BART Exemption Modeling Report:

Georgia Power Company
Plant Mitchell

Prepared by:

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for Georgia Power Company

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1.0 Introduction

1.1 Objectives

The Regional Haze Rule requires Best Available Retrofit Technology (BART) for any BART-eligible source that "emits any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility" in any mandatory Class I federal area. Pursuant to federal regulations, states have the option of exempting a BART-eligible source from the BART requirements based on dispersion modeling demonstrating that the source cannot reasonably be anticipated to cause or contribute to visibility impairment in a Class I area. In addition, the Environmental Protection Agency (EPA) has promulgated a rule allowing states subject to the Clean Air Interstate Rule (CAIR) to determine that CAIR satisfies the BART requirements for SO_2 and NO_x for electric generating units (EGUs). Feedback from the Georgia Environmental Protection Division indicates that CAIR satisfies BART for SO_2 and NO_x for EGUs. Therefore, this modeling report focuses on performing the BART modeling analysis for particulate matter (PM) only.

Unit 3 at Plant Mitchell, located near Albany, which is owned and operated by Georgia Power Company, has been identified as a BART-eligible source. The modeling procedures outlined in the source-specific BART modeling protocol for Plant Mitchell were used to determine whether the source is subject to BART requirements (exemption modeling). The modeling procedures are consistent with those outlined in the updated final VISTAS common BART modeling protocol (dated December 22, 2005, revision 3 – July 18, 2006), available at http://www.vistas-sesarm.org/BART/BARTModelingProtocol_rev3_18Jul2006.pdf. This source-specific BART modeling protocol references relevant portions of the common VISTAS modeling protocol.

1.2 Location of source vs. relevant Class I Areas

The Georgia Environmental Protection Division, which is in charge of the state's BART program, has determined that Unit 3 at Plant Mitchell is BART-eligible for PM. Figure 1-1 shows a plot of Plant Mitchell relative to nearby Class I Areas. There are three Class I areas within 300 km of the plant: Okefenokee (163.4 km), Saint Marks (141.7 km), and Wolf Island (265.4 km). The BART exemption modeling was conducted for these Class I areas in accordance with the referenced VISTAS common BART modeling protocol and the procedures described in the source-specific BART modeling protocol.

Figure 1-1 Location of Class I Areas in Relation to Plant Mitchell

2.0 Source description and emissions data

2.1 Unit-specific source data

The emissions data used to assess the visibility impacts at the Class I areas within 300 km of Plant Mitchell are discussed in this section. The Georgia Environmental Protection Division has indicated that CAIR will satisfy BART for EGUs for SO_2 and NO_x. Therefore, this BART exemption modeling analysis focuses only on PM_{10}. Since various components of PM_{10} emissions have different visibility extinction efficiencies, the PM_{10} emissions are divided, or "speciated," into several components (VISTAS common protocol Sections 4.3.3 and 4.4.2). The VISTAS protocol (Section 5) allows for the use of source-specific emissions and speciation factors and/or default values from AP-42. The PM_{10} emissions and speciation approach that were used for the modeling is indicated below. Where default speciation values are used, the data represents a unit where current (baseline) emission controls include electrostatic precipitators (ESPs), but no post-combustion NO_x or SO_2 control equipment exists.

- Total PM_{10} is comprised of filterable and condensable emissions.
- Baseline filterable PM_{10} emissions are based on the highest stack test for the most recent 3-year period (2003-2005). This stack test is combined with the highest 24 hour heat input value for this period from CEMS data to calculate the "maximum 24 hour average emission rate" as required by the VISTAS protocol.
- Filterable PM_{10} has been subdivided by size category consistent with the default approach from AP-42 Table 1-1.6, and as noted on pages 43 and 44 of the VISTAS common BART modeling protocol. The AP-42 Table 1-1.6 specifies for the emission controls indicated above that 55.6% of filterable PM_{10} emissions is coarse (greater than 2.5 microns in size) and 44.4% is fine. Of the fine portion, 3.7% is elemental carbon and the remainder is inorganic fine particulates (soil).
- Condensable PM_{10} consists of inorganic and organic compounds. The inorganic portion is by default assumed to be H_2SO_4, although other non-sulfate inorganic condensables could be present. The organic portion is modeled as organic aerosols.
- Baseline H_2SO_4 emissions are calculated consistent with the method used by Georgia Power to derive these emissions for TRI purposes. This approach assumes that the H_2SO_4 emissions released from the stack are proportional to SO_2 emissions from combustion and are dependent on the fuel type and the removal of H_2SO_4 by downstream equipment (i.e., ESP and air heater). For eastern bituminous coal the baseline H_2SO_4 release rate is in the range of 0.3 to 0.8% of the SO_2 emissions. Appendix A of the site-specific modeling protocol provides the basis for the site-specific values used.
- Baseline emissions of condensable organics (the remaining portion of condensable PM_{10}) are derived based on the supporting field observational information in Appendix B of the site-specific modeling protocol and is estimated as 0.32% of SO_2 emitted.
- Coarse filterable particles (between 2.5 and 10 microns in size) will be modeled with a geometric mass mean diameter of 5 microns, while fine filterable and all condensable particles will be modeled with a geometric mass mean diameter of 0.48 microns, consistent with the CALPUFF default value for fine particles. The geometric standard deviation for both fine and coarse particles will be set to 2 microns, consistent with the CALPUFF default value. The 0.48 micron diameter value for fine particles comes from the default values in sample input files presented on the TRC web site. There is no default value presented for the coarse particles on the TRC web site. However, since 5 is the geometric mass mean diameter of 2.5 and 10 (the bounds of coarse particle sizes), it is a reasonable estimate for the geometric mass mean diameter for that class of particles.

