 \text{ lbs}}{\text{hr}} X \frac{0.126 gms/\text{sec}}{1 lb/hr} = 7.94 gms/\text{sec}$$

PB03 - No.3 Power Boiler

SO_2

Given: Normal firing scenario - fuel oil 34.4% / wood waste 65.6%
AP-42 Table 1.3-1, Fuel Oil Emission Factor = 157S lb/1000 gal
Fuel Oil Emission Factor = 157 x 1.4 = 220 lb SO_2 / 1000 gal
AP-42 Table 1.6-2, Wood Emission Factor = 0.025 lb/mmBtu
Fuel Normal Sulfur Content 1.4%
Boiler Input Rating 485 mmBtu/hr
Fuel heating value 151,000 Btu/gal
Potential firing rate 3,212 GPH
Potential operating schedule 8,760 hr/yr

Conversions: 1 lb/hr = 0.126 gm/sec

Calculations:

$$\text{SO2 - oil (tons/yr)} = \frac{220 \text{ lbs SO2}}{\text{k Gal}} X \frac{3.212 kGal}{hr} X \frac{34.4\%}{100\%} X \frac{8{,}760 hr}{yr} X \frac{1 ton}{2{,}000 lbs} = 1{,}063 TPY$$

$$\text{SO2 - wood (tons/yr)} = \frac{0.025 \text{ lbs SO2}}{\text{mmBtu}} X \frac{485 MMBtu}{hr} X \frac{65.6\%}{100\%} X \frac{8{,}760 hr}{yr} X \frac{1 ton}{2{,}000 lbs} = 34.9 TPY$$

$$\text{SO2 - total (tons/yr)} = 1{,}063 + 34.9 = 1{,}098 TPY$$

$$\text{SO2 (lb/hr)} = \frac{1{,}098 \text{ tons}}{\text{yr}} X \frac{1 yr}{8{,}760 hr} X \frac{2{,}000 lbs}{ton} = 250.6 lb/hr$$

$$\text{SO2 (gms/sec)} = \frac{250.6 \text{ lbs}}{\text{hr}} X \frac{0.126 gms/\text{sec}}{1 lb/hr} = 31.58 gms/\text{sec}$$

PM_{10} SPECIATION

The PM_{10} speciation used in the POSTUTIL control files are summarized in Table 3. The supporting calculations follow.

Table 3
PM_{10} Speciation Emission Rate Summary
Rayonier - Jesup Facility

Source	CALPUFF Size	FILTERABLE			CONDENSABLE		
		PMC	SOIL	EC	SO_4	SOA	SOIL
		coarse filterable inorganic	inorganic fine filterable	elemental carbon fine filterable	H_2SO_4	organic condensable	inorganic condensable - H_2SO_4
		(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)
No. 5 Recovery Furnace	PM800	1.33E-01					
	PM425	2.12E-01					
	PM187		7.36E-01				
	PM112		4.10E-01				
	PM081		5.89E-01			3.93E-02	1.17E-01
	PM056		1.26E+00	1.01E-01		3.93E-02	1.17E-01
	Total	3.45E-01	3.00E+00	1.01E-01	1.64E-01	7.86E-02	2.34E-01
No. 5 Smelter	PM800	8.14E-03					
	PM425	7.59E-02					
	PM187		1.33E-01	4.84E-03			
	PM112		3.93E-02	1.42E-03			
	PM081		7.59E-02	2.75E-03		3.34E-03	5.45E-03
	PM056		1.33E-01	4.84E-03		3.34E-03	5.45E-03
	Total	8.41E-02	3.82E-01	1.39E-02	6.42E-03	6.67E-03	1.09E-02
NO. 3 Power Boiler	PM800	2.80E-01					
	PM425	3.45E-01					
	PM187		2.58E-01	2.30E-03			
	PM112		7.95E-02	1.20E-03			
	PM081		2.80E+00	1.10E-01		4.42E-01	
	PM056		1.83E-01	1.40E-02		4.42E-01	
	Total	6.25E-01	3.32E+00	1.28E-01	7.93E-01	8.84E-01	

The speciation of PM10 into filterable and condensable was based upon the results presented in Table 2 of the NCASI study of PM speciation:
"Summary PM data for Kraft Mill Sources - July 2006 with Appendices"

Table 2. Recovery Furnace Data Summary
Kraft Non-DCE Recovery Furnace

Parameter	Measurement Method	No. of Sources	Range (lb/ton BLS)	Mean (lb/ton BLS)	[5]Mean Percent of PM
PM	EPA Method 5	20	0.02 - 3.50	0.65	
PM_{10}	Dilution Tunnel	10			67.8[1]
$PM_{2.5}$	Dilution Tunnel	10			51.0[1]
CPM	EPA Method 202	7	0.04 - 0.18	0.09	
Organic CPM		3			16.5[2]
Inorganic CPM		3			83.5[2]
Sulfate CPM		1			34.5[2]

[1]Filterable PM10 and PM2.5 values expressed as percent of filterable PM values.
[2]Mean values were determined by applying the mean percent of PM to mean value for PM.

No condensable data was available for PM10, therefore it was assumed that the filterable and condensable breakdown of PM10 was the same as that shown for PM in Table 2.

PM filterable %	**0.65/(0.65 + 0.09)**	**= 87.8%**
PM condensable %	**0.09/(0.65 + 0.09)**	**= 12.2%**

Sulfate % of Inorganic Condensable	**Directly from table.**	**=34.5%**
Inorganic Condensable - SO_4	**83.5% - 34.5%**	**=49.0%**
Organic Condensable	**Directly from table.**	**=16.5%**

Cumulative mass fraction from AP42 Table 10.2-3, Recovery Boiler non-DCE with ESP.

No information available on elemental carbon emissions from Recovery furnace burning BLS. Elemental carbon breakdown based upon FLM recommendation of 7.4% of just the PM056 size for Utility Residual Oil Boiler with ESP .

No. 5 Recovery Furnace Firing BLS

	total	filterable	condensable		H_2SO_4	Inorganic condensable - H_2SO_4	Organic condensable
					condensable split		
%		87.84%	12.16%		34.5%	49.00%	16.5%
(g/s)	**3.919**	3.44	0.48		0.164	0.234	0.079

				FILTERABLE					CONDENSABLE			
						fine filterable						
		Diameter (µm)	%	filterable (g/s)	coarse filterable inorganic (g/s)	Assume inorganicis 92.6% of only PM056 fine filterable (g/s)	Assume elemental carbon is 7.4% of only PM056 fine filterable (g/s)		H_2SO_4 (g/s)	organic condensable (g/s)	inorganic condensable (g/s)	Diameter (µm)
												6.00 - 10.00
coarse (10%)	PM800	6.00 - 10.00	3.9%	0.1334	**0.133**							2.50-6.00
	PM425	2.50-6.00	6.1%	0.2117	**0.212**							1.25-2.50
fine (90%)	PM187	1.25-2.50	21.4%	0.7363		**0.736**						1.00-1.25
	PM112	1.00-1.25	11.9%	0.4095		**0.410**				**0.039**	**0.117**	0.625-1.00
	PM081	0.625-1.00	17.1%	0.5890		**0.589**				**0.039**	**0.117**	0.50-0.625
	PM056	0.50-0.625	39.6%	1.3621		**1.261**	**0.1008**					
total			100%	3.44	**0.345**	**2.996**	**0.1008**		**0.164**	**0.0786**	**0.234**	
					PMC	**SOIL**	**EC**		**H_2SO_4**	**SOA**	**SOIL**	
Ext. coefficient					0.6	1	10		3*f(RH)	4	1	

No. 5 Recovery Furnace Firing BLS

	total	filterable	condensable		H_2SO_4	Inorganic condensable - H_2SO_4	Organic condensable
					condensable split		
%		87.84%	12.16%		34.5%	49.00%	16.5%
(lb/hr)	**31.10**	27.32	3.78		1.305	1.853	0.624

		FILTERABLE							CONDENSABLE			
						fine filterable						
		Diameter (µm)	%	filterable (lb/hr)	coarse filterable inorganic (lb/hr)	Assume inorganicis 92.6% of only PM056 fine filterable (lb/hr)	Assume elemental carbon is 7.4% of only PM056 fine filterable (lb/hr)		H_2SO_4 (lb/hr)	organic condensable (lb/hr)	inorganic condensable (lb/hr)	Diameter (µm)
												6.00 - 10.00
coarse (10%)	PM800	6.00 - 10.00	3.9%	1.0591	**1.059**							2.50-6.00
	PM425	2.50-6.00	6.1%	1.6800	**1.680**							1.25-2.50
fine (90%)	PM187	1.25-2.50	21.4%	5.8433		**5.843**						1.00-1.25
	PM112	1.00-1.25	11.9%	3.2504		**3.250**				**0.312**	**0.927**	0.625-1.00
	PM081	0.625-1.00	17.1%	4.6747		**4.675**				**0.312**	**0.927**	0.50-0.625
	PM056	0.50-0.625	39.6%	10.8102		**10.010**	**0.8000**					
total			100%	27.32	**2.739**	**23.779**	**0.8000**		**1.305**	**0.6241**	**1.853**	
					PMC	**SOIL**	**EC**		**H_2SO_4**	**SOA**	**SOIL**	
Ext. coefficient					0.6	1	10		3*f(RH)	4	1	

