BART EXEMPTION MODELING ANALYSIS
FOR
AFFECTED CITY OF TALLAHASSEE
GENERATING STATIONS

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INTRODUCTION

Pursuant to Section 403.061(35), Florida Statutes, the Federal Clean Air Act, and the regional haze regulations contained in Title 40, Part 51 of the Code of Federal Regulations (40 CFR 51), Subpart P – Protection of Visibility, the Florida Department of Environmental Protection (FDEP) is required to ensure that certain sources of visibility impairing pollutants in Florida use Best Available Retrofit Technology (BART) to reduce the impact of their emissions on regional haze in federal Class I areas. Requirements for individual source BART control technology determinations and for BART exemptions are proposed in Rule 62-296.340 of the Florida Administrative Code (F.A.C.).

Proposed Rule 62-296.340(5)(c), F.A.C., states that a BART-eligible source may demonstrate that it is exempt from the requirement for BART determination for all pollutants by performing an individual source attribution analysis in accordance with the procedures contained in 40 CFR 51, Appendix Y. A BART-eligible source is exempt from BART determination requirements if its contribution to visibility impairment, as determined below, does not exceed 0.5 deciview (dv) above natural conditions in any Class I area.

For electric generating units subject to the clean air interstate rule (CAIR) program, the source attribution analysis need only consider particulate matter emissions (including primary sulfate) for comparison with the contribution threshold.

The 98th percentile, i.e., the 8th highest 24-hour average visibility impairment value in any year or the 22nd highest 24-hour average visibility impairment value over 3 years combined, whichever is higher, is compared to 0.5 dv in the source attribution analysis.

Based on the proposed Rule 62-296.340(5)(c), F.A.C., if the owner or operator of a BART-eligible source requests exemption from the requirement for BART determination for all pollutants by submitting its source attribution analysis to the FDEP by January 31, 2007, and the FDEP ultimately grants such exemption, the requirement for submission of an air construction permit application pursuant to 62-296.340(3)(b)1., F.A.C., shall not apply.

This report is submitted to the FDEP to present the source attribution analysis for the following BART-eligible emissions units at the two City of Tallahassee generating stations that are BART-eligible sources:

- Arvah B. Hopkins Generating Station – Boiler No. 1 and Boiler No. 2 (EU ID Nos. 001 and 004, respectively); and
- Sam O. Purdom Generating Station – Boiler No. 7 (EU ID 007).

The objective of the analysis is to demonstrate that these emissions units are exempt from BART determination.

Section A of this report contains a brief source description, modeling methodology and the modeling analysis results for the Hopkins Generating Station. Section B of this report contains a brief source description, modeling methodology and the modeling analysis results for the Purdom Generating Station. The source information and methodologies used for the BART exemption analysis are the same as those presented in the document entitled "Air Modeling Protocol to Evaluate Best Available Retrofit Technology (BART) Options for Affected City of Tallahassee Generating Stations." A copy of this document has been included for reference in Appendix A.

SECTION A- ARVAH R. HOPKINS GENERATING STATION

1.0 SOURCE DESCRIPTION

The Arvah B. Hopkins Generating Station is an existing generating facility presently comprised of two steam electric generating units (Units 1 and 2), two Westinghouse combustion turbines (CTs) (referred to as HC-1 and HC-2), and two General Electric (GE) LM6000 CTs (referred to as HC-3 and HC-4). HC-3 and HC-4 began operation in 2005. In 2006, the City of Tallahassee submitted an air construction permit application to repower Unit No. 2. The repowering of Unit No. 2 will include the addition of one nominal 188-megawatt (MW) combined-cycle unit and the permanent shut down of the fossil fuel steam boiler for Unit 2. The proposed combined cycle unit will consist of one GE7FA CT and associated electric generator, heat recovery steam generator (HRSG), and the existing steam turbine-electric generator. The unit will be equipped with a bypass stack that will be used with natural gas firing only.

Although the repowering of Unit No. 2 at the Hopkins Generating Station will include the permanent shut down of the fossil fuel steam boiler for Unit 2, this unit is not exempt from the BART exemption modeling. As a result, both Units 1 and 2 were modeled together.

The Hopkins Generating Station is located at 1125 Geddie Road in Tallahassee, Leon County, Florida. An area map showing the Hopkins Generating Station and Prevention of Significant Deterioration (PSD) Class I areas located within 300 kilometers (km) of the station is presented in Figure 1-1 of the Protocol. The PSD Class I areas and their distances from the station are as follows:

- St. Marks National Wilderness Area (NWA) - 39 km;
- Okefenokee (NWA) - 182 km; and
- Chassahowitzka (NWA) - 249 km.

The general location of this station, in Universal Transverse Mercator (UTM) coordinates, is 749.665 km East; 3,371.565 km North, Zone 16.

The stack, operating and particulate matter (PM) emission data, including PM speciation, for the BART-eligible emissions units are presented in detail in the Protocol.

Because there are minimal fugitive PM emissions and the station is 39 km from the St. Marks Class I area, fugitive PM emissions from this station were not addressed in the BART evaluation.

Building downwash effects were considered in the modeling since the distance of the nearest PSD Class I area is less than 50 km from the station.

2.0 AIR QUALITY MODELING METHODOLOGY

The CALPUFF model, Version 5.756, was used to predict the maximum visibility impairment at the PSD Class I areas located within 300 km of the Hopkins Generating Station. Recent technical enhancements, including changes to the over-water boundary layer formulation and coastal effects modules (sponsored by the Minerals Management Service), are included in this version. The methods and assumptions used in the CALPUFF model are presented in the Protocol. The 4-km spacing Florida domain was used for the BART exemption. The refined CALMET domain used for this modeling analysis has been provided by the FDEP. The major features used in preparing these CALMET data have also been described in Section 4.0 of the Protocol.