In practice, CALPUFF allows for the user to input certain components of PM_{10} as separate species and separate sizes, which will result in more accurate wet and dry deposition velocity results and also more

accurate effects on light scattering. As noted above, the particle size distribution information is provided in AP-42 Table 1-1.6, and will be used for the BART exemption modeling.

Table 2-1 provides a summary of the modeling emission parameters used in the BART CALPUFF modeling, consistent with the source emissions data presented in Appendices A and B of the site-specific modeling protocol for the baseline. All of the emissions in Table 2-1 were derived from CEMS data for the 2003 to 2005 period and represent the maximum 24-hour average lb/hr rates (excluding days where startup, shutdown, or malfunctions occurred). For NO_x and SO_2 the values are directly from CEMS. Filterable PM_{10} emissions were calculated using the highest stack test over the 2003 to 2005 period and multiplying these values times the maximum 24-hour average heat input derived from CEMS. These values were then adjusted using AP-42 factors from Table 1.1-6 that indicate that PM_{10} is 67% of total PM for a pulverized coal unit with an ESP. PM_{10} speciation was then performed as indicated above such that total Filterable PM_{10} is made up of Coarse Soil plus total Fine PM and total Fine PM is made up of Fine Soil plus Elemental Carbon (EC).

Table 2-1 Plant Mitchell modeling emission parameters

Case	Source / Unit	Location UTM (Zone 17 NAD-83)		Actual Stack Ht	Base Elev.	Flue Dia-meter	Gas Exit Vel.	Stack Gas Exit Temp.	Emissions[1]			Particle Speciation[2]							
		UTM East	UTM North						SO_2	NO_X	PM_{10}	Filt. PM_{10}	Coarse Soil	Fine PM	Fine Soil	EC	Cond. PM_{10}	H_2SO_4	Organic
		m	m	m	m	m	m/s	deg K	lbs/hr	lbs/hr	lbs/hr	lbs/hr	lbs/hr	lbs/hr	lbs/hr	lbs/hr	lbs/hr	lbs/hr	lbs/hr
Baseline Data - Current Configuration (Unit Basis)																			
Baseline	Unit 3	772,550	3,482,419	152.4	53.0	6.4	9.2	421.9	4408.41	1032.50	63.77	36.69	20.40	16.29	15.69	0.60	27.08	12.97	14.11
Baseline Data - Current Configuration (Stack Basis)																			
				Modeled Stk Ht[3]															
Baseline		m	m	m	m	m	m/s	deg K	lbs/hr	lbs/hr	lbs/hr	lbs/hr	lbs/hr	lbs/hr	lbs/hr	lbs/hr	lbs/hr	lbs/hr	lbs/hr
Stack 1	Unit 3	772,550	3,482,419	105.2	53.0	6.4	9.2	421.9	4408.41	1032.50	63.77	36.69	20.40	16.29	15.69	0.60	27.08	12.97	14.11
Stack Basis Emissions Converted to g/sec									g/sec	g/sec	g/sec	g/sec	g/sec	g/sec	g/sec	g/sec	g/sec	g/sec	g/sec
Stack 1	Unit 3	772,550	3,482,419	105.2	53.0	6.4	9.2	421.9	555.46	130.09	8.03	4.62	2.57	2.05	1.98	0.08	3.41	1.63	1.78

[1] SO_2 and NO_x emissions are not BART-applicable for EGU sources in CAIR states, if the state agency agrees with EPA's interpretation of the BART final rule. The emissions for SO_2 and NO_x are provided for information purposes, and for reference in the computation of certain particle species such as H_2SO_4.

[2] Elemental carbon (EC) and Fine PM are a part of Filterable PM_{10} and H_2SO_4 and Organics are a part of Condensable PM_{10}. Note that H_2SO_4 is input to CALPUFF as SO_4. The molecular weights of H_2SO_4 and SO_4 are 98 and 96 respectively, therefore the conversion factor from H_2SO_4 to SO_4 is 96/98.

[3] Stack credit is equal to GEP. GEP of 345 ft (105.2 m) is less than actual height therefore GEP height is used for modeling.

3.0 Modeling results

The exemption modeling results are provided in Table 3-1, and Appendix A lists delta-deciview results for the top 20 days for each year modeled and the top 25 days for the overall three years at each Class I area. The table indicates that both the 8th highest day's impacts for each year and the 22nd highest day's impacts over all three years are below 0.5 delta-dv. These results demonstrate that Plant Mitchell's PM_{10} emissions do not cause or contribute to visibility impairment. Therefore, the source is not subject to BART for PM_{10}, and no further BART analysis is required.

Electronic data related to this application are provided on the attached disk. They include all input (INP) and list (LST) files.