Recovery Boiler non-DCE w/ESP
from AP-42 Table 10.2-3
(User inputs **filterable** emission rate in lb/hr)

Particle Size (um)	Cumulative Mass < Stated Size **ESP**	Fraction of PM10 < Stated Size (%)	Particle Size Range (um)	Emissions in Size Range (lb/hr)
10	75%	100%	10-6	1.06
6	72%	96%	6-2.5	1.68
2.5	67%	90%	2.5-1.25	5.84
1.25	51%	69%	1.25-1.0	3.25
1	42%	57%	1.0-625	4.67
0.625	30%	40%	0.625-0	10.81

CALPUFF

Particle Size (um)	Particle Size Range (um)	Fraction of PM10 (%)	Emissions in Size Range (lb/hr)	Extinction Coef.	Emissions in Size Range (g/sec)	
8	10-6	3.9%	1.059	0.6	0.1336	
4.25	6-2.5	6.1%	1.680	0.6	0.2119	10.0% Coarse >/= 2.5 micron
1.88	2.5-1.25	21.4%	5.843	1.0	0.7369	90.0% Fine Soil </= 2.5 micron
1.25	1.25-1	11.9%	3.250	1.0	0.4099	
0.813	1.6-25	17.1%	4.675	1.0	0.5895	
0.625	0.625-0	39.6%	10.810	1.0	1.2624	
		100%	27.3			

The speciation of PM10 into filterable and condensable was based upon the results presented in Table 1 of the NCASI study of PM speciation:
"Summary PM data for Kraft Mill Sources - July 2006 with Appendices"

Table 1. Smelt Tank Data Summary

Parameter	Measurement Method	No. of Sources	Range (lb/ton BLS)	Mean (lb/ton BLS)	[5]Mean Percent of PM
PM	EPA Method 5	42	0.03 - 0.64	0.148	
PM_{10}	Dilution Tunnel	7			81.9[1]
$PM_{2.5}$	Dilution Tunnel	7			72.6[1]
CPM	EPA Method 202	8	0.002 - 0.015	0.0074	
Organic CPM		6			27.8[2]
Inorganic CPM		6			72.2[2]
Sulfate CPM		3			26.8[2]

[1]Filterable PM10 and PM2.5 values expressed as percent of filterable PM values.
[2]Mean values were determined by applying the mean percent of PM to mean value for PM.

No breakdown of filterable and condensable was available for PM10, therefore it was assumed that the filterable and condensable breakdown of PM10 was the same as that shown for PM in Table 1.

PM filterable %	**0.148/(0.148 + 0.0074)**	**= 95.2%**
PM condensable %	**0.0074/(0.148 + 0.0074)**	**= 4.8%**

Sulfate % of Inorganic Condensable	**Directly from table.**	**=26.8%**
Inorganic Condensable - SO_4	**72.2% - 26.8%**	**=45.4%**
Organic Condensable	**Directly from table.**	**=27.8%**

Cumulative mass fraction from AP42 Table 10.2-6, Smelter Uncontrolled.

No information available on elemental carbon emissions, based nominal 3.5% of fine filterable to be elemental carbon, upon FLM recommendation for lime kilns.

No. 5 Smelt Dissolving Tank

	total	filterable	condensable		H_2SO_4	Inorganic condensable - H_2SO_4	Organic condensable
					condensable split		
%		95.24%	4.76%		26.8%	45.40%	27.8%
(g/s)	**0.504**	0.48	0.024		0.006	0.011	0.007

									CONDENSABLE			
FILTERABLE												
						fine filterable						
		Diameter (μm)	%	filterable (g/s)	coarse filterable inorganic (g/s)	Assume inorganic (96.5% of fine filterable) (g/s)	Assume elemental carbon (3.5% of fine filterable) (g/s)		H_2SO_4 (g/s)	organic condensable (g/s)	inorganic condensable (g/s)	Diameter (μm)
												6.00 - 10.00
coarse (18%)	PM800	6.00 - 10.00	1.7%	0.0081	**0.0081**							2.50-6.00
	PM425	2.50-6.00	15.8%	0.0759	**0.0759**							1.25-2.50
fine (82%)	PM187	1.25-2.50	28.8%	0.1383		**0.1335**	**0.0048**					1.00-1.25
	PM112	1.00-1.25	8.5%	0.0407		**0.0393**	**0.0014**			**0.0033**	**0.0054**	0.625-1.00
	PM081	0.625-1.00	16.4%	0.0786		**0.0759**	**0.0028**			**0.0033**	**0.0054**	0.50-0.625
	PM056	0.50-0.625	28.8%	0.1383		**0.1335**	**0.0048**					
total			100%	0.48	**0.0841**	**0.3821**	**0.0139**		**0.0064**	**0.0067**	**0.0109**	
					PMC	**SOIL**	**EC**		**H_2SO_4**	**SOA**	**SOIL**	
Ext. coefficient					0.6	1	10		3*f(RH)	4	1	

No. 5 Smelt Dissolving Tank

	total	filterable	condensable		H_2SO_4	Inorganic condensable - H_2SO_4	Organic condensable
					condensable split		
%		95.24%	4.76%		26.8%	45.40%	27.8%
(lb/hr)	**4.00**	3.81	0.19		0.051	0.086	0.053

		FILTERABLE							CONDENSABLE			
						fine filterable						
		Diameter (µm)	%	filterable (lb/hr)	coarse filterable inorganic (lb/hr)	Assume inorganic (96.5% of fine filterable) (lb/hr)	Assume elemental carbon (3.5% of fine filterable) (lb/hr)		H_2SO_4 (lb/hr)	organic condensable (lb/hr)	inorganic condensable (lb/hr)	Diameter (µm)
coarse (18%)	PM800	6.00 - 10.00	1.7%	0.0646	**0.0646**							6.00 - 10.00
	PM425	2.50-6.00	15.8%	0.6026	**0.6026**							2.50-6.00
fine (82%)	PM187	1.25-2.50	28.8%	1.0977		**1.059**	**0.0384**					1.25-2.50
	PM112	1.00-1.25	8.5%	0.3228		**0.312**	**0.0113**					1.00-1.25
	PM081	0.625-1.00	16.4%	0.6242		**0.602**	**0.0218**			**0.0265**	**0.0432**	0.625-1.00
	PM056	0.50-0.625	28.8%	1.0977		**1.059**	**0.0384**			**0.0265**	**0.0432**	0.50-0.625
total			100%	3.81	**0.6672**	**3.0323**	**0.1100**		**0.0510**	**0.0530**	**0.0865**	
					PMC	**SOIL**	**EC**		**H_2SO_4**	**SOA**	**SOIL**	
Ext. coefficient					0.6	1	10		3*f(RH)	4	1	

Smelter Uncontrolled
from AP-42 Table 10.2-6
(User inputs **filterable** emission rate in lb/hr)

Particle Size (um)	Cumulative Mass < Stated Size	Fraction of PM10 < Stated Size (%)	Particle Size Range (um)	Emissions in Size Range (lb/hr)
10	89%	100%	10-6	0.0646
6	87%	98%	6-2.5	0.6026
2.5	73%	82%	2.5-1.25	1.0977
1.25	48%	54%	1.25-1.0	0.3228
1	40%	45%	1.0-625	0.6242
0.625	26%	29%	0.625-0	1.10E+00

CALPUFF

Particle Size (um)	Particle Size Range (um)	Fraction of PM10 (%)	Emissions in Size Range (lb/hr)	Extinction Coef.	Emissions in Size Range (g/sec)	
8	10-6	1.7%	0.065	0.6	8.14E-03	
4.25	6-2.5	15.8%	0.603	0.6	7.60E-02	18% Coarse >/= 2.5 micron
1.88	2.5-1.25	28.8%	1.098	1	1.38E-01	82% Fine Soil </= 2.5 micron
1.25	1.25-1	8.5%	0.323	1	4.07E-02	
0.813	1.6-25	16.4%	0.624	1	7.87E-02	
0.625	0.625-0	28.8%	1.098	1	1.38E-01	
		100%	3.810			
					4.80E-01	