Currently, the atmospheric light extinction is estimated by an algorithm developed by the Interagency Monitoring of Protected Visual Environments (IMPROVE) committee, which was adopted by the EPA under the 1999 Regional Haze Rule (RHR) and referred to in this report as the "1999 IMPROVE algorithm". This algorithm tends to underestimate light extinction for the highest haze conditions and overestimate it for the lowest haze conditions and does not include light extinction due to sea salt, which is important at sites near the sea coasts. As a result of these limitations, the IMPROVE Steering Committee recently developed a new algorithm (the "new IMPROVE algorithm") for estimating light extinction from particulate matter component concentrations, which provides a better correspondence between measured visibility and that calculated from particulate matter component concentrations. A detailed description of the new IMPROVE algorithm and its implementation is presented in Section 3.4 of the Protocol.

The new IMPROVE algorithm can be used if the visibility impairment values predicted with the 1999 IMPROVE algorithm are greater than 0.5 dv. If the new IMPROVE algorithm is used, the maximum predicted visibility impairment values will be lower than those predicted with the 1999 IMPROVE algorithm.

Visibility impacts were predicted at each PSD Class I area using receptors provided by the National Park Service and are presented in Figures 4-1 through 4-3 of the Protocol.

3.0 AIR MODELING ANALYSIS RESULTS

Summaries of the maximum visibility impairment values for the Units 1 and 2 at the Purdom Generating Station estimated using the 1999 IMPROVE algorithm are presented in Tables A-1 and A-2. The 98th percentile 24-average visibility impairment values (i.e., 8th highest) for the years 2001, 2002 and 2003, and the 22nd highest 24-average visibility impairment value over the three years, are presented in Table A-1. The number of days and receptors for which the visibility impairment was predicted to be greater than 0.5 dv is also presented in Table A-1. The eight highest visibility impairment values predicted at the PSD Class I areas are presented in Table A-2.

As shown in Tables A-1 and A-2, the 8th highest visibility impairment values predicted for each year at two of the PSD Class I areas using the 1999 IMPROVE algorithm are less than 0.5 dv. The 22nd highest visibility impairment value predicted over the 3-year period at the PSD Class I areas are also less than 0.5 dv. However, at the St. Marks NWA, the highest 8th highest visibility impairment value is predicted to be 0.52 dv in 2002 while the 22nd highest visibility impairment value predicted over the 3-year period is 0.49 dv.

As a result, the visibility impacts were evaluated at the St. Marks NWA with the new IMPROVE algorithm. Similar to the results presented using the 1999 IMPROVE algorithm, summaries of the maximum visibility impairment values estimated using the new IMPROVE algorithm are presented in Tables A-3 and A-4. As shown in Tables A-3 and A-4, the highest 8th highest visibility impairment value predicted at the St. Marks NWA with the new IMPROVE algorithm is 0.44 dv. The 22nd highest visibility impairment value predicted at this PSD Class I area over the 3-year period is 0.42 dv.

Based on these results which demonstrate that the maximum visibility impairment values for the station are predicted to be less than the FDEP's BART exemption criteria of 0.5 dv, an exemption from BART determination is requested for the Hopkins Generating Station.

The input and output files (excluding CALMET) used for the exemption modeling are provided on a CD submitted with this report. Quality assurance procedures were followed, as described in the Protocol, to ensure that the setup and execution of the CALPUFF model and processing of the modeling results satisfy the regulatory objectives of the BART program.

TABLE A-1
SUMMARY OF BART EXEMPTION MODELING RESULTS
HOPKINS GENERATING STATION

Class I Area	Distance (km) of Source to Nearest Class I Area Boundary	Number of Days and Receptors with Impact >0.5 dv									22nd Highest Impact (dv) Over 3-Yr Period
		2001			2002			2003			
		No. of Days	No. of Receptors	8th Highest Impact (dv)	No. of Days	No. of Receptors	8th Highest Impact (dv)	No. of Days	No. of Receptors	8th Highest Impact (dv)	
St. Marks NWA	39	9	90	0.518	8	55	0.522	4	53	0.422	0.492
Okefenokee NWA	182	0	0	0.085	0	0	0.072	0	0	0.090	0.085
Chassahowitzka NWA	249	0	0	0.056	0	0	0.039	0	0	0.043	0.048

TABLE A-2
VISIBILITY IMPACT RANKINGS AT PSD CLASS I AREAS
HOPKINS GENERATING STATION

Class I Area	Rank	Predicted Impact (dv) 2001	2002	2003
St. Marks NWA	1	0.854	0.675	0.659
	2	0.799	0.672	0.645
	3	0.699	0.658	0.548
	4	0.626	0.604	0.513
	5	0.599	0.584	0.492
	6	0.521	0.562	0.488
	7	0.519	0.526	0.450
	8	0.518	0.522	0.422
Okefenokee NWA	1	0.107	0.125	0.135
	2	0.101	0.116	0.121
	3	0.096	0.116	0.119
	4	0.093	0.098	0.115
	5	0.089	0.096	0.115
	6	0.088	0.076	0.114
	7	0.087	0.074	0.094
	8	0.085	0.072	0.090
Chassahowitzka NWA	1	0.121	0.147	0.106
	2	0.085	0.086	0.085
	3	0.072	0.077	0.061
	4	0.066	0.069	0.059
	5	0.061	0.058	0.053
	6	0.061	0.057	0.045
	7	0.058	0.046	0.043
	8	0.056	0.039	0.043

TABLE A-3
SUMMARY OF BART EXEMPTION MODELING RESULTS- BASED ON NEW IMPROVE EQUATION
HOPKINS GENERATING STATION

Class I Area	Distance (km) of Source to Nearest Class I Area Boundary	Number of Days and Receptors with Impact >0.5 dv [a]									22nd Highest Impact (dv) Over 3-Yr Period
		2001			2002			2003			
		No. of Days	No. of Receptors	8th Highest Impact (dv)	No. of Days	No. of Receptors	8th Highest Impact (dv)	No. of Days	No. of Receptors	8th Highest Impact (dv)	
St. Marks NWA	39	NA	NA	0.440	NA	NA	0.444	NA	NA	0.362	0.422

NA= not available

[a] No. of days and receptors are not readily available from the spreadsheet developed by VISTAS to estimate visbility impairment with the new IMPROVE equation.