Table 3-1 Summary of Results – Plant Mitchell Refined BART Exemption Modeling

		2001			2002			2003			Highest of 8th Highest delta-dv for the 3-years	22nd Highest delta-dv over 3-year period
Class I area	**Distance from source to Class I area boundary**	**# of days and receptors beyond 98th percentile with impact > 0.5 delta-dv**		**8th Highest delta-dv**	**# of days and receptors beyond 98th percentile with impact > 0.5 delta-dv**		**8th Highest delta-dv**	**# of days and receptors beyond 98th percentile with impact > 0.5 delta-dv**		**8th Highest delta-dv**		
	km	**Days**	**Rec**	**delta-dv**	**Days**	**Rec**	**delta-dv**	**Days**	**Rec**	**delta-dv**	**delta-dv**	**delta-dv**
Okefenokee	**163.4**	0	0	0.03	0	0	0.04	0	0	0.04	0.04	0.03
Wolf Island	**265.4**	0	0	0.02	0	0	0.01	0	0	0.01	0.02	0.01
Saint Marks	**141.7**	0	0	0.04	0	0	0.05	0	0	0.04	0.05	0.04

Appendix A

Delta-Deciview Values for the Top 20 Days – for Each Year/Each Class I Area and for the Top 25 Days – Over Three Years

Ranked Daily Visibility Change for Okefenokee (Top 20 Days for Each Year)

							% of Modeled Extinction by Species					
YEAR	DAY	REC	DV(Total)	DV(BKG)	DELTA DV	F(RH)	% SO4	% NO3	% OC	% EC	% PMC	% PMF	Ranking
2001	221	387	7.645	7.608	0.037	4.1	71.35	0.00	18.77	2.11	2.54	5.22	1
2001	192	494	7.645	7.608	0.037	3.7	69.58	0.00	20.29	2.28	2.21	5.64	2
2001	65	139	7.644	7.608	0.036	3.1	66.85	0.00	23.26	2.61	0.80	6.47	3
2001	151	280	7.642	7.608	0.034	3.6	68.57	0.00	20.55	2.31	2.86	5.71	4
2001	313	499	7.639	7.608	0.031	3.5	68.54	0.00	21.13	2.37	2.07	5.88	5
2001	234	51	7.638	7.608	0.030	4.1	71.38	0.00	18.78	2.11	2.50	5.22	6
2001	5	17	7.636	7.608	0.028	3.5	68.10	0.00	20.99	2.36	2.71	5.84	7
2001	336	275	7.635	7.608	0.027	3.6	69.03	0.00	20.69	2.32	2.20	5.75	8
2001	137	494	7.635	7.608	0.027	3.6	68.95	0.00	20.66	2.32	2.31	5.75	9
2001	361	500	7.634	7.608	0.026	3.6	69.32	0.00	20.77	2.33	1.79	5.78	10
2001	190	299	7.634	7.608	0.026	3.7	69.85	0.00	20.37	2.29	1.83	5.66	11
2001	187	499	7.634	7.608	0.026	3.7	69.54	0.00	20.27	2.28	2.27	5.64	12
2001	61	17	7.634	7.608	0.026	3.1	65.33	0.00	22.73	2.55	3.05	6.32	13
2001	8	189	7.634	7.608	0.026	3.5	68.20	0.00	21.02	2.36	2.56	5.85	14
2001	202	406	7.633	7.608	0.025	3.7	68.89	0.00	20.09	2.26	3.17	5.59	15
2001	133	254	7.633	7.608	0.025	3.6	69.04	0.00	20.69	2.32	2.18	5.75	16
2001	7	371	7.633	7.608	0.025	3.5	68.84	0.00	21.22	2.38	1.66	5.90	17
2001	337	1	7.632	7.608	0.024	3.6	69.17	0.00	20.73	2.33	2.00	5.76	18
2001	92	104	7.632	7.608	0.024	3.0	64.52	0.00	23.20	2.61	3.22	6.45	19
2001	189	299	7.632	7.608	0.023	3.7	69.32	0.00	20.21	2.27	2.56	5.62	20
2002	351	17	7.699	7.608	0.091	3.6	69.22	0.00	20.74	2.33	1.94	5.77	1
2002	364	393	7.667	7.608	0.059	3.6	68.77	0.00	20.61	2.32	2.57	5.73	2
2002	346	254	7.656	7.608	0.048	3.6	68.75	0.00	20.60	2.31	2.60	5.73	3
2002	19	464	7.652	7.608	0.044	3.5	68.54	0.00	21.13	2.37	2.07	5.88	4
2002	327	17	7.645	7.608	0.037	3.5	68.16	0.00	21.01	2.36	2.62	5.84	5
2002	338	16	7.643	7.608	0.035	3.6	69.04	0.00	20.69	2.32	2.18	5.75	6
2002	214	357	7.643	7.608	0.035	4.1	71.85	0.00	18.90	2.12	1.86	5.26	7
2002	202	500	7.643	7.608	0.035	3.7	69.56	0.00	20.28	2.28	2.23	5.64	8
2002	48	139	7.642	7.608	0.034	3.2	66.34	0.00	22.36	2.51	2.56	6.22	9
2002	182	393	7.641	7.608	0.033	3.7	69.38	0.00	20.23	2.27	2.48	5.63	10
2002	322	348	7.638	7.608	0.030	3.5	69.12	0.00	21.30	2.39	1.25	5.92	11
2002	8	299	7.638	7.608	0.030	3.5	68.34	0.00	21.06	2.37	2.36	5.86	12
2002	219	393	7.636	7.608	0.028	4.1	71.23	0.00	18.74	2.11	2.70	5.21	13
2002	355	478	7.634	7.608	0.026	3.6	69.60	0.00	20.86	2.34	1.40	5.80	14
2002	349	254	7.634	7.608	0.026	3.6	69.65	0.00	20.87	2.35	1.33	5.80	15
2002	237	499	7.635	7.608	0.026	4.1	71.44	0.00	18.80	2.11	2.43	5.23	16
2002	255	499	7.633	7.608	0.025	4.0	71.20	0.00	19.20	2.16	2.10	5.34	17
2002	347	254	7.632	7.608	0.024	3.6	68.32	0.00	20.47	2.30	3.21	5.69	18
2002	74	86	7.633	7.608	0.024	3.1	64.98	0.00	22.61	2.54	3.58	6.29	19
2002	304	299	7.630	7.608	0.022	3.8	70.82	0.00	20.11	2.26	1.21	5.59	20
2003	50	51	7.658	7.608	0.050	3.2	67.07	0.00	22.61	2.54	1.49	6.29	1
2003	9	433	7.657	7.608	0.049	3.5	68.27	0.00	21.04	2.36	2.47	5.85	2
2003	353	68	7.655	7.608	0.047	3.6	68.54	0.00	20.54	2.31	2.90	5.71	3
2003	191	500	7.654	7.608	0.046	3.7	69.14	0.00	20.16	2.26	2.83	5.61	4
2003	27	254	7.653	7.608	0.045	3.5	69.20	0.00	21.33	2.40	1.14	5.93	5
2003	210	434	7.652	7.608	0.044	3.7	69.14	0.00	20.16	2.27	2.82	5.61	6
2003	352	17	7.646	7.608	0.038	3.6	69.52	0.00	20.83	2.34	1.51	5.79	7
2003	49	254	7.646	7.608	0.038	3.2	66.74	0.00	22.50	2.53	1.98	6.26	8
2003	4	254	7.640	7.608	0.032	3.5	69.04	0.00	21.28	2.39	1.38	5.92	9
2003	83	393	7.638	7.608	0.030	3.1	66.35	0.00	23.09	2.59	1.54	6.42	10
2003	173	433	7.636	7.608	0.028	3.7	69.57	0.00	20.28	2.28	2.23	5.64	11
2003	123	448	7.636	7.608	0.028	3.6	69.03	0.00	20.68	2.32	2.20	5.75	12
2003	103	324	7.636	7.608	0.028	3.0	64.71	0.00	23.27	2.61	2.94	6.47	13
2003	44	347	7.636	7.608	0.028	3.2	67.00	0.00	22.59	2.54	1.59	6.28	14
2003	102	371	7.633	7.608	0.025	3.0	64.92	0.00	23.34	2.62	2.62	6.49	15
2003	298	227	7.631	7.608	0.023	3.8	69.72	0.00	19.79	2.22	2.75	5.50	16
2003	336	51	7.630	7.608	0.022	3.6	68.47	0.00	20.52	2.31	3.00	5.71	17
2003	272	433	7.629	7.608	0.021	4.0	70.33	0.00	18.97	2.13	3.29	5.27	18
2003	354	17	7.627	7.608	0.019	3.6	69.03	0.00	20.69	2.32	2.20	5.75	19
2003	150	209	7.627	7.608	0.019	3.6	68.19	0.00	20.43	2.30	3.40	5.68	20