Bark/Oil Fired Boiler (66% wood with 34% oil)

	total	filterable	condensable		condensable split: H_2SO_4	condensable split: condensable - H_2SO_4
%		71.3%	28.67%		47.3%	52.7%
(g/s)	**5.846**	4.17	1.68		0.79	0.88

FILTERABLE

		Diameter (μm)	%	filterable (g/s)	coarse filterable inorganic (g/s)	fine filterable: inorganic (96.3% of filterable) (g/s)	fine filterable: elemental carbon (3.7% of filterable) (g/s)
coarse (15%)	PM800	6.00 - 10.00	6.7%	0.28	**0.2795**		
	PM425	2.50-6.00	8.3%	0.35	**0.3453**		
fine (85%)	PM187	1.25-2.50	6.2%	0.26		**0.2576**	**0.0023**
	PM112	1.00-1.25	1.9%	0.081		**0.0795**	**0.0012**
	PM081	0.625-1.00	72.1%	3.01		**2.8972**	**0.1101**
	PM056	0.50-0.625	4.7%	0.20		**0.1833**	**0.0140**
total			100%	4.17	**0.6248**	**3.4176**	**0.1275**
					PMC	**SOIL**	**EC**
Ext. coefficient					0.6	1	10

CONDENSABLE

H_2SO_4 (g/s)	organic condensable (g/s)	inorganic condensable (g/s)	Diameter (μm)
			6.00 - 10.00
			2.50-6.00
			1.25-2.50
			1.00-1.25
	0.4419		0.625-1.00
	0.4419		0.50-0.625
0.7927	**0.8837**		
H_2SO_4	**SOA**	**SOIL**	
3*f(RH)	4	1	

Wood-Fired Boiler w/scrubber

	total	filterable	condensable		H_2SO_4	condensable - H_2SO_4
					condensable split	
%		79.5%	20.5%		5.0%	95.0%
(g/s)	**5.846**	4.65	1.20		0.060	1.14

												35.65
FILTERABLE									CONDENSABLE			
						fine filterable						
		Diameter (μm)	%	filterable (g/s)	coarse filterable inorganic (g/s)	inorganic (96.3% of filterable) (g/s)	elemental carbon (3.7% of filterable) (g/s)		H_2SO_4 (g/s)	organic condensable (g/s)	inorganic condensable (g/s)	Diameter (μm)
												6.00 - 10.00
coarse (0%)	PM800	6.00 - 10.00	0.0%	0.00	**0.0000**							2.50-6.00
	PM425	2.50-6.00	0.0%	0.00	**0.0000**							1.25-2.50
fine (100%)	PM187	1.25-2.50	2.0%	0.09		**0.0914**	**0.0035**					1.00-1.25
	PM112	1.00-1.25	1.0%	0.05		**0.0457**	**0.0018**			**0.5688**		0.625-1.00
	PM081	0.625-1.00	96.9%	4.51		**4.3399**	**0.1667**			**0.5688**		0.50-0.625
	PM056	0.50-0.625	0.0%	0.00								
total			100%	4.65	**0.0000**	**4.4769**	**0.1720**		**0.0599**	**1.1376**		
					PMC	**SOIL**	**EC**		**H_2SO_4**	**SOA**	**SOIL**	
Ext. coefficient					0.6	1	10		3*f(RH)	4	1	

Wood-Fired Boiler w/scrubber

	total	filterable	condensable		H_2SO_4	condensable - H_2SO_4
					condensable split	
%		79.5%	20.5%		5.0%	95.0%
(lb/hr)	**46.40**	36.90	9.50		0.48	9.03

FILTERABLE

		Diameter (μm)	%	filterable (lb/hr)	coarse filterable inorganic (lb/hr)	fine filterable: inorganic (96.3% of filterable) (lb/hr)	fine filterable: elemental carbon (3.7% of filterable) (lb/hr)
coarse (0%)	PM800	6.00 - 10.00	0.0%	0.00	**0.0000**		
	PM425	2.50-6.00	0.0%	0.00	**0.0000**		
fine (100%)	PM187	1.25-2.50	2.0%	0.75		**0.7251**	**0.0279**
	PM112	1.00-1.25	1.0%	0.38		**0.3626**	**0.0139**
	PM081	0.625-1.00	96.9%	35.77		**34.4435**	**1.3234**
	PM056	0.50-0.625	0.0%	0.00			
total			100%	36.90	**0.0000**	**35.5312**	**1.3652**
					PMC	**SOIL**	**EC**
Ext. coefficient					0.6	1	10

CONDENSABLE

	H_2SO_4 (lb/hr)	organic condensable (lb/hr)	inorganic condensable (lb/hr)	Diameter (μm)
PM800				6.00 - 10.00
PM425				2.50-6.00
PM187				1.25-2.50
PM112				1.00-1.25
PM081		**4.5142**		0.625-1.00
PM056		**4.5142**		0.50-0.625
total	**0.4752**	**9.0284**		
	H_2SO_4	**SOA**	**SOIL**	
Ext. coefficient	3*f(RH)	4	1	

Wood-Fired Boiler w/scrubber
from AP-42 Table 1.6-5
(User inputs **filterable** emission rate in lb/hr)

Particle Size (um)	Cumulative Mass < Stated Size **Scrubber**	Fraction of PM10 < Stated Size (%)	Particle Size Range (um)	Emissions in Size Range (lb/hr)
10	98%	100%	10-6	0.00
6	98%	100%	6-2.5	0.00
2.5	98%	100%	2.5-1.25	0.95
1.25	96%	98%	1.25-1.0	0.47
1	95%	97%	1.0-625	44.98
0.625	0%	0%	0.625-0	0.00

CALPUFF

Particle Size (um)	Particle Size Range (um)	Fraction of PM10 (%)	Emissions in Size Range (lb/hr)	Extinction Coef.	Emissions in Size Range (g/sec)	
8	10-6	0.0%	0.000	0.6	0.0000	
4.25	6-2.5	0.0%	0.000	0.6	0.0000	0.0% Coarse >/= 2.5 micron
1.88	2.5-1.25	2.0%	0.947	1.0	0.1194	100.0% Fine Soil </= 2.5 micron
1.25	1.25-1	1.0%	0.473	1.0	0.0597	
0.813	1.6-25	96.9%	44.980	1.0	5.6724	
0.625	0.625-0	0.0%	0.000	1.0	0.0000	
		100%	46.4			

Oil-Fired Boiler w/scrubber

	total	filterable	condensable		condensable split: H_2SO_4	condensable split: condensable - H_2SO_4
%		55.4%	44.6%		85.0%	15.0%
(g/s)	**5.846**	3.24	2.61		2.22	0.39

FILTERABLE

		Diameter (μm)	%	filterable (g/s)	coarse filterable inorganic (g/s)	fine filterable: inorganic (96.3% of filterable) (g/s)	fine filterable: elemental carbon (3.7% of filterable) (g/s)
coarse (0%)	PM800	6.00 - 10.00	25.4%	0.82	**0.8222**		
	PM425	2.50-6.00	31.3%	1.02	**1.0156**		
fine (100%)	PM187	1.25-2.50	17.9%	0.58		**0.5803**	
	PM112	1.00-1.25	4.5%	0.15		**0.1451**	
	PM081	0.625-1.00	3.0%	0.10		**0.0967**	
	PM056	0.50-0.625	17.9%	0.58		**0.5391**	**0.0412**
total			100%	3.24	**1.8378**	**1.3613**	**0.0412**
					PMC	**SOIL**	**EC**
Ext. coefficient					0.6	1	10

CONDENSABLE

	H_2SO_4 (g/s)	organic condensable (g/s)	inorganic condensable (g/s)	Diameter (μm)
				6.00 - 10.00
				2.50-6.00
				1.25-2.50
				1.00-1.25
		0.1955		0.625-1.00
		0.1955		0.50-0.625
	2.2152	**0.3909**		
	H_2SO_4	**SOA**	**SOIL**	
	3*f(RH)	4	1	

Oil-Fired Boiler w/scrubber

	total	filterable	condensable		H_2SO_4	condensable - H_2SO_4
					condensable split	
%		55.4%	44.6%		85.0%	15.0%
(lb/hr)	**46.40**	25.72	20.68		17.58	3.10

FILTERABLE

		Diameter (μm)	%	filterable (lb/hr)	coarse filterable inorganic (lb/hr)	fine filterable: inorganic (92.9% of filterable) (lb/hr)	fine filterable: elemental carbon (7.1% of filterable) (lb/hr)
coarse (57%)	PM800	6.00 - 10.00	25.4%	6.53	**6.5251**		
	PM425	2.50-6.00	31.3%	8.06	**8.0604**		
fine (43%)	PM187	1.25-2.50	17.9%	4.61		**4.6059**	
	PM112	1.00-1.25	4.5%	1.15		**1.1515**	
	PM081	0.625-1.00	3.0%	0.77		**0.7677**	
	PM056	0.50-0.625	17.9%	4.61		**4.2789**	**0.3270**
total			100%	25.72	**14.5855**	**10.8040**	**0.3270**
					PMC	**SOIL**	**EC**
Ext. coefficient					0.6	1	10