TABLE A-4
VISIBILITY IMPACT RANKINGS AT PSD CLASS I AREAS
BASED ON NEW IMPROVE EQUATION
HOPKINS GENERATING STATION

Class I Area	Rank	Predicted Impact (dv) 2001	2002	2003
St. Marks NWA	1	0.728	0.581	0.562
	2	0.683	0.572	0.549
	3	0.597	0.561	0.464
	4	0.534	0.518	0.436
	5	0.515	0.502	0.422
	6	0.445	0.482	0.418
	7	0.445	0.450	0.384
	8	0.440	0.444	0.362

SECTION B- SAM O. PURDOM GENERATING STATION

1.0 SOURCE DESCRIPTION

The Sam O. Purdom Generating Station consists of a steam electric generating unit (Unit 7), two simple cycle CTs, an auxiliary boiler, and a combined cycle gas turbine.

The Purdom Generating Station is located at 667 Port Leon Drive in St. Marks, Wakulla County, Florida. An area map showing the Purdom Generating Station and PSD Class I areas located within 300 kilometers (km) of the station is presented in Figure 1-1 of the Protocol. The PSD Class I areas and their distances from the station are as follows:

- St. Marks NWA - 1 km;
- Okefenokee NWA - 175 km; and
- Chassahowitzka (NWA) - 213 km.

The general location of this station, in Universal Transverse Mercator (UTM) coordinates, is 769.877 km East; 3,339.814 km North, Zone 16.

The stack, operating and PM emission data, including PM speciation, for the BART-eligible emissions units are presented in detail in the Protocol.

Because the Purdom Station is operated infrequently and has material handling operations that generate minimal fugitive PM emissions due to the type of fuel fired at the station, fugitive PM emissions from this station were not addressed in the BART evaluation.

Building downwash effects were considered in the modeling since the distance of the nearest PSD Class I area is less than 50 km from the station.

2.0 AIR QUALITY MODELING METHODOLOGY

The CALPUFF model, Version 5.756, was used to predict the maximum visibility impairment at the PSD Class I areas located within 300 km of the Purdom Generating Station. Recent technical enhancements, including changes to the over-water boundary layer formulation and coastal effects modules (sponsored by the Minerals Management Service), are included in this version. The methods and assumptions used in the CALPUFF model are presented in the Protocol. The 4-km spacing Florida domain was used for the BART exemption. The refined CALMET domain used for this modeling analysis has been provided by the FDEP. The major features used in preparing these CALMET data have also been described in Section 4.0 of the Protocol.

Currently, the atmospheric light extinction is estimated by an algorithm developed by the Interagency Monitoring of Protected Visual Environments (IMPROVE) committee, which was adopted by the EPA under the 1999 Regional Haze Rule (RHR) and referred to in this report as the "1999 IMPROVE algorithm". This algorithm tends to underestimate light extinction for the highest haze conditions and overestimate it for the lowest haze conditions and does not include light extinction due to sea salt, which is important at sites near the sea coasts. As a result of these limitations, the IMPROVE Steering Committee recently developed a new algorithm (the "new IMPROVE algorithm") for estimating light extinction from particulate matter component concentrations, which provides a better correspondence between measured visibility and that calculated from particulate matter component concentrations. A detailed description of the new IMPROVE algorithm and its implementation is presented in Section 3.4 of the Protocol.

The new IMPROVE algorithm can be used if the visibility impairment values predicted with the 1999 IMPROVE algorithm are greater than 0.5 dv. If the new IMPROVE algorithm is used, the maximum predicted visibility impairment values will be lower than those predicted with the 1999 IMPROVE algorithm.

Visibility impacts were predicted at each PSD Class I area using receptors provided by the National Park Service and are presented in Figures 4-1 through 4-3 of the Protocol. Because of the proximity of St. Marks NWA, visibility impacts were also predicted at 40 receptors that were added to that PSD Class I area and are presented in Figure 4-4 of the Protocol.

3.0 AIR MODELING ANALYSIS RESULTS

Summaries of the maximum visibility impairment values for the sulfur recovery plants at the Purdom Generating Station estimated using the 1999 IMPROVE algorithm are presented in Tables B-1 and B-2. The 98th percentile 24-average visibility impairment values (i.e., 8th highest) for the years 2001, 2002 and 2003, and the 22nd highest 24-average visibility impairment value over the three years, are presented in Table B-1. The number of days and receptors for which the visibility impairment was predicted to be greater than 0.5 dv is also presented in Table B-1. The 8 highest visibility impairment values predicted at the PSD Class I areas are presented in Table B-2.

As shown in Tables B-1 and B-2, the 8th highest visibility impairment values predicted for each year at two of the PSD Class I areas using the 1999 IMPROVE algorithm are less than 0.5 dv. The 22nd highest visibility impairment value predicted over the 3-year period at the PSD Class I areas are also less than 0.5 dv. However, at the St. Marks NWA, the highest 8th highest visibility impairment value is predicted to be 3.05 dv in 2001 while the 22nd highest visibility impairment value predicted over the 3-year period is 2.38 dv.

As a result, the visibility impacts were evaluated at the St. Marks NWA with the new IMPROVE algorithm. Similar to the results presented using the 1999 IMPROVE algorithm, summaries of the maximum visibility impairment values estimated using the new IMPROVE algorithm are presented in Tables B-3 and B-4. As shown in Tables B-3 and B-4, the highest 8th highest visibility impairment value predicted at the St. Marks NWA with the new IMPROVE algorithm is 2.75 dv. The 22nd highest visibility impairment value predicted at this PSD Class I area over the 3-year period is 2.41 dv.

Based on these results which demonstrate that the maximum visibility impairment values for the station are predicted to be greater than the FDEP's BART exemption criteria of 0.5 dv, further BART control evaluations are required.

The input and output files (excluding CALMET) used for the exemption modeling are provided on a CD submitted with this report. Quality assurance procedures were followed, as described in the Protocol, to ensure that the setup and execution of the CALPUFF model and processing of the modeling results satisfy the regulatory objectives of the BART program.