Ranked Daily Visibility Change for Okefenokee (Top 25 Days Over Three Years)

							% of Modeled Extinction by Species					
YEAR	DAY	REC	DV(Total)	DV(BKG)	DELTA DV	F(RH)	% SO4	% NO3	% OC	% EC	% PMC	% PMF	Ranking
2002	351	17	7.699	7.608	0.091	3.6	69.22	0.00	20.74	2.33	1.94	5.77	1
2002	364	393	7.667	7.608	0.059	3.6	68.77	0.00	20.61	2.32	2.57	5.73	2
2003	50	51	7.658	7.608	0.050	3.2	67.07	0.00	22.61	2.54	1.49	6.29	3
2003	9	433	7.657	7.608	0.049	3.5	68.27	0.00	21.04	2.36	2.47	5.85	4
2002	346	254	7.656	7.608	0.048	3.6	68.75	0.00	20.60	2.31	2.60	5.73	5
2003	353	68	7.655	7.608	0.047	3.6	68.54	0.00	20.54	2.31	2.90	5.71	6
2003	191	500	7.654	7.608	0.046	3.7	69.14	0.00	20.16	2.26	2.83	5.61	7
2003	27	254	7.653	7.608	0.045	3.5	69.20	0.00	21.33	2.40	1.14	5.93	8
2002	19	464	7.652	7.608	0.044	3.5	68.54	0.00	21.13	2.37	2.07	5.88	9
2003	210	434	7.652	7.608	0.044	3.7	69.14	0.00	20.16	2.27	2.82	5.61	10
2003	352	17	7.646	7.608	0.038	3.6	69.52	0.00	20.83	2.34	1.51	5.79	11
2003	49	254	7.646	7.608	0.038	3.2	66.74	0.00	22.50	2.53	1.98	6.26	12
2001	221	387	7.645	7.608	0.037	4.1	71.35	0.00	18.77	2.11	2.54	5.22	13
2001	192	494	7.645	7.608	0.037	3.7	69.58	0.00	20.29	2.28	2.21	5.64	14
2002	327	17	7.645	7.608	0.037	3.5	68.16	0.00	21.01	2.36	2.62	5.84	15
2001	65	139	7.644	7.608	0.036	3.1	66.85	0.00	23.26	2.61	0.80	6.47	16
2002	338	16	7.643	7.608	0.035	3.6	69.04	0.00	20.69	2.32	2.18	5.75	17
2002	214	357	7.643	7.608	0.035	4.1	71.85	0.00	18.90	2.12	1.86	5.26	18
2002	202	500	7.643	7.608	0.035	3.7	69.56	0.00	20.28	2.28	2.23	5.64	19
2001	151	280	7.642	7.608	0.034	3.6	68.57	0.00	20.55	2.31	2.86	5.71	20
2002	48	139	7.642	7.608	0.034	3.2	66.34	0.00	22.36	2.51	2.56	6.22	21
2002	182	393	7.641	7.608	0.033	3.7	69.38	0.00	20.23	2.27	2.48	5.63	22
2003	4	254	7.640	7.608	0.032	3.5	69.04	0.00	21.28	2.39	1.38	5.92	23
2001	313	499	7.639	7.608	0.031	3.5	68.54	0.00	21.13	2.37	2.07	5.88	24
2001	234	51	7.638	7.608	0.030	4.1	71.38	0.00	18.78	2.11	2.50	5.22	25