CONDENSABLE

	H_2SO_4 (lb/hr)	organic condensable (lb/hr)	inorganic condensable (lb/hr)	Diameter (μm)
				6.00 - 10.00
				2.50-6.00
				1.25-2.50
				1.00-1.25
		1.5513		0.625-1.00
		1.5513		0.50-0.625
	17.5810	**3.1025**		
	H_2SO_4	**SOA**	**SOIL**	
	3*f(RH)	4	1	

Residual Oil-fired Utility Boiler w Scrubber
from AP-42 Table 1.3-4
(User inputs **filterable** emission rate in lb/hr)

Particle Size (um)	Cumulative Mass < Stated Size **Scrubber**	Fraction of PM10 < Stated Size (%)	Particle Size Range (um)	Emissions in Size Range (lb/hr)
10	67%	100%	10-6	4.17
6	50%	75%	6-2.5	5.15
2.5	29%	43%	2.5-1.25	2.94
1.25	17%	25%	1.25-1.0	0.74
1	14%	21%	1.0-625	0.49
0.625	12%	18%	0.625-0	2.94

CALPUFF

Particle Size (um)	Particle Size Range (um)	Fraction of PM10 (%)	Emissions in Size Range (lb/hr)	Extinction Coef.	Emissions in Size Range (g/sec)	
8	10-6	25%	4.2	0.6	0.5259	
4.25	6-2.5	31%	5.2	0.6	0.6497	56.7% Coarse >/= 2.5 micron
1.88	2.5-1.25	18%	2.9	1	0.3713	43.3% Fine Soil </= 2.5 micron
1.25	1.25-1	4%	0.7	1	0.0928	
0.813	1.6-25	3%	0.5	1	0.0619	
0.625	0.625-0	18%	2.9	1	0.2300	
		100%	16.4	10	0.1413	7.1% of Fine Soil
					2.07	

APPENDIX C

Model Output Summary

Wolf Island Model Output Summary

	---	Ranked	Daily	Visibility	Change	---						% of Modeled Extinction by Species					
YEAR	DAY	HR	RECEPTOR	COORDINATES (km)		TYPE	DV(Total)	DV(BKG)	DELTA	DV	F(RH)	%_SO4	%_NO3	%_OC	%_EC	%_PMC	%_PMF
2001	312	0	18	1485.385	-830.106	D	3.965	3.743	0.222	1	55.19	6.4	10.5	6.74	1.65	19.52	1
2001	220	0	1	1488.69	-835.192	D	3.918	3.743	0.175	1	63.81	0.77	9.87	6.16	1.54	17.85	2
2001	316	0	29	1489.135	-828.509	D	3.916	3.743	0.173	1	69.54	5.51	7.03	4.4	0.8	12.73	3
2001	66	0	18	1485.385	-830.106	D	3.911	3.743	0.167	1	24.61	6.75	19.82	12.33	1.03	35.46	4
2001	202	0	29	1489.135	-828.509	D	3.891	3.743	0.148	1	66.45	1.05	9.27	5.62	1.29	16.31	5
2001	353	0	24	1485.226	-829.19	D	3.872	3.743	0.129	1	31.11	3.57	18.44	11.41	2.47	33	6
2001	53	0	3	1488.53	-834.276	D	3.872	3.743	0.129	1	59.22	4.13	10.4	6.34	1.54	18.36	7
2001	262	0	30	1485.848	-828.138	D	3.871	3.743	0.128	1	75.65	1.17	6.57	4.11	0.68	11.82	8
2001	176	0	8	1486.486	-831.802	D	3.871	3.743	0.128	1	68.42	0.52	8.64	5.46	1.14	15.83	9
2001	5	0	30	1485.848	-828.138	D	3.872	3.743	0.128	1	26.29	12.67	18.96	10.28	2.47	29.34	10
2001	263	0	29	1489.135	-828.509	D	3.858	3.743	0.115	1	79.28	0.56	5.71	3.57	0.58	10.29	11
2001	336	0	29	1489.135	-828.509	D	3.857	3.743	0.113	1	64.96	13.32	6.15	3.78	0.89	10.9	12
2001	138	0	1	1488.69	-835.192	D	3.852	3.743	0.109	1	51.33	0.6	13.94	8.27	1.86	24	13
2001	17	0	18	1485.385	-830.106	D	3.836	3.743	0.093	1	55.23	5.35	10.94	6.88	1.65	19.95	14
2001	269	0	1	1488.69	-835.192	D	3.833	3.743	0.089	1	50.26	1.99	13.57	8.32	1.82	24.03	15
2001	26	0	29	1489.135	-828.509	D	3.827	3.743	0.084	1	21.66	10.77	17.08	12.15	2.42	35.92	16
2001	234	0	1	1488.69	-835.192	D	3.827	3.743	0.083	1	60.1	0.87	11.32	6.71	1.7	19.31	17
2001	361	0	29	1489.135	-828.509	D	3.824	3.743	0.081	1	23.88	11.9	18.57	11.08	2.6	31.97	18
2002	1	0	1	1488.69	-835.192	D	3.823	3.743	0.08	1	36.44	15.1	13.42	8.54	1.72	24.78	19
2001	144	0	4	1487.428	-832.581	D	3.818	3.743	0.075	1	44.87	0.63	15.34	9.51	2.13	27.53	20
2001	82	0	30	1485.848	-828.138	D	3.818	3.743	0.075	1	29.72	5.73	17.94	11.31	2.46	32.84	21
2001	22	0	1	1488.69	-835.192	D	3.813	3.743	0.07	1	24.35	13.33	18.55	10.73	2.25	30.79	22
2002	294	0	29	1489.135	-828.509	D	4.062	3.743	0.319	1	68.21	1.06	8.9	5.31	1.24	15.27	1
2002	356	0	27	1487.571	-828.781	D	3.964	3.743	0.221	1	27.9	8.56	18.91	10.86	2.54	31.24	2
2002	64	0	4	1487.428	-832.581	D	3.963	3.743	0.22	1	25.31	11.82	18.2	11.09	1.53	32.05	3