TABLE B-1
SUMMARY OF BART EXEMPTION MODELING RESULTS
PURDOM GENERATING STATION

Class I Area	Distance (km) of Source to Nearest Class I Area Boundary	Number of Days and Receptors with Impact >0.5 dv									22nd Highest Impact (dv) Over 3-Yr Period
		2001			2002			2003			
		No. of Days	No. of Receptors	8th Highest Impact (dv)	No. of Days	No. of Receptors	8th Highest Impact (dv)	No. of Days	No. of Receptors	8th Highest Impact (dv)	
St. Marks NWA	39	132	116	3.054	137	112	2.626	121	135	2.420	2.700
Okefenokee NWA	182	0	0	0.024	0	0	0.023	0	0	0.027	0.025
Chassahowitzka NWA	249	0	0	0.020	0	0	0.018	0	0	0.014	0.017

TABLE B-2
VISIBILITY IMPACT RANKINGS AT PSD CLASS I AREAS
PURDOM GENERATING STATION

Class I Area	Rank	Predicted Impact (dv)		
		2001	2002	2003
St. Marks NWA	1	4.531	3.595	3.269
	2	3.810	2.959	2.946
	3	3.739	2.924	2.870
	4	3.362	2.894	2.810
	5	3.288	2.757	2.576
	6	3.161	2.700	2.545
	7	3.121	2.635	2.455
	8	3.054	2.626	2.420
Okefenokee NWA	1	0.040	0.033	0.044
	2	0.037	0.033	0.035
	3	0.037	0.030	0.035
	4	0.031	0.030	0.035
	5	0.025	0.026	0.032
	6	0.025	0.025	0.031
	7	0.024	0.025	0.028
	8	0.024	0.023	0.027
Chassahowitzka NWA	1	0.042	0.046	0.034
	2	0.036	0.042	0.028
	3	0.025	0.034	0.026
	4	0.023	0.033	0.025
	5	0.022	0.021	0.017
	6	0.022	0.020	0.017
	7	0.022	0.018	0.014
	8	0.020	0.018	0.014

TABLE B-3
SUMMARY OF BART EXEMPTION MODELING RESULTS- BASED ON NEW IMPROVE EQUATION
PURDOM GENERATING STATION

Class I Area	Distance (km) of Source to Nearest Class I Area Boundary	Number of Days and Receptors with Impact >0.5 dv									22nd Highest Impact (dv) Over 3-Yr Period
		2001			2002			2003			
		No. of Days	No. of Receptors	8th Highest Impact (dv)	No. of Days	No. of Receptors	8th Highest Impact (dv)	No. of Days	No. of Receptors	8th Highest Impact (dv)	
St. Marks NWA	39	NA	NA	2.752	NA	NA	2.360	NA	NA	2.190	2.413

NA= not available

[a] No. of days and receptors are not readily available from the spreadsheet developed by VISTAS to estimate visbility impairment with the new IMPROVE equation.

TABLE B-4
VISIBILITY IMPACT RANKINGS AT PSD CLASS I AREAS
BASED ON NEW IMPROVE EQUATION
PURDOM GENERATING STATION

Class I Area	Rank	Predicted Impact (dv)		
		2001	2002	2003
St. Marks NWA	1	4.110	3.271	2.907
	2	3.471	2.686	2.653
	3	3.408	2.625	2.563
	4	3.020	2.619	2.509
	5	2.951	2.498	2.333
	6	2.870	2.448	2.268
	7	2.813	2.368	2.199
	8	2.752	2.360	2.190

4.0 BART DETERMINATION

Based on proposed Rule 62-296.340(3)(b), F.A.C., the owner or operator of a BART-eligible source subject to the requirements for BART determination shall perform a BART evaluation for each emissions unit comprising the BART-eligible source and for each pollutant for which a BART determination is required. In addition, the air construction permit issued by the Department shall require the owner or operator of a BART-eligible source to comply with BART as expeditiously as practicable, but no later than December 31, 2013.

The BART-eligible emissions unit at the Purdom Generating Station, Unit 7, is planned to be permanently shutdown by March 2011. Since the unit is planned to be shutdown prior to the effective date that BART controls must be in place (i.e., December 31, 2013), the BART determination is based on the unit shutdown. No further BART evaluation is required for Unit 7. As a result, Unit 7 will comply with the BART regulations.

ATTACHMENT A

AIR MODELING PROTOCOL

TO EVALUATE

BEST AVAILABLE RETROFIT TECHNOLOGY (BART) OPTIONS

FOR AFFECTED CITY OF TALLAHASSEE GENERATING STATIONS

AIR MODELING PROTOCOL
TO EVALUATE
BEST AVAILABLE RETROFIT
TECHNOLOGY (BART) OPTIONS
FOR AFFECTED CITY OF TALLAHASSEE
GENERATING STATIONS

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1.0 INTRODUCTION

1.1 Objectives

Under the regional haze regulations, which are contained in Title 40, Part 51 of the Code of Federal Regulations (40 CFR 51), Subpart P – Protection of Visibility, the U.S. Environmental Protection Agency (EPA) has issued final guidelines dated July 6, 2005 for Best Available Retrofit Technology (BART) determinations [Federal Register (FR), Volume 70, pages 39104-39172]. BART applies to certain large stationary sources known as BART-eligible sources. Sources are BART-eligible if they meet the following three criteria:

- Contains emissions units that are one of the 26 listed source categories in the guidance;
- Contains emissions units that were "in existence" on August 7, 1962 and "began operation" before August 7, 1977; and
- Potential emissions from these emissions units of at least 250 tons per year (TPY) of a visibility-impairing pollutant [sulfur dioxide (SO_2), nitrogen oxides (NO_x), and direct particulate matter of equal to less than 10 microns (PM_{10})].

The Florida Department of Environmental Protection (FDEP) has identified two City of Tallahassee generating stations as BART-eligible sources with BART-eligible emissions units. These stations include:

- Arvah B. Hopkins Generating Station – Boiler No. 1 and Boiler No. 2 (EU ID Nos. 001 and 004, respectively); and
- Sam O. Purdom Generating Station – Boiler No. 7 (EU ID 007).

FDEP has proposed to adopt EPA's visibility protection rules and guidelines contained in 40 CFR 51, Subpart P. Final adoption of these rules is expected by the end of this year.