Ranked Daily Visibility Change for Wolf Island (Top 20 Days for Each Year)

							% of Modeled Extinction by Species					
YEAR	DAY	REC	DV(Total)	DV(BKG)	DELTA DV	F(RH)	% SO4	% NO3	% OC	% EC	% PMC	% PMF	Ranking
2001	222	501	7.62	7.58	0.04	4.1	71.77	0	18.88	2.12	1.96	5.25	1
2001	240	524	7.61	7.58	0.03	4.1	71.44	0	18.8	2.11	2.42	5.23	2
2001	313	524	7.605	7.58	0.025	3.5	68.52	0	21.12	2.37	2.12	5.87	3
2001	37	501	7.6	7.58	0.02	3.1	65.24	0	22.7	2.55	3.2	6.31	4
2001	195	501	7.598	7.58	0.018	3.7	69.14	0	20.16	2.26	2.82	5.61	5
2001	223	530	7.597	7.58	0.017	4.1	71.89	0	18.92	2.13	1.8	5.26	6
2001	325	524	7.596	7.58	0.016	3.5	67.89	0	20.93	2.35	3.01	5.82	7
2001	221	501	7.596	7.58	0.016	4.1	71.94	0	18.93	2.13	1.73	5.26	8
2001	242	530	7.595	7.58	0.015	4.1	71.62	0	18.84	2.12	2.17	5.24	9
2001	194	530	7.595	7.58	0.015	3.7	69.43	0	20.24	2.27	2.42	5.63	10
2001	193	530	7.594	7.58	0.014	3.7	70.1	0	20.44	2.3	1.48	5.68	11
2001	188	530	7.593	7.58	0.013	3.7	69.49	0	20.26	2.28	2.32	5.63	12
2001	187	501	7.593	7.58	0.013	3.7	69.88	0	20.38	2.29	1.77	5.67	13
2001	364	501	7.592	7.58	0.012	3.5	68.65	0	21.16	2.38	1.92	5.88	14
2001	336	524	7.592	7.58	0.012	3.5	68.75	0	21.19	2.38	1.77	5.89	15
2001	137	502	7.592	7.58	0.012	3.3	66.42	0	21.71	2.44	3.39	6.04	16
2001	265	501	7.591	7.58	0.011	4	71.33	0	19.24	2.16	1.91	5.35	17
2001	139	530	7.591	7.58	0.011	3.3	67.71	0	22.13	2.49	1.51	6.16	18
2001	53	518	7.591	7.58	0.011	3.1	66.11	0	23.01	2.58	1.9	6.4	19
2001	161	501	7.59	7.58	0.01	3.7	69.42	0	20.24	2.27	2.44	5.63	20
2002	202	501	7.604	7.58	0.024	3.7	69.87	0	20.37	2.29	1.8	5.67	1
2002	255	529	7.601	7.58	0.021	4	71.18	0	19.2	2.16	2.12	5.34	2
2002	19	501	7.601	7.58	0.021	3.4	68.33	0	21.68	2.44	1.53	6.03	3
2002	232	530	7.6	7.58	0.02	4.1	71.83	0	18.9	2.12	1.89	5.26	4
2002	279	524	7.596	7.58	0.016	3.7	69.58	0	20.29	2.28	2.2	5.64	5
2002	213	529	7.595	7.58	0.015	3.7	69.42	0	20.24	2.27	2.43	5.63	6
2002	231	524	7.594	7.58	0.014	4.1	71.56	0	18.83	2.12	2.26	5.24	7
2002	365	501	7.592	7.58	0.012	3.5	69.12	0	21.3	2.39	1.25	5.92	8
2002	237	501	7.592	7.58	0.012	4.1	71.65	0	18.85	2.12	2.11	5.24	9
2002	212	530	7.592	7.58	0.012	3.7	69.75	0	20.34	2.28	1.97	5.66	10
2002	112	529	7.592	7.58	0.012	3	65.17	0	23.43	2.63	2.25	6.52	11
2002	197	530	7.591	7.58	0.011	3.7	70.07	0	20.43	2.3	1.52	5.68	12
2002	179	501	7.591	7.58	0.011	3.7	69.68	0	20.32	2.28	2.05	5.65	13
2002	10	529	7.59	7.58	0.011	3.4	67.59	0	21.44	2.41	2.59	5.96	14
2002	338	501	7.59	7.58	0.01	3.5	67.89	0	20.93	2.35	2.99	5.82	15
2002	113	530	7.59	7.58	0.01	3	65.47	0	23.54	2.65	1.78	6.55	16
2002	20	524	7.59	7.58	0.01	3.4	68.69	0	21.8	2.45	1.01	6.06	17
2002	358	524	7.589	7.58	0.009	3.5	68.68	0	21.17	2.38	1.87	5.89	18
2002	238	530	7.589	7.58	0.009	4.1	71.99	0	18.94	2.13	1.66	5.27	19
2002	364	501	7.588	7.58	0.008	3.5	69.31	0	21.36	2.4	0.99	5.94	20
2003	20	502	7.608	7.58	0.028	3.4	67.14	0	21.3	2.39	3.23	5.92	1
2003	298	530	7.605	7.58	0.025	3.7	69.4	0	20.23	2.27	2.47	5.63	2
2003	211	530	7.601	7.58	0.021	3.7	69.38	0	20.23	2.27	2.5	5.63	3
2003	10	502	7.597	7.58	0.017	3.4	68.11	0	21.61	2.43	1.84	6.01	4
2003	191	501	7.596	7.58	0.016	3.7	69.71	0	20.33	2.28	2.02	5.65	5
2003	199	501	7.594	7.58	0.014	3.7	70.04	0	20.42	2.29	1.56	5.68	6
2003	192	530	7.594	7.58	0.014	3.7	69.28	0	20.2	2.27	2.63	5.62	7
2003	19	518	7.592	7.58	0.012	3.4	68.48	0	21.73	2.44	1.31	6.04	8
2003	202	530	7.591	7.58	0.011	3.7	69.52	0	20.27	2.28	2.3	5.64	9
2003	295	530	7.59	7.58	0.01	3.7	70.36	0	20.51	2.3	1.12	5.7	10
2003	161	502	7.59	7.58	0.01	3.7	70.03	0	20.42	2.29	1.58	5.68	11
2003	27	518	7.59	7.58	0.01	3.4	68.45	0	21.72	2.44	1.37	6.04	12
2003	210	501	7.589	7.58	0.009	3.7	70.01	0	20.41	2.29	1.58	5.68	13
2003	123	501	7.589	7.58	0.009	3.3	67.63	0	22.11	2.48	1.61	6.15	14
2003	101	518	7.589	7.58	0.009	3	66.27	0	23.83	2.68	0.58	6.63	15
2003	33	524	7.589	7.58	0.009	3.1	65.5	0	22.79	2.56	2.81	6.34	16
2003	34	501	7.587	7.58	0.007	3.1	66.09	0	23	2.58	1.93	6.4	17
2003	218	530	7.586	7.58	0.006	4.1	71.83	0	18.9	2.12	1.88	5.26	18
2003	153	501	7.586	7.58	0.006	3.7	69.75	0	20.34	2.29	1.97	5.66	19
2003	44	501	7.586	7.58	0.006	3.1	65.83	0	22.91	2.57	2.31	6.37	20