2002	329	0	30	1485.848	-828.138	D	3.934	3.743	0.191	1	39.78	16.97	12.99	7.35	1.89	21.02	4
2002	4	0	30	1485.848	-828.138	D	3.916	3.743	0.173	1	33.65	11.16	15.4	9.71	1.85	28.24	5
2002	219	0	1	1488.69	-835.192	D	3.892	3.743	0.149	1	73.4	0.61	7.14	4.58	1.09	13.18	6
2002	340	0	29	1489.135	-828.509	D	3.878	3.743	0.135	1	64.86	2.53	10.1	5.51	1.35	15.65	7
2002	53	0	3	1488.53	-834.276	D	3.876	3.743	0.133	1	57.35	4.69	10.68	6.67	1.31	19.31	8
2002	14	0	5	1488.21	-832.444	D	3.875	3.743	0.132	1	31.57	11.58	16.19	9.88	2.21	28.57	9
2002	350	0	1	1488.69	-835.192	D	3.868	3.743	0.125	1	28.58	11.07	17.96	10.29	2.69	29.41	10
2002	290	0	18	1485.385	-830.106	D	3.861	3.743	0.118	1	42.71	4.93	15.13	9.06	1.99	26.19	11
2002	36	0	11	1488.833	-831.392	D	3.859	3.743	0.116	1	28.29	4.82	19.32	11.76	1.98	33.82	12
2002	16	0	1	1488.69	-835.192	D	3.859	3.743	0.116	1	40.02	13.68	13.33	8	1.94	23.04	13
2002	29	0	30	1485.848	-828.138	D	3.858	3.743	0.115	1	69.13	6.57	6.84	4.3	0.76	12.4	14
2002	48	0	30	1485.848	-828.138	D	3.856	3.743	0.113	1	56.17	11.43	9.09	5.62	1.37	16.31	15
2002	45	0	1	1488.69	-835.192	D	3.852	3.743	0.109	1	43.37	5.38	14.73	8.97	1.83	25.73	16
2002	326	0	1	1488.69	-835.192	D	3.849	3.743	0.105	1	56.89	6.14	10.47	6.43	1.48	18.59	17
2002	5	0	18	1485.385	-830.106	D	3.847	3.743	0.104	1	31.27	18.48	14.45	8.77	1.78	25.25	18
2002	351	0	29	1489.135	-828.509	D	3.845	3.743	0.102	1	21.87	11.02	13.55	12.66	2.51	38.4	19
2002	310	0	24	1485.226	-829.19	D	3.845	3.743	0.102	1	59.8	8.18	8.64	5.7	1.06	16.62	20
2002	281	0	8	1486.486	-831.802	D	3.845	3.743	0.102	1	60.12	4.44	9.99	6.15	1.6	17.7	21
2002	87	0	1	1488.69	-835.192	D	3.845	3.743	0.102	1	44.77	3.95	14.45	9	1.71	26.11	22
2003	327	0	18	1485.385	-830.106	D	3.937	3.743	0.194	1	55.52	4.04	11.46	7.01	1.74	20.23	1
2003	34	0	29	1489.135	-828.509	D	3.918	3.743	0.175	1	32.94	11.39	16.39	9.5	2.44	27.34	2
2003	5	0	8	1486.486	-831.802	D	3.916	3.743	0.173	1	34.3	15.71	14.28	8.7	1.82	25.19	3
2003	104	0	8	1486.486	-831.802	D	3.912	3.743	0.169	1	54.87	2.7	12.78	7.21	1.8	20.65	4
2003	173	0	8	1486.486	-831.802	D	3.903	3.743	0.16	1	68.61	1.19	8.59	5.22	1.28	15.11	5
2003	59	0	29	1489.135	-828.509	D	3.89	3.743	0.147	1	65.08	14.48	6.05	3.54	0.64	10.21	6
2003	49	0	29	1489.135	-828.509	D	3.889	3.743	0.145	1	59.31	10.3	8.56	5.33	1.11	15.39	7
2003	26	0	24	1485.226	-829.19	D	3.883	3.743	0.14	1	44.63	28.01	7.35	4.88	1.09	14.03	8
2003	76	0	24	1485.226	-829.19	D	3.881	3.743	0.137	1	62.82	15.29	7.07	3.64	0.84	10.34	9
2003	40	0	8	1486.486	-831.802	D	3.878	3.743	0.135	1	38.84	14.75	13.29	8.11	1.65	23.35	10
2003	336	0	4	1487.428	-832.581	D	3.873	3.743	0.13	1	29.48	8	18.85	10.63	2.62	30.42	11
2003	7	0	29	1489.135	-828.509	D	3.865	3.743	0.122	1	37.98	8.9	13.97	9.45	1.93	27.78	12
2003	340	0	1	1488.69	-835.192	D	3.856	3.743	0.113	1	47.31	9.46	12.21	7.53	1.68	21.81	13
2003	32	0	29	1489.135	-828.509	D	3.854	3.743	0.111	1	62.51	22.02	4.37	2.72	0.48	7.9	14
2003	349	0	1	1488.69	-835.192	D	3.854	3.743	0.11	1	47.28	9.1	12.33	7.66	1.4	22.23	15
2003	365	0	1	1488.69	-835.192	D	3.852	3.743	0.108	1	54.95	3.6	11.65	7.28	1.43	21.1	16
2003	15	0	2	1489.472	-835.055	D	3.848	3.743	0.105	1	42.18	10.12	13.54	8.32	1.9	23.94	17
2003	50	0	30	1485.848	-828.138	D	3.847	3.743	0.104	1	49.23	13.95	10.41	6.44	1.38	18.59	18
2003	18	0	1	1488.69	-835.192	D	3.847	3.743	0.104	1	28.87	10.6	17.31	10.73	1.39	31.11	19
2003	90	0	1	1488.69	-835.192	D	3.846	3.743	0.103	1	37.65	11.1	14.63	8.98	1.69	25.95	20
2003	39	0	30	1485.848	-828.138	D	3.837	3.743	0.094	1	35.33	15.83	14.01	8.46	1.96	24.43	21
2003	44	0	29	1489.135	-828.509	D	3.837	3.743	0.093	1	28.59	9.65	14.48	11.22	2.59	33.47	22