The basic tenet of the regional haze program is the achievement of natural visibility conditions in Prevention of Significant Deterioration (PSD) Class I areas by the year 2064. Florida has four PSD Class I areas while Georgia has two PSD Class I areas that can be affected by Florida sources [i.e., located in Florida or within 300 kilometers (km) of Florida].

BART is required for any BART-eligible source that the FDEP determines emits any air pollutant that may "reasonably be anticipated to cause or contribute to any impairment of visibility in any Class I area." The BART guidelines establish a threshold value of 0.5 deciview (dv) for any single source for determining whether the source contributes to visibility impairment.

Throughout this protocol the terms "source" and "facility" have the same meanings. The term "BART-eligible emissions unit" is defined as any single emissions unit that meets the criteria described above, except for the 250 TPY criteria, which applies to the BART-eligible source. A "BART-eligible source" is defined as the collection of all BART-eligible emissions units at a single facility. If a source has several emissions units, only those that meet the BART-eligible criteria are included in the definition of "BART-eligible source."

The FDEP requires that the California Puff (CALPUFF) modeling system be used to determine visibility impacts from BART-eligible sources at the PSD Class I areas. A source-specific modeling protocol is required to be submitted by the affected sources to the FDEP for review and approval. The source-specific modeling must be included in the BART application, due to FDEP no later than January 31, 2007.

This protocol describes the modeling procedures to be followed for performing the air modeling and includes site-specific data for the BART-eligible emissions units. The site-specific data includes emissions unit locations, stack parameters, emission rates, and PM_{10} speciation information.

For guidance in preparing the air modeling protocol, the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) has developed a general modeling protocol outline that describes the recommended procedures for performing a visibility impairment analysis under the BART regulations [see *Protocol for the Application of the CALPUFF Model for Analyses of Best Available Retrofit Technology (BART)*, December 22, 2005 (Revision 3.2- August 31, 2006)]. The proposed modeling protocol for the facility follows the general procedures recommended by VISTAS.

1.2 Location of Source

The Hopkins Generating Station is located at 1125 Geddie Road in Tallahassee, Leon County and the Purdom Generating Station is located at 667 Port Leon Drive in St. Marks, Wakulla County. An area map showing the Hopkins and Purdom Generating Stations and PSD Class I areas located within

300 km of the each station is presented in Figure 1-1. The PSD Class I areas and their distances from the stations are as follows:

- Hopkins – Saint Marks National Wilderness Area (NWA) - 39 km;
  Okefenokee NWA - 182 km; and
  Chassahowitzka (NWA) - 249 km.
- Purdom – Saint Marks NWA - 1 km;
  Okefenokee NWA - 175 km; and
  Chassahowitzka (NWA) - 213 km.

The general locations of the City of Tallahassee generating stations, in Universal Transverse Mercator (UTM) coordinates, are as follows:

- Hopkins – 749.665 km East; 3,371.565 km North, Zone 17; and
- Purdom – 769.877 km East; 3,339.814 km North, Zone 17.

1.3 Source Impact Evaluation Criteria

The common BART modeling protocol describes the application of the CALPUFF modeling system for two purposes:

- Air quality modeling to determine whether a BART-eligible source is "subject to BART" – to evaluate whether a BART-eligible source is exempt from BART controls because it is not reasonably expected to cause or contribute to impairment of visibility in Class I areas, and
- Air quality modeling of emissions from sources that have been found to be subject to BART – to evaluate regional haze benefits of alternative control options and to document the benefits of the preferred option.

The common BART protocol identifies the first situation as the "BART exemption analysis" and the second situation as the "BART control analysis."

The final BART rule (70 FR 39118) states that the proposed threshold at which a source may "contribute" to visibility impairment should not be higher than 0.5 dv. The FDEP is also recommending the criterion of 0.5 dv.

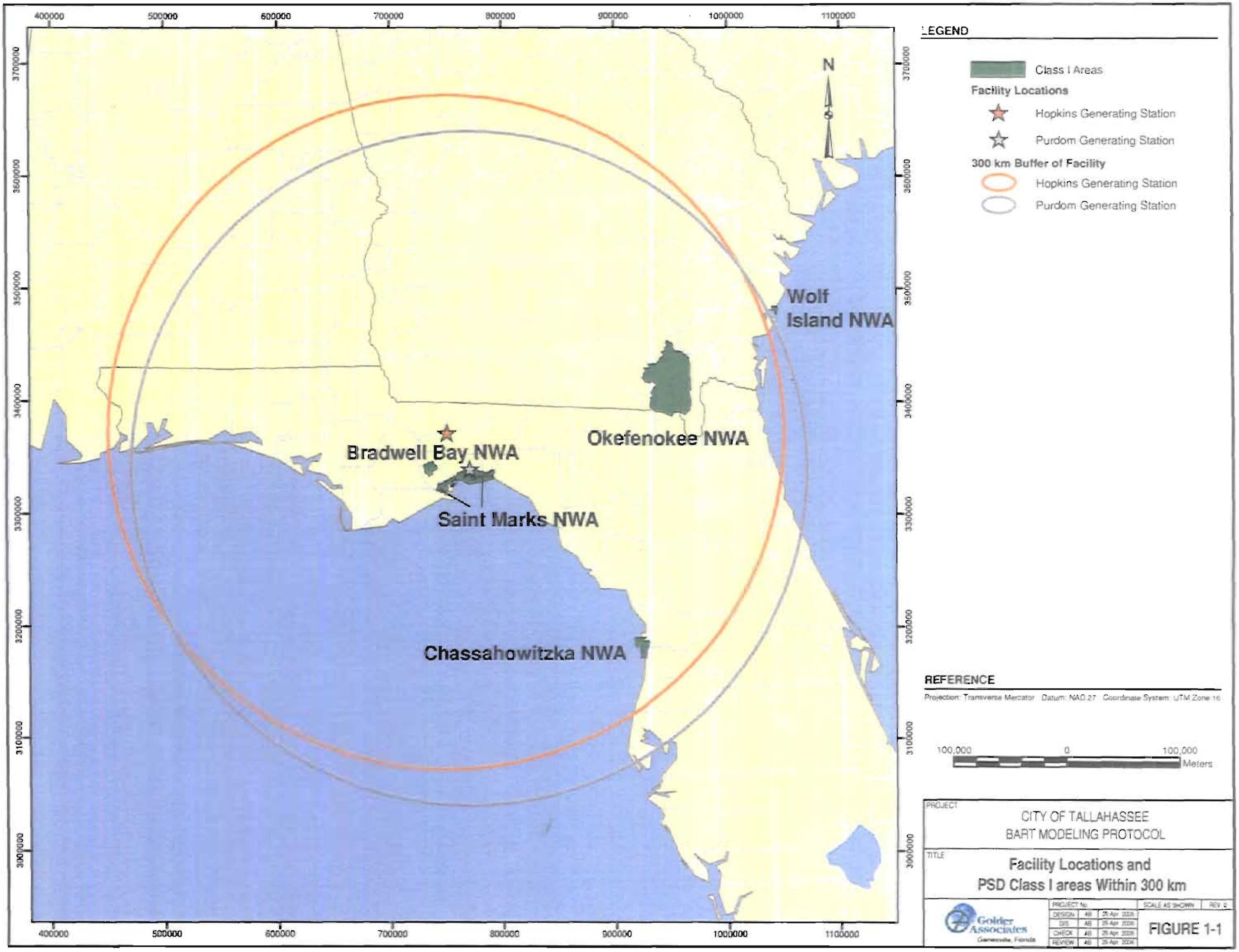
Based on VISTAS recommendations regarding BART exemption analysis, "initial screening" and "refined" analyses can be performed to determine whether a BART-eligible source is subject to or exempt from BART. The initial screening analysis, which is based on a coarse scale 12-km regional VISTAS CALMET domain, is optional and answers two questions – whether (a) a particular source may be exempted from further BART analyses and (b) if refined (finer grid) CALPUFF analyses were to be undertaken, which Class I areas should be included.