Ranked Daily Visibility Change for Wolf Island (Top 25 Days Over Three Years)

							% of Modeled Extinction by Species					
YEAR	DAY	REC	DV(Total)	DV(BKG)	DELTA DV	F(RH)	% SO4	% NO3	% OC	% EC	% PMC	% PMF	Ranking
2001	222	501	7.620	7.580	0.040	4.1	71.77	0.00	18.88	2.12	1.96	5.25	1
2001	240	524	7.610	7.580	0.030	4.1	71.44	0.00	18.80	2.11	2.42	5.23	2
2003	20	502	7.608	7.580	0.028	3.4	67.14	0.00	21.30	2.39	3.23	5.92	3
2001	313	524	7.605	7.580	0.025	3.5	68.52	0.00	21.12	2.37	2.12	5.87	4
2003	298	530	7.605	7.580	0.025	3.7	69.40	0.00	20.23	2.27	2.47	5.63	5
2002	202	501	7.604	7.580	0.024	3.7	69.87	0.00	20.37	2.29	1.80	5.67	6
2002	255	529	7.601	7.580	0.021	4.0	71.18	0.00	19.20	2.16	2.12	5.34	7
2002	19	501	7.601	7.580	0.021	3.4	68.33	0.00	21.68	2.44	1.53	6.03	8
2003	211	530	7.601	7.580	0.021	3.7	69.38	0.00	20.23	2.27	2.50	5.63	9
2001	37	501	7.600	7.580	0.020	3.1	65.24	0.00	22.70	2.55	3.20	6.31	10
2002	232	530	7.600	7.580	0.020	4.1	71.83	0.00	18.90	2.12	1.89	5.26	11
2001	195	501	7.598	7.580	0.018	3.7	69.14	0.00	20.16	2.26	2.82	5.61	12
2001	223	530	7.597	7.580	0.017	4.1	71.89	0.00	18.92	2.13	1.80	5.26	13
2003	10	502	7.597	7.580	0.017	3.4	68.11	0.00	21.61	2.43	1.84	6.01	14
2001	325	524	7.596	7.580	0.016	3.5	67.89	0.00	20.93	2.35	3.01	5.82	15
2001	221	501	7.596	7.580	0.016	4.1	71.94	0.00	18.93	2.13	1.73	5.26	16
2002	279	524	7.596	7.580	0.016	3.7	69.58	0.00	20.29	2.28	2.20	5.64	17
2003	191	501	7.596	7.580	0.016	3.7	69.71	0.00	20.33	2.28	2.02	5.65	18
2001	242	530	7.595	7.580	0.015	4.1	71.62	0.00	18.84	2.12	2.17	5.24	19
2001	194	530	7.595	7.580	0.015	3.7	69.43	0.00	20.24	2.27	2.42	5.63	20
2002	213	529	7.595	7.580	0.015	3.7	69.42	0.00	20.24	2.27	2.43	5.63	21
2001	193	530	7.594	7.580	0.014	3.7	70.10	0.00	20.44	2.30	1.48	5.68	22
2002	231	524	7.594	7.580	0.014	4.1	71.56	0.00	18.83	2.12	2.26	5.24	23
2003	199	501	7.594	7.580	0.014	3.7	70.04	0.00	20.42	2.29	1.56	5.68	24
2003	192	530	7.594	7.580	0.014	3.7	69.28	0.00	20.20	2.27	2.63	5.62	25