Okefenokee Model Output Summary

	---	Ranked	Daily	Visibility	Change	---						% of Modeled Extinction by Species					
YEAR	DAY	HR	RECEPTOR	COORDINATES (km)		TYPE	DV(Total)	DV(BKG)	DELTA	DV	F(RH)	%_SO4	%_NO3	%_OC	%_EC	%_PMC	%_PMF
2001	44	0	552	1396.089	-878.906	D	3.978	3.771	0.208	1	59.22	7.41	9.59	5.87	0.95	16.96	1
2001	177	0	552	1396.089	-878.906	D	3.977	3.771	0.206	1	61.35	1.91	10.26	6.37	1.57	18.54	2
2001	36	0	1463	1416.467	-890.671	D	3.963	3.771	0.192	1	50.32	13.99	10.09	6.26	1.19	18.15	3
2001	297	0	721	1404.798	-876.357	D	3.958	3.771	0.187	1	60.42	10.27	8.21	5.1	1.22	14.79	4
2001	315	0	645	1400.85	-877.049	D	3.939	3.771	0.168	1	68.38	6.5	7.11	4.37	1.04	12.6	5
2001	29	0	721	1404.798	-876.357	D	3.932	3.771	0.162	1	47.84	8.98	12.34	7.47	1.7	21.67	6
2001	117	0	737	1406.307	-879.159	D	3.889	3.771	0.119	1	30.88	8.18	17.75	10.59	2.18	30.43	7
2001	321	0	1650	1421.531	-910	D	3.889	3.771	0.118	1	31.01	2.26	18.84	11.79	1.74	34.36	8
2001	274	0	664	1401.837	-876.876	D	3.889	3.771	0.118	1	30.56	3.03	19.54	11.68	1.51	33.68	9
2001	203	0	222	1402.58	-904.358	D	3.888	3.771	0.118	1	31.31	16.72	15.94	8.79	2	25.24	10
2001	302	0	721	1404.798	-876.357	D	3.888	3.771	0.117	1	24.53	10.32	19.14	11.42	1.68	32.91	11
2001	23	0	1391	1386.326	-892.885	D	3.885	3.771	0.114	1	29.62	22.65	13.92	8.26	1.73	23.82	12
2001	4	0	1373	1416.989	-893.648	D	3.885	3.771	0.114	1	25.17	25.49	14.86	8.35	2	24.12	13
2001	294	0	737	1406.307	-879.159	D	3.882	3.771	0.112	1	46.98	3.31	14.01	8.69	1.79	25.22	14
2001	272	0	1542	1396.229	-932.074	D	3.877	3.771	0.107	1	59.07	9.11	8.89	5.58	1.15	16.2	15
2001	322	0	1685	1384.066	-894.571	D	3.874	3.771	0.103	1	35.22	3.84	21.12	9.92	2.17	27.72	16
2001	45	0	607	1398.876	-877.395	D	3.871	3.771	0.1	1	48.19	13.39	11.05	6.68	1.68	19	17
2001	303	0	1685	1384.066	-894.571	D	3.87	3.771	0.099	1	36.28	8.75	16.16	9.62	1.52	27.67	18
2001	172	0	663	1402.011	-877.868	D	3.87	3.771	0.099	1	60.73	1.94	10.42	6.5	1.53	18.88	19
2002	1	0	1636	1408.458	-879.966	D	3.869	3.771	0.098	1	29.96	20.43	14.31	8.54	2.05	24.71	20
2001	310	0	626	1399.863	-877.222	D	3.869	3.771	0.098	1	28.4	2.6	19.73	12.12	1.98	35.17	21
2001	271	0	1485	1392.276	-932.766	D	3.864	3.771	0.093	1	68.16	2.1	8.22	5.21	1.12	15.17	22
2002	331	0	1467	1415.77	-886.702	D	3.942	3.771	0.171	1	58.86	7.58	9.13	5.89	1.3	17.24	1
2002	141	0	645	1400.85	-877.049	D	3.941	3.771	0.171	1	28.13	4.92	19.63	11.63	2.06	33.63	2
2002	261	0	1459	1414.609	-885.883	D	3.933	3.771	0.163	1	70.54	1.4	7.71	4.89	1.18	14.27	3
2002	337	0	1647	1419.041	-908.114	D	3.922	3.771	0.151	1	35.57	15.53	15.42	8.21	1.87	23.41	4
2002	308	0	1467	1415.77	-886.702	D	3.92	3.771	0.149	1	44.62	7.84	13.21	8.32	1.98	24.03	5
2002	54	0	552	1396.089	-878.906	D	3.91	3.771	0.14	1	47.43	5.72	13.18	8.16	1.93	23.58	6
2002	28	0	683	1402.824	-876.703	D	3.907	3.771	0.137	1	56.57	6.53	10.42	6.44	1.54	18.49	7
2002	324	0	1638	1412.283	-880.953	D	3.897	3.771	0.127	1	56.39	5.58	10.21	6.8	1.37	19.65	8
2002	289	0	664	1401.837	-876.876	D	3.889	3.771	0.118	1	35.11	4.91	18.6	10.19	1.94	29.25	9
2002	286	0	578	1399.8	-888.481	D	3.889	3.771	0.118	1	60.41	1.68	10.91	6.54	1.46	19	10
2002	343	0	552	1396.089	-878.906	D	3.879	3.771	0.108	1	41.46	14.85	12.01	7.76	1.58	22.34	11
2002	126	0	1461	1414.261	-883.899	D	3.871	3.771	0.1	1	39.68	5.27	15.75	9.57	1.94	27.79	12
2002	342	0	552	1396.089	-878.906	D	3.867	3.771	0.097	1	33.89	16.92	14.18	8.55	1.79	24.68	13
2002	140	0	683	1402.824	-876.703	D	3.868	3.771	0.097	1	36.84	9.92	15.13	9.41	1.37	27.33	14
2002	325	0	1683	1379.553	-902.53	D	3.865	3.771	0.094	1	32.46	18.56	14.43	8.42	2.01	24.12	15
2002	301	0	552	1396.089	-878.906	D	3.864	3.771	0.094	1	62.9	1.41	10.11	6.19	1.52	17.87	16
2002	17	0	1467	1415.77	-886.702	D	3.857	3.771	0.086	1	51.18	10.53	10.44	6.72	1.48	19.64	17
2002	307	0	1650	1421.531	-910	D	3.856	3.771	0.085	1	54.96	4.26	11.73	7.12	1.25	20.67	18
2002	56	0	1467	1415.77	-886.702	D	3.856	3.771	0.085	1	35.46	11.42	15.39	9.22	1.79	26.72	19
2002	172	0	552	1396.089	-878.906	D	3.855	3.771	0.084	1	47.97	1.82	14.65	8.7	1.8	25.05	20
2002	35	0	1683	1379.553	-902.53	D	3.852	3.771	0.081	1	60.29	8.78	8.61	5.45	1.1	15.76	21
2002	333	0	1635	1407.43	-880.151	D	3.851	3.771	0.08	1	27.26	10.05	20.04	10.49	2.2	29.97	22
2003	32	0	552	1396.089	-878.906	D	4.025	3.771	0.254	1	39.7	23.99	10.28	6.3	1.5	18.22	1
2003	293	0	737	1406.307	-879.159	D	3.918	3.771	0.147	1	43.69	3.87	15.1	9.1	1.97	26.27	2
2003	83	0	32	1393.866	-906.907	D	3.912	3.771	0.141	1	51.92	6.77	11.9	7.11	1.7	20.59	3
2003	361	0	721	1404.798	-876.357	D	3.907	3.771	0.137	1	40.84	10.55	13.86	8.44	1.81	24.5	4
2003	313	0	1683	1379.553	-902.53	D	3.895	3.771	0.124	1	48.25	16.76	10.1	6.15	1.02	17.72	5
2003	273	0	645	1400.85	-877.049	D	3.886	3.771	0.115	1	34.75	1.81	18.48	11.05	2	31.91	6
2003	275	0	1638	1412.283	-880.953	D	3.883	3.771	0.112	1	49.43	1.09	14.27	8.63	1.7	24.88	7
2003	307	0	1685	1384.066	-894.571	D	3.877	3.771	0.107	1	35.18	2.4	19.89	10.43	2.58	29.53	8
2003	319	0	552	1396.089	-878.906	D	3.874	3.771	0.104	1	38.82	7.46	15.77	9.31	1.77	26.87	9
2003	256	0	1685	1384.066	-894.571	D	3.873	3.771	0.103	1	54.54	1.63	13.6	7.42	1.81	20.99	10
2003	314	0	1638	1412.283	-880.953	D	3.87	3.771	0.1	1	29.54	3.75	19.39	11.95	0.75	34.62	11
2003	255	0	737	1406.307	-879.159	D	3.869	3.771	0.098	1	45.72	1.84	15.08	9.15	1.7	26.5	12
2003	259	0	721	1404.798	-876.357	D	3.868	3.771	0.097	1	57.68	1.55	11.54	7.08	1.59	20.56	13
2003	292	0	1467	1415.77	-886.702	D	3.867	3.771	0.096	1	41.9	6.02	15.08	9.07	1.74	26.18	14
2003	60	0	1053	1414.364	-930.946	D	3.863	3.771	0.093	1	35.59	19.6	13.01	7.82	1.42	22.56	15
2003	41	0	1650	1421.531	-910	D	3.864	3.771	0.093	1	45.27	24.26	8.68	5.3	1.14	15.35	16
2003	347	0	721	1404.798	-876.357	D	3.851	3.771	0.081	1	46.98	9.47	12.36	7.52	1.82	21.84	17
2003	276	0	721	1404.798	-876.357	D	3.848	3.771	0.078	1	50.47	1.48	13.5	8.47	1.42	24.66	18
2003	253	0	1460	1414.435	-884.891	D	3.849	3.771	0.078	1	48.12	4.97	13.23	8.18	1.92	23.58	19
2003	340	0	1142	1380.628	-901.04	D	3.848	3.771	0.077	1	30.71	34.77	9.95	6.01	1.17	17.39	20
2003	284	0	552	1396.089	-878.906	D	3.847	3.771	0.077	1	56.55	1.17	11.67	7.52	1.47	21.62	21
2003	342	0	1467	1415.77	-886.702	D	3.846	3.771	0.076	1	37.76	11.56	14.21	8.85	1.79	25.82	22