For the screening analysis, the highest predicted 24-hour impairment value is compared to the 0.5 dv criteria. If the highest predicted impacts are found to be less than 0.5 dv, no further analysis is required. But if the highest impact is predicted to be greater than 0.5 dv, then a refined, finer grid, analysis may be performed.

The refined analysis, which is based on a finer grid subregional California Meteorological Model (CALMET) domain, is the definitive test for whether a source is subject to BART. In the refined analysis, the 98th percentile, i.e., the 8th highest 24-hour average visibility impairment value in 1 year or the 22nd highest 24-hour average visibility impairment value over 3 years combined, whichever is higher, is compared to 0.5 dv.

The screening analysis is optional for large sources that will clearly exceed the initial screening thresholds or sources that are very close to the Class I areas, which will be better treated by a finer grid resolution. For the City of Tallahassee BART analyses, only the refined analysis will be performed to determine whether the source is exempt from BART. All Class I areas within 300 km of the City of Tallahassee stations will be included in the refined modeling analysis and modeling results will be presented for each evaluated Class I area.

If the BART exemption analysis reveals that the BART-eligible source is subject to BART controls, part of the BART review process involves evaluating the visibility benefits of different BART control measures. These benefits will be determined by the refined analysis, where CALPUFF will be executed with the baseline emission rates and again with emission rates reflective of BART control options.



LEGEND
Class I Areas
Facility Locations
Hopkins Generating Station
Purdom Generating Station
300 km Buffer of Facility
Hopkins Generating Station
Purdom Generating Station
N
Wolf Island NWA
Okefenokee NWA
Bradwell Bay NWA
Saint Marks NWA
Chassahowitzka NWA
400000
500000
600000
700000
800000
900000
1000000
1100000
3700000
3600000
3500000
3400000
3300000
3200000
3100000
3000000
REFERENCE
Projection: Transverse Mercator Datum: NAD 27 Coordinate System: UTM Zone 16
100,000
0
100,000
Meters
PROJECT
CITY OF TALLAHASSEE
BART MODELING PROTOCOL
TITLE
Facility Locations and
PSD Class I areas Within 300 km
Golder Associates
Gainesville, Florida
FIGURE 1-1

2.0 SOURCE DESCRIPTION

2.1 Source Applicability

The Arvah B. Hopkins Generating Station is an existing generating facility presently comprised of two steam electric generating units (Units 1 and 2), two Westinghouse combustion turbines (CTs) (referred to as HC-1 and HC-2), and two General Electric (GE) LM6000 CTs (referred to as HC-3 and HC-4). HC-3 and HC-4 began operation in 2005. In 2006, the City of Tallahassee submitted an air construction permit application to repower Unit No. 2. The repowering of Unit No. 2 will include the addition of one nominal 188-megawatt (MW) combined-cycle unit and the permanent shut down of the fossil fuel steam boiler for Unit 2. The proposed combined cycle unit will consist of one GE 7FA CT and associated electric generator, heat recovery steam generator (HRSG), and the existing steam turbine-electric generator. The unit will be equipped with a bypass stack that will be used with natural gas firing only.

The Sam O. Purdom Generating Station consists of a steam electric generating unit (Unit 7), two simple cycle CTs, an auxiliary boiler, and a combined cycle gas turbine.

The FDEP has published a list of potential BART-eligible sources (updated September 12, 2006), which is based on a survey questionnaire sent by FDEP to selected facilities in Florida on November 4, 2002 and April 18, 2003. The FDEP's list contains a total of 3 potential BART-eligible emissions units from the Hopkins and Purdom Generating Stations. These generating stations are on the FDEP list since they are one of the 26 major source categories identified in the BART regulation [fossil-fuel fired steam electric plants of more than 250 million British thermal units per hour (MMBtu/hr) heat input] and has potential emissions of visibility impairment pollutants (i.e., SO_2, NO_x, and PM_{10}) that are greater than 250 TPY. As presented earlier, these emission units are:

- Arvah B. Hopkins Generating Station – Boiler No. 1 and Boiler No. 2 (EU ID Nos. 001 and 004, respectively); and
- Sam O. Purdom Generating Station – Boiler No. 7 (EU ID 007)

First, each station is classified under the source category of "Fossil-fuel fired steam electric plants of more than 250 MMBtu/hr heat input".