Ranked Daily Visibility Change for Saint Marks (Top 20 Days for Each Year)

							% of Modeled Extinction by Species					
YEAR	DAY	REC	DV(Total)	DV(BKG)	DELTA DV	F(RH)	% SO4	% NO3	% OC	% EC	% PMC	% PMF	Ranking
2001	23	629	7.73	7.669	0.062	3.7	69.55	0	20.28	2.28	2.25	5.64	1
2001	270	531	7.723	7.669	0.055	4.2	71.61	0	18.39	2.07	2.82	5.12	2
2001	17	541	7.718	7.669	0.049	3.7	69.25	0	20.19	2.27	2.67	5.62	3
2001	3	537	7.712	7.669	0.044	3.7	70.13	0	20.45	2.3	1.43	5.69	4
2001	337	628	7.707	7.669	0.039	3.8	70.33	0	19.97	2.24	1.9	5.55	5
2001	24	532	7.708	7.669	0.039	3.7	68.85	0	20.07	2.26	3.24	5.58	6
2001	109	619	7.705	7.669	0.037	3.4	68.31	0	21.67	2.44	1.55	6.03	7
2001	300	628	7.705	7.669	0.036	3.8	70.45	0	20	2.25	1.75	5.56	8
2001	22	628	7.704	7.669	0.036	3.7	69.95	0	20.39	2.29	1.69	5.67	9
2001	49	596	7.703	7.669	0.034	3.4	68.13	0	21.62	2.43	1.81	6.01	10
2001	269	628	7.7	7.669	0.032	4.2	71.85	0	18.46	2.07	2.48	5.13	11
2001	276	629	7.7	7.669	0.031	3.8	69.34	0	19.69	2.21	3.29	5.47	12
2001	68	546	7.7	7.669	0.031	3.4	66.81	0	21.2	2.38	3.72	5.89	13
2001	291	629	7.699	7.669	0.03	3.8	70.11	0	19.9	2.24	2.22	5.53	14
2001	144	573	7.698	7.669	0.03	3.5	68.34	0	21.06	2.37	2.38	5.86	15
2001	360	542	7.697	7.669	0.028	3.8	69.53	0	19.74	2.22	3.02	5.49	16
2001	4	541	7.697	7.669	0.028	3.7	69.22	0	20.18	2.27	2.72	5.61	17
2001	176	550	7.695	7.669	0.026	4	70.41	0	18.99	2.13	3.19	5.28	18
2001	35	626	7.694	7.669	0.026	3.4	67.53	0	21.43	2.41	2.68	5.96	19
2001	344	541	7.693	7.669	0.024	3.8	70.03	0	19.88	2.23	2.33	5.53	20
2002	331	542	7.754	7.669	0.085	3.7	68.99	0	20.11	2.26	3.05	5.59	1
2002	2	592	7.74	7.669	0.072	3.7	69.37	0	20.23	2.27	2.5	5.62	2
2002	305	629	7.728	7.669	0.06	3.8	70.12	0	19.91	2.24	2.21	5.54	3
2002	328	628	7.727	7.669	0.058	3.7	69.28	0	20.2	2.27	2.63	5.62	4
2002	341	628	7.725	7.669	0.056	3.8	69.97	0	19.87	2.23	2.4	5.52	5
2002	34	629	7.724	7.669	0.056	3.4	68.11	0	21.61	2.43	1.84	6.01	6
2002	307	537	7.717	7.669	0.049	3.7	69.72	0	20.33	2.28	2.01	5.65	7
2002	201	541	7.718	7.669	0.049	4.1	70.83	0	18.64	2.09	3.26	5.18	8
2002	169	629	7.717	7.669	0.048	4	70.72	0	19.07	2.14	2.76	5.3	9
2002	362	546	7.715	7.669	0.047	3.8	69.49	0	19.73	2.22	3.07	5.49	10
2002	45	628	7.711	7.669	0.042	3.4	67.13	0	21.3	2.39	3.25	5.92	11
2002	44	546	7.71	7.669	0.042	3.4	67.52	0	21.42	2.41	2.7	5.96	12
2002	336	628	7.706	7.669	0.037	3.8	70.09	0	19.9	2.24	2.24	5.53	13
2002	200	614	7.704	7.669	0.035	4.1	70.95	0	18.67	2.1	3.1	5.19	14
2002	70	631	7.702	7.669	0.033	3.4	68.1	0	21.61	2.43	1.85	6.01	15
2002	96	546	7.7	7.669	0.031	3.4	67.17	0	21.31	2.39	3.2	5.93	16
2002	312	628	7.697	7.669	0.028	3.7	69.16	0	20.16	2.27	2.8	5.61	17
2002	281	631	7.696	7.669	0.028	3.8	70.33	0	19.97	2.24	1.9	5.55	18
2002	334	631	7.696	7.669	0.027	3.7	68.8	0	20.06	2.25	3.31	5.58	19
2002	352	628	7.695	7.669	0.026	3.8	69.8	0	19.82	2.23	2.65	5.51	20
2003	343	619	7.746	7.669	0.078	3.8	69.75	0	19.8	2.22	2.72	5.51	1
2003	360	541	7.74	7.669	0.071	3.8	70.18	0	19.92	2.24	2.12	5.54	2
2003	83	537	7.729	7.669	0.06	3.4	66.9	0	21.23	2.38	3.59	5.9	3
2003	16	593	7.728	7.669	0.059	3.7	69.6	0	20.29	2.28	2.19	5.64	4
2003	8	629	7.718	7.669	0.05	3.7	68.88	0	20.08	2.26	3.2	5.58	5
2003	342	532	7.712	7.669	0.044	3.8	69.72	0	19.79	2.22	2.76	5.5	6
2003	149	626	7.71	7.669	0.042	3.5	67.58	0	20.83	2.34	3.46	5.79	7
2003	313	537	7.709	7.669	0.04	3.7	69.55	0	20.28	2.28	2.26	5.64	8
2003	12	593	7.709	7.669	0.04	3.7	69.08	0	20.14	2.26	2.92	5.6	9
2003	325	619	7.708	7.669	0.039	3.7	69.52	0	20.27	2.28	2.29	5.64	10
2003	43	542	7.708	7.669	0.039	3.4	66.98	0	21.25	2.39	3.47	5.91	11
2003	25	631	7.707	7.669	0.039	3.7	70.01	0	20.41	2.29	1.61	5.68	12
2003	350	628	7.702	7.669	0.034	3.8	69.92	0	19.85	2.23	2.48	5.52	13
2003	289	628	7.702	7.669	0.034	3.8	70.37	0	19.98	2.24	1.85	5.56	14
2003	37	540	7.702	7.669	0.033	3.4	67.93	0	21.55	2.42	2.1	5.99	15
2003	312	628	7.701	7.669	0.032	3.7	69.1	0	20.15	2.26	2.89	5.6	16
2003	252	631	7.701	7.669	0.032	4.2	72.04	0	18.5	2.08	2.24	5.15	17
2003	28	629	7.699	7.669	0.031	3.7	69.73	0	20.33	2.28	2	5.65	18
2003	276	537	7.699	7.669	0.03	3.8	70.49	0	20.01	2.25	1.69	5.56	19
2003	251	537	7.698	7.669	0.03	4.2	73.03	0	18.76	2.11	0.89	5.22	20