Cape Romain Model Output Summary

	---	Ranked	Daily	Visibility	Change	---						% of Modeled Extinction by Species					
YEAR	DAY	HR	RECEPTOR	COORDINATES (km)		TYPE	DV(Total)	DV(BKG)	DELTA	DV	F(RH)	%_SO4	%_NO3	%_OC	%_EC	%_PMC	%_PMF
2001	313	0	2	1610.682	-633.471	D	3.814	3.681	0.132	1	58.51	6.42	9.82	6.17	1.23	17.85	1
2001	298	0	32	1611.037	-623.021	D	3.778	3.681	0.096	1	65.58	14.46	5.22	3.57	0.68	10.49	2
2001	277	0	48	1633.97	-614.771	D	3.771	3.681	0.09	1	62.54	2.1	10.07	6.17	1.31	17.81	3
2001	16	0	1	1609.918	-633.619	D	3.76	3.681	0.078	1	76.1	8.29	4.41	2.73	0.56	7.92	4
2001	265	0	2	1610.682	-633.471	D	3.756	3.681	0.075	1	77.64	4.45	5.41	3.06	0.68	8.77	5
2001	90	0	1	1609.918	-633.619	D	3.746	3.681	0.065	1	67.58	17.14	4.35	2.69	0.48	7.76	6
2001	119	0	1	1609.918	-633.619	D	3.741	3.681	0.06	1	69.08	2.32	7.99	5.03	0.97	14.61	7
2001	131	0	2	1610.682	-633.471	D	3.736	3.681	0.055	1	60.7	10.15	8.4	5.07	1.05	14.63	8
2001	47	0	2	1610.682	-633.471	D	3.73	3.681	0.049	1	53.87	17.02	7.96	5.12	1.05	14.97	9
2001	8	0	1	1609.918	-633.619	D	3.728	3.681	0.046	1	56.61	5.15	10.86	6.74	1.14	19.5	10
2001	240	0	1	1609.918	-633.619	D	3.726	3.681	0.045	1	74.73	0.85	7.19	4.2	0.94	12.09	11
2001	99	0	48	1633.97	-614.771	D	3.725	3.681	0.044	1	69.75	3.95	7.74	4.54	0.94	13.09	12
2001	76	0	20	1610.214	-626.955	D	3.723	3.681	0.042	1	54.65	15.49	8.24	5.29	0.88	15.45	13
2001	201	0	1	1609.918	-633.619	D	3.72	3.681	0.039	1	71.71	1.26	7.39	4.74	1.04	13.86	14
2001	174	0	127	1634.601	-609.927	D	3.72	3.681	0.039	1	75.99	1.99	6.27	3.84	0.79	11.13	15
2001	222	0	127	1634.601	-609.927	D	3.719	3.681	0.038	1	77.63	1.01	6.03	3.76	0.7	10.88	16
2001	158	0	32	1611.037	-623.021	D	3.719	3.681	0.038	1	75.13	1.21	6.17	4.25	0.7	12.54	17
2001	233	0	2	1610.682	-633.471	D	3.717	3.681	0.036	1	64.73	0.67	9.68	6.07	1.31	17.55	18
2001	139	0	163	1629.721	-605.221	D	3.717	3.681	0.036	1	80.7	5.15	3.88	2.56	0.33	7.38	19
2001	46	0	65	1615.318	-616.528	D	3.717	3.681	0.036	1	66.41	13.39	5.68	3.56	0.61	10.34	20
2001	63	0	65	1615.318	-616.528	D	3.717	3.681	0.035	1	56.79	16.67	7.09	4.76	0.74	13.96	21
2001	264	0	1	1609.918	-633.619	D	3.715	3.681	0.034	1	87.58	0.41	3.46	2.13	0.32	6.11	22
2002	330	0	2	1610.682	-633.471	D	3.769	3.681	0.088	1	55.97	13.66	8.41	5.36	1.04	15.55	1
2002	272	0	2	1610.682	-633.471	D	3.762	3.681	0.081	1	69.47	6.69	6.99	4.11	0.87	11.85	2
2002	18	0	2	1610.682	-633.471	D	3.759	3.681	0.078	1	71.75	7.77	5.8	3.59	0.74	10.36	3
2002	77	0	1	1609.918	-633.619	D	3.757	3.681	0.076	1	63.52	15.7	5.94	3.63	0.74	10.47	4
2002	30	0	2	1610.682	-633.471	D	3.752	3.681	0.071	1	71.09	12.01	4.8	2.97	0.6	8.53	5
2002	309	0	65	1615.318	-616.528	D	3.746	3.681	0.065	1	72.49	11.13	4.49	2.89	0.58	8.42	6
2002	78	0	1	1609.918	-633.619	D	3.745	3.681	0.064	1	68.63	9.34	6.22	3.88	0.67	11.26	7
2002	237	0	48	1633.97	-614.771	D	3.742	3.681	0.061	1	75.42	1.69	6.63	3.98	0.79	11.5	8
2002	303	0	1	1609.918	-633.619	D	3.735	3.681	0.054	1	73.17	7.48	5.59	3.44	0.46	9.86	9
2002	187	0	1	1609.918	-633.619	D	3.736	3.681	0.054	1	80.7	1	4.99	3.25	0.57	9.5	10
2002	310	0	1	1609.918	-633.619	D	3.732	3.681	0.05	1	80.55	5.54	3.88	2.47	0.4	7.17	11
2002	146	0	32	1611.037	-623.021	D	3.729	3.681	0.048	1	76.34	3.04	5.52	3.69	0.61	10.81	12
2002	231	0	48	1633.97	-614.771	D	3.728	3.681	0.047	1	71.89	2.07	7.32	4.57	0.88	13.27	13
2002	280	0	1	1609.918	-633.619	D	3.726	3.681	0.045	1	78	7.97	4.08	2.46	0.43	7.07	14
2002	31	0	65	1615.318	-616.528	D	3.726	3.681	0.045	1	62.42	19.33	5.11	3.22	0.58	9.34	15
2002	6	0	1	1609.918	-633.619	D	3.726	3.681	0.045	1	48.88	22.32	8.06	5.05	1.05	14.64	16
2002	153	0	48	1633.97	-614.771	D	3.725	3.681	0.044	1	70.83	1.85	7.75	4.76	1.06	13.76	17
2002	199	0	2	1610.682	-633.471	D	3.72	3.681	0.039	1	87.49	1.46	3.25	1.93	0.39	5.49	18
2002	279	0	65	1615.318	-616.528	D	3.713	3.681	0.032	1	77.71	1.77	5.8	3.59	0.72	10.42	19
2002	233	0	48	1633.97	-614.771	D	3.712	3.681	0.031	1	80.1	2.06	5.07	3.12	0.66	8.98	20
2002	166	0	2	1610.682	-633.471	D	3.711	3.681	0.03	1	77.5	4.19	5.05	3.24	0.59	9.44	21
2002	304	0	7	1610.155	-630.742	D	3.71	3.681	0.029	1	38.99	22.2	11.07	6.81	1.21	19.72	22
2003	72	0	163	1629.721	-605.221	D	3.781	3.681	0.1	1	75.33	11.53	3.75	2.34	0.33	6.73	1
2003	65	0	2	1610.682	-633.471	D	3.782	3.681	0.1	1	65.73	16.12	5.48	3.1	0.66	8.91	2
2003	317	0	32	1611.037	-623.021	D	3.756	3.681	0.075	1	72.92	1.7	7.11	4.47	0.79	13.01	3
2003	71	0	20	1610.214	-626.955	D	3.751	3.681	0.07	1	81.87	5.45	3.62	2.25	0.3	6.51	4
2003	6	0	1	1609.918	-633.619	D	3.747	3.681	0.066	1	56.36	12.73	8.86	5.43	0.88	15.73	5
2003	128	0	2	1610.682	-633.471	D	3.746	3.681	0.065	1	62.17	6.57	9.25	5.38	1.13	15.5	6
2003	69	0	25	1610.626	-624.988	D	3.741	3.681	0.06	1	76.02	10.93	3.68	2.3	0.37	6.7	7
2003	35	0	2	1610.682	-633.471	D	3.741	3.681	0.06	1	52.51	10.72	10.44	6.46	1.12	18.75	8
2003	3	0	1	1609.918	-633.619	D	3.739	3.681	0.058	1	69.55	7.3	6.41	4.11	0.71	11.93	9
2003	157	0	48	1633.97	-614.771	D	3.736	3.681	0.055	1	65.2	8.52	7.65	4.56	0.92	13.16	10
2003	89	0	1	1609.918	-633.619	D	3.732	3.681	0.051	1	76.6	4.94	5.3	3.26	0.47	9.43	11
2003	34	0	1	1609.918	-633.619	D	3.732	3.681	0.051	1	58.44	9.77	9.08	5.59	0.91	16.21	12
2003	178	0	20	1610.214	-626.955	D	3.727	3.681	0.046	1	70.53	0.51	8.21	5.04	1.07	14.64	13
2003	264	0	1	1609.918	-633.619	D	3.723	3.681	0.042	1	73.66	0.65	7.82	4.55	0.49	12.84	14
2003	210	0	48	1633.97	-614.771	D	3.723	3.681	0.042	1	77.69	2.08	5.71	3.53	0.73	10.26	15
2003	211	0	47	1633.208	-614.921	D	3.722	3.681	0.041	1	65.65	3.9	9.06	5.21	1.18	15	16
2003	147	0	2	1610.682	-633.471	D	3.721	3.681	0.04	1	77.73	6.97	4.43	2.66	0.56	7.65	17
2003	213	0	1	1609.918	-633.619	D	3.72	3.681	0.039	1	63.44	3.32	9.49	5.78	1.23	16.76	18
2003	105	0	1	1609.918	-633.619	D	3.72	3.681	0.039	1	78.44	5.82	4.44	2.81	0.39	8.09	19
2003	203	0	25	1610.626	-624.988	D	3.719	3.681	0.038	1	79.9	7.39	3.57	2.24	0.41	6.49	20
2003	90	0	164	1630.482	-605.072	D	3.72	3.681	0.038	1	71	8.33	5.85	3.66	0.57	10.59	21
2003	218	0	1	1609.918	-633.619	D	3.718	3.681	0.037	1	79.14	1.9	5.5	3.28	0.68	9.5	22