Second, each emissions unit and each station was reviewed to determine which units met the date requirements for a BART-eligible unit. For each emissions unit, it was determined which units began operation after August 7, 1962, and also were in existence on August 7, 1977.

Third, if an emissions unit met the date requirements for BART eligibility, the potential emissions of visibility impairing pollutants from each unit were identified. At present, the visibility impairing pollutants include SO_2, NO_x, and PM_{10}. Other potential visibilities impairing pollutants, such as volatile organic compounds (VOC), and ammonia, have been determined by the FDEP to have no significant effect on regional haze in Florida. As a result, the SO_2, NO_x, and PM_{10} emissions from the facility are the only pollutants that would be included in the analysis unless FDEP makes a determination to include the other pollutants.

On March 10, 2005, EPA issued the Clean Air Interstate Rule (CAIR) requiring affected electric generating units (EGUs) in the eastern U.S. to reduce emissions of NO_x and SO_2. Some issues regarding how the CAIR emission reductions would affect BART-eligible units pursued, and based on a proposed settlement agreement between the EPA and the Utility Air Regulatory (UARG), EGUs would have to model only particulate matter (PM) and primary sulfate emissions for either BART exemption or BART determination. The FDEP has agreed to uphold the proposed agreement and, because the City of Tallahassee stations are subject to the provisions of CAIR, SO_2 and NO_x emissions will not be included in the air modeling analysis.

Although the repowering of Unit No. 2 at the Hopkins Generating Station will include the permanent shut down of the fossil fuel steam boiler for Unit 2, this unit is not exempt from the BART exemption modeling. As a result, both Units 1 and 2 will be modeled together.

As shown in Table 2-1, the potential annual PM_{10} emissions from the BART-eligible emissions units total more than 250 TPY for each of the plants. Although the emissions of one or more pollutants are greater than the 250 TPY threshold, only PM emissions will be included in the visibility impairment assessment because each station is subject to CAIR.

Based on discussions with the FDEP, if a facility is more than 50 km from the nearest PSD Class I area, fugitive PM emissions from BART-eligible emissions units are not required to undergo BART control evaluation nor need to be included in assessing visibility impairment. Except for the St. Marks Class I area, both generating stations are more than 50 km from any PSD Class I area.

Based on comments received from the FDEP, although fugitive PM emissions are minimal from the Purdom Station, to the extent quantifiable, they will be considered in the analysis. For the Hopkins Station, because there are minimal fugitive PM emissions and the station is 39 km from the St. Marks Class I area, fugitive PM emissions from this station will not be addressed in the BART evaluation.

2.2 Stack Parameters

The stack height above ground, stack diameter, exit velocity, and exit temperature for the BART-eligible emissions units at the Hopkins and Purdom Generating Stations are presented in Table 2-2. The general location of each plant is provided in UTM coordinates and in the VISTAS domain Lambert Conformal Conic (LCC) coordinate system.

2.3 Emission Rates for Visibility Impairment Analyses

The EPA BART guidance indicates that the emission rate to be used for BART modeling is the highest 24-hour actual emission rate representative of normal operations for the modeling period. Depending on the availability of the source data, the source emissions information should be based on the following in order of priority, based on the BART common protocol:

- 24-hour maximum emissions based on continuous emission monitoring (CEM) data for the period 2001-2003,
- Facility stack test emissions,
- Potential to emit,
- Allowable permit limits, and
- AP-42 emission factors.

PM_{10} emission rates for the Hopkins and Purdom Generating Stations were obtained from Permit Nos. 0730003-007-AV and 1290001-007-AV, respectively, which are the current Title V permits or available stack tests. For the Purdom Station, since stack tests have not been performed over the last five years due to minimal operation of the emission unit, PM_{10} emissions were calculated based on maximum permitted normal operation for 21 hours at 0.1 lb/MMBtu and soot blowing for 3 hours in a 24-hour period at 0.3 lb/MMBtu.

For the Hopkins Station, stack tests for PM emissions have been performed since 2001 with a summary of the actual measure PM emissions presented in Table 2-4. The maximum daily PM emission rate was based on the maximum PM emission rate measured during normal operation, which is assumed to occur for 21 hours, added to the maximum PM emission rate during soot blowing, which is assumed to occur for 3 hours.

The maximum 24-hour average PM_{10} emission rates for filterable PM emissions for the BART-eligible units at both stations are presented in Table 2-4. As discussed in Section 2.4, both filterable and condensable PM emissions will be used in the modeling.

2.4 Particulate Matter (PM) Speciation

Based on the latest regulatory guidance, PM emissions by size category need to be considered in the appropriate species for the visibility analysis. The effect that each species has on visibility impairment is related to a parameter called the extinction coefficient. The higher the extinction coefficient, the greater the species' affect on visibility. Filterable PM is speciated into coarse (PMC), fine (PMF), and elemental carbon (EC), with default extinction efficiencies of 0.6, 1.0, and 10.0, respectively. PMC is PM with aerodynamic diameter between 10 microns and 2.5 microns. Both EC and PMF have aerodynamic diameters equal to or less than 2.5 microns. Condensable PM is comprised of inorganic PM, such as sulfate (SO_4), and organic PM, such as secondary organic aerosols (SOA). The extinction efficiencies for these species are 3 x f(RH) and 4, respectively, where f(RH) is the relative humidity factor.

Summaries of PM speciation for the Hopkins Generating Station are presented in Tables 2-5a and 2-5b while those for the Purdom Generating Station are presented in Table 2-6. These species categories were generally based on the speciation profile provided by VISTAS for Uncontrolled Utility Residual Oil Boiler. The PM condensable emission rates were estimated based on emission factors presented in Table 1.3-2 in AP-42 while the different PM particle size categories were determined from particle size distribution for Uncontrolled Residual Oil-fired Utility Boilers provided in Table 1.3-4 in AP-42. The PM elemental carbon emission rates were based on data provided in EPA's January 2002 DRAFT "Catalog of Global Emissions Inventories and Emission Inventory Tools for Black Carbon".

2.5 Building Dimension

Based on discussions with FDEP, building downwash effects will be considered in the modeling since the distance of the nearest PSD Class I area is less than 50 km from both generating stations.