Ranked Daily Visibility Change for Saint Marks (Top 25 Days Over Three Years)

							% of Modeled Extinction by Species					
YEAR	DAY	REC	DV(Total)	DV(BKG)	DELTA DV	F(RH)	% SO4	% NO3	% OC	% EC	% PMC	% PMF	Ranking
2002	331	542	7.754	7.669	0.085	3.7	68.99	0.00	20.11	2.26	3.05	5.59	1
2003	343	619	7.746	7.669	0.078	3.8	69.75	0.00	19.80	2.22	2.72	5.51	2
2002	2	592	7.740	7.669	0.072	3.7	69.37	0.00	20.23	2.27	2.50	5.62	3
2003	360	541	7.740	7.669	0.071	3.8	70.18	0.00	19.92	2.24	2.12	5.54	4
2001	23	629	7.730	7.669	0.062	3.7	69.55	0.00	20.28	2.28	2.25	5.64	5
2002	305	629	7.728	7.669	0.060	3.8	70.12	0.00	19.91	2.24	2.21	5.54	6
2003	83	537	7.729	7.669	0.060	3.4	66.90	0.00	21.23	2.38	3.59	5.90	7
2003	16	593	7.728	7.669	0.059	3.7	69.60	0.00	20.29	2.28	2.19	5.64	8
2002	328	628	7.727	7.669	0.058	3.7	69.28	0.00	20.20	2.27	2.63	5.62	9
2002	341	628	7.725	7.669	0.056	3.8	69.97	0.00	19.87	2.23	2.40	5.52	10
2002	34	629	7.724	7.669	0.056	3.4	68.11	0.00	21.61	2.43	1.84	6.01	11
2001	270	531	7.723	7.669	0.055	4.2	71.61	0.00	18.39	2.07	2.82	5.12	12
2003	8	629	7.718	7.669	0.050	3.7	68.88	0.00	20.08	2.26	3.20	5.58	13
2001	17	541	7.718	7.669	0.049	3.7	69.25	0.00	20.19	2.27	2.67	5.62	14
2002	307	537	7.717	7.669	0.049	3.7	69.72	0.00	20.33	2.28	2.01	5.65	15
2002	201	541	7.718	7.669	0.049	4.1	70.83	0.00	18.64	2.09	3.26	5.18	16
2002	169	629	7.717	7.669	0.048	4.0	70.72	0.00	19.07	2.14	2.76	5.30	17
2002	362	546	7.715	7.669	0.047	3.8	69.49	0.00	19.73	2.22	3.07	5.49	18
2001	3	537	7.712	7.669	0.044	3.7	70.13	0.00	20.45	2.30	1.43	5.69	19
2003	342	532	7.712	7.669	0.044	3.8	69.72	0.00	19.79	2.22	2.76	5.50	20
2002	45	628	7.711	7.669	0.042	3.4	67.13	0.00	21.30	2.39	3.25	5.92	21
2002	44	546	7.710	7.669	0.042	3.4	67.52	0.00	21.42	2.41	2.70	5.96	22
2003	149	626	7.710	7.669	0.042	3.5	67.58	0.00	20.83	2.34	3.46	5.79	23
2003	313	537	7.709	7.669	0.040	3.7	69.55	0.00	20.28	2.28	2.26	5.64	24
2003	12	593	7.709	7.669	0.040	3.7	69.08	0.00	20.14	2.26	2.92	5.60	25