Saint Marks Model Output Summary

	---	Ranked	Daily	Visibility	Change	---						% of Modeled Extinction by Species					
YEAR	DAY	HR	RECEPTOR	COORDINATES (km)		TYPE	DV(Total)	DV(BKG)	DELTA	DV	F(RH)	%_SO4	%_NO3	%_OC	%_EC	%_PMC	%_PMF
2001	296	0	55	1255.24	-1008.114	D	3.918	3.832	0.086	1	62.44	11.5	7.42	4.57	0.81	13.26	1
2001	272	0	16	1256.438	-1010.767	D	3.917	3.832	0.085	1	79.55	2.2	5.08	3.23	0.53	9.41	2
2001	304	0	21	1256.305	-1009.845	D	3.904	3.832	0.072	1	47.47	11.73	11.68	7.16	1.18	20.79	3
2001	295	0	101	1234.492	-1005.43	D	3.89	3.832	0.058	1	59.82	7.11	9.43	5.84	0.87	16.93	4
2001	319	0	86	1234.885	-1008.199	D	3.889	3.832	0.057	1	46.87	6.57	13.25	8.36	0.53	24.43	5
2001	18	0	98	1255.506	-1004.308	D	3.886	3.832	0.054	1	78.31	3.39	5.14	3.23	0.55	9.38	6
2001	297	0	7	1210.455	-1025.751	D	3.885	3.832	0.052	1	78.96	6.76	4.01	2.56	0.32	7.39	7
2001	294	0	11	1211.127	-1024.716	D	3.879	3.832	0.047	1	63.32	2.97	9.9	5.87	0.99	16.95	8
2001	309	0	96	1253.91	-1004.538	D	3.876	3.832	0.044	1	68.69	1.46	8.51	5.3	0.67	15.39	9
2001	303	0	16	1256.438	-1010.767	D	3.875	3.832	0.043	1	40.39	13.56	13.35	8.15	0.85	23.71	10
2001	271	0	98	1255.506	-1004.308	D	3.873	3.832	0.041	1	82.86	0.93	4.5	2.87	0.49	8.35	11
2001	338	0	7	1210.455	-1025.751	D	3.87	3.832	0.038	1	63.1	3.64	9.42	5.9	0.74	17.2	12
2001	322	0	16	1256.438	-1010.767	D	3.869	3.832	0.037	1	56.75	3.52	9.75	7.28	1.02	21.67	13
2001	258	0	16	1256.438	-1010.767	D	3.862	3.832	0.03	1	47.83	6.16	12.67	8.3	0.69	24.35	14
2001	59	0	16	1256.438	-1010.767	D	3.857	3.832	0.024	1	78.74	1.44	5.6	3.5	0.59	10.14	15
2001	292	0	98	1255.506	-1004.308	D	3.856	3.832	0.023	1	35.65	10.29	16.14	9.32	1.67	26.93	16
2001	204	0	101	1234.492	-1005.43	D	3.855	3.832	0.023	1	62.24	0.39	11.06	6.64	0.5	19.17	17
2001	205	0	98	1255.506	-1004.308	D	3.854	3.832	0.022	1	64.83	0.93	9.85	6	1	17.39	18
2001	196	0	101	1234.492	-1005.43	D	3.853	3.832	0.021	1	68.91	0.35	8.75	5.49	0.57	15.94	19
2001	136	0	7	1210.455	-1025.751	D	3.853	3.832	0.021	1	85.72	0.53	3.86	2.46	0.32	7.11	20
2001	311	0	101	1234.492	-1005.43	D	3.852	3.832	0.02	1	43.21	4.77	14.83	9.18	1.49	26.52	21
2001	273	0	101	1234.492	-1005.43	D	3.853	3.832	0.02	1	37.24	7.88	15.72	9.83	0.74	28.59	22
2002	325	0	16	1256.438	-1010.767	D	3.983	3.832	0.151	1	63.59	6.2	8.58	5.31	0.92	15.41	1
2002	343	0	101	1234.492	-1005.43	D	3.904	3.832	0.072	1	60.64	10.97	7.99	5.02	0.87	14.52	2
2002	54	0	16	1256.438	-1010.767	D	3.883	3.832	0.051	1	69.53	4.59	7.22	4.57	0.81	13.29	3
2002	344	0	101	1234.492	-1005.43	D	3.88	3.832	0.048	1	45.77	21.33	9.61	5.77	0.92	16.61	4
2002	285	0	98	1255.506	-1004.308	D	3.877	3.832	0.045	1	68.31	9.82	6.1	3.87	0.63	11.28	5
2002	302	0	2	1214.041	-1028.078	D	3.877	3.832	0.044	1	86.12	1.59	3.54	2.18	0.29	6.29	6
2002	339	0	7	1210.455	-1025.751	D	3.871	3.832	0.039	1	70.19	6.69	6.52	4.08	0.69	11.83	7
2002	283	0	101	1234.492	-1005.43	D	3.871	3.832	0.039	1	79.71	1.36	5.4	3.36	0.43	9.74	8
2002	245	0	96	1253.91	-1004.538	D	3.869	3.832	0.036	1	66.89	1.47	9.13	5.58	0.77	16.18	9
2002	247	0	16	1256.438	-1010.767	D	3.868	3.832	0.035	1	72.52	2.18	7.18	4.46	0.74	12.93	10
2002	57	0	1	1212.44	-1028.3	D	3.861	3.832	0.029	1	74.19	6.61	5.5	3.41	0.44	9.85	11
2002	96	0	16	1256.438	-1010.767	D	3.858	3.832	0.026	1	73.72	3.15	6.52	4.08	0.69	11.84	12
2002	342	0	16	1256.438	-1010.767	D	3.857	3.832	0.025	1	64.56	12.48	6.41	4.1	0.52	11.94	13
2002	319	0	2	1214.041	-1028.078	D	3.856	3.832	0.024	1	63.8	4.13	9.12	5.68	0.82	16.47	14
2002	300	0	84	1255.772	-1006.153	D	3.856	3.832	0.024	1	80.55	5.06	4.18	2.56	0.3	7.37	15
2002	353	0	98	1255.506	-1004.308	D	3.855	3.832	0.023	1	64.85	19.3	4.52	2.81	0.39	8.14	16
2002	326	0	7	1210.455	-1025.751	D	3.855	3.832	0.022	1	76.65	3.16	5.8	3.56	0.52	10.32	17
2002	289	0	16	1256.438	-1010.767	D	3.854	3.832	0.022	1	42.94	12.45	12.83	7.85	1.09	22.84	18
2002	83	0	16	1256.438	-1010.767	D	3.854	3.832	0.022	1	55.82	9.11	9.81	6.18	1.13	17.96	19
2002	136	0	2	1214.041	-1028.078	D	3.853	3.832	0.021	1	57.33	1.02	12.12	7.27	1.27	21	20
2002	253	0	16	1256.438	-1010.767	D	3.852	3.832	0.02	1	72.49	0.3	7.89	4.8	0.64	13.89	21
2002	174	0	101	1234.492	-1005.43	D	3.852	3.832	0.02	1	60.42	5.48	9.65	6.03	0.87	17.54	22
2003	313	0	16	1256.438	-1010.767	D	3.906	3.832	0.074	1	79.91	2.09	5.07	3.19	0.47	9.27	1
2003	326	0	98	1255.506	-1004.308	D	3.888	3.832	0.055	1	65.54	3.3	8.6	5.49	1.09	15.97	2
2003	256	0	101	1234.492	-1005.43	D	3.882	3.832	0.05	1	66.67	2.52	9.05	5.37	0.93	15.47	3
2003	254	0	16	1256.438	-1010.767	D	3.877	3.832	0.045	1	71.5	2.82	7.37	4.5	0.79	13.02	4
2003	340	0	1	1212.44	-1028.3	D	3.876	3.832	0.043	1	70.67	17.15	3.49	2.17	0.27	6.27	5
2003	327	0	99	1233.825	-1006.466	D	3.875	3.832	0.043	1	77.14	2.26	5.83	3.66	0.56	10.55	6
2003	348	0	101	1234.492	-1005.43	D	3.866	3.832	0.033	1	63.61	13.01	6.62	4.14	0.63	12	7
2003	294	0	98	1255.506	-1004.308	D	3.865	3.832	0.033	1	72.4	0.63	7.56	4.77	0.76	13.88	8
2003	308	0	101	1234.492	-1005.43	D	3.864	3.832	0.032	1	38.28	5.81	16.09	9.87	1.29	28.65	9
2003	60	0	98	1255.506	-1004.308	D	3.863	3.832	0.03	1	78.42	9.18	3.6	2.2	0.25	6.36	10
2003	315	0	16	1256.438	-1010.767	D	3.861	3.832	0.029	1	48.75	6	13.25	8.14	0.23	23.64	11
2003	67	0	98	1255.506	-1004.308	D	3.861	3.832	0.029	1	80.91	12.65	1.86	1.16	0.06	3.37	12
2003	52	0	98	1255.506	-1004.308	D	3.859	3.832	0.026	1	82.95	8.74	2.37	1.48	0.2	4.26	13
2003	277	0	101	1234.492	-1005.43	D	3.857	3.832	0.025	1	45.89	4.16	15.15	8.72	1.11	24.97	14
2003	362	0	101	1234.492	-1005.43	D	3.856	3.832	0.024	1	49.34	19.07	8.93	5.61	0.8	16.25	15
2003	306	0	98	1255.506	-1004.308	D	3.856	3.832	0.024	1	61.27	1.54	10.54	6.6	0.89	19.17	16
2003	351	0	98	1255.506	-1004.308	D	3.855	3.832	0.023	1	72.76	16.07	3.2	1.98	0.26	5.74	17
2003	304	0	101	1234.492	-1005.43	D	3.854	3.832	0.022	1	69.85	0.82	8.25	5.18	0.83	15.07	18
2003	290	0	1	1212.44	-1028.3	D	3.853	3.832	0.021	1	57.12	1.21	12.02	7.25	1.43	20.99	19
2003	283	0	101	1234.492	-1005.43	D	3.852	3.832	0.02	1	80.41	1.93	5.04	3.13	0.47	9.03	20
2003	275	0	101	1234.492	-1005.43	D	3.852	3.832	0.02	1	43.6	4.4	14.8	9.16	1.56	26.48	21
2003	274	0	11	1211.127	-1024.716	D	3.851	3.832	0.019	1	63.73	0.86	10.09	6.34	0.54	18.44	22