TABLE 2-1
BART ELIGIBILITY ANALYSIS FOR THE CITY OF TALLAHASSEE - ARVAH B. HOPKINS AND SAM O. PURDOM GENERATING STATIONS
(FACILITY ID NOS. 0730003 AND 1290001)

EU ID	Emission Unit	BART Category [a]	Dates: Start-Up	Dates: Initial Construction	In Existence on 8/7/1977 ? (Yes/No)	Began Operation After 8/7/1962 ? (Yes/No)	Meets BART Date Criteria ? (Yes/No)	SO_2, NO_x, or PM Source ? (Yes/No)	BART Eligible ? (Yes/No)	Potential PM_{10} Emissions (TPY)	Comments
ARVAH B. HOPKINS GENERAING STATION [b]											
001	Boiler No. 1	1	May 1971	--	Yes	Yes	Yes	Yes	Yes	494	[d]
004	Boiler No. 2	1	October 1977		Yes	Yes	Yes	Yes	Yes	1273	[d] To be shutdown
									Hopkins Total TPY =	494	
SAM O. PURDOM GENERATING STATION [c]											
007	Boiler No. 7	1	1966	--	Yes	Yes	Yes	Yes	Yes	340	[d]
									Purdom Total TPY =	340	

[a] BART category 1 is Steam Electric Plants of More Than 250 MMBtu/hr Heat Input.
[b] Title V permit No. 0730003-007-AV.
[c] Title V permit No. 1290001-007-AV.
[d] PM_{10} emissions based on maximum hourly rate and maximum heat input rate for 8,760 hours/year.

		Heat Input Rate MMBtu/hr	Normal Operation lb/MMBtu	Normal Operation Hours/day	Soot Blowing lb/MMBtu	Soot Blowing Hours/day
Hopkins	Boiler No. 1	903	0.1	21	0.3	3
	Boiler No. 2	2325	0.1	21	0.3	3
Purdom	Boiler No. 7	621	0.1	21	0.3	3

TABLE 2-2
SUMMARY OF STACK AND OPERATING PARAMETERS AND LOCATIONS FOR THE BART-ELIGIBLE EMISSIONS UNITS
CITY OF TALLAHASSEE - ARVAH B. HOPKINS AND SAM O. PURDOM GENERATING STATIONS

		Stack Parameters				Operating Parameters				
		Height		Diameter		Flow Rate	Exit Temperature		Velocity	
Emission Unit	Model ID	ft	m	ft	m	acfm	°F	K	ft/s	m/s
ARVAH B. HOPKINS GENERAING STATION [a]										
Boiler No. 1	AHBLR1	200	61.0	11.0	3.35	223,755	261	400	39.2	11.96
Boiler No. 2	AHBLR2	250	76.2	14.0	4.27	636,706	260	400	68.9	21.01
SAM O. PURDOM GENERATING STATION [a]										
Boiler No. 7	SPBLR7	180	54.9	9.0	2.74	180,798	300	422	47.4	14.44

[a] UTM East and North Coordinates (km), Zone 16	Hopkins	749.665	3,371.565
	Purdom	769.662	3,339.938
Latitude and Longitude:	Hopkins	30° 27' 8.26"	84° 23' 59.78"
	Purdom	30° 09' 46"	84° 12' 00"
Lambert Conformal Conic (LCC) coordinates:	Hopkins	1,210.334	-975.166
	Purdom	1,233.955	-1,004.523

TABLE 2-3
HOPKINS GENERATING STATION
STACK TEST RESULTS FOR PM EMISSIONS

Unit 2					Unit 1				
			PM10 Emissions					PM10 Emissions	
			Actual	Allowable				Actual	Allowable
Year	Date	Operating Mode	lb/MMBtu	lb/MMBtu	Year	Date	Operating Mode	lb/MMBtu	lb/MMBtu
2001	Sep. 6	Normal	0.0409	0.1	2001	Sep. 5	Normal	0.0369	0.1
	Sep. 6 & 7	Soot-blowing	0.0342	0.3		Sep. 4	Soot-blowing	0.0356	0.3
2002	Nov. 5	Normal	0.0626	0.1					
	Nov. 6	Soot-blowing	0.047	0.3					
2003	Aug. 27	Normal	0.0424	0.1	2003	Aug. 28	Normal	0.0431	0.1
	Aug. 27	Soot-blowing	0.0944	0.3		Aug. 28	Soot-blowing	0.046	0.3
2004	May 26	Normal	0.0519	0.1					
	May 26	Soot-blowing	0.0517	0.3					
2005	Aug. 23	Normal	0.0674	0.1					
	Aug. 24	Soot-blowing	0.0856	0.3					
2006	Aug. 8	Normal	0.0472	0.1					
	Aug. 9	Soot-blowing	0.0411	0.3					
Maximum		Normal	0.0674	0.1	Maximum		Normal	0.0431	0.1
		Soot-blowing	0.0944	0.3			Soot-blowing	0.046	0.3
	# Hours					# Hours			
	21	Normal				21	Normal		
	3	Soot-blowing				3	Soot-blowing		
Effective 24-hour rate			0.071	0.125				0.043	0.125
% Allowable			56.6%					34.8%	

TABLE 2-4
SUMMARY OF MAXIMUM 24-HOUR AVERAGE ACTUAL PM_{10} EMISSION RATES FOR THE BART-ELIGIBLE EMISSIONS UNITS
CITY OF TALLAHASSEE - ARVAH B. HOPKINS AND SAM O. PURDOM GENERATING STATIONS

Source	Model ID	Heat Input Rate MMBtu/hr	Maximum PM_{10} Emission Rate [c] Normal Operation lb/MMBtu	Normal Operation Hours/day	Soot Blowing lb/MMBtu	Soot Blowing Hours/day	Daily PM_{10} Emissions Normal Operation lb/hr	Daily PM_{10} Emissions Soot Blowing lb/hr	Maximum PM_{10} Emissions lb/hr
ARVAH B. HOPKINS GENERAING STATION [a]									
Boiler No. 1	AHBLR1	903	0.0431	21	0.0460	3	34.1	5.2	39.2
Boiler No. 2	AHBLR2	2325	0.0674	21	0.0944	3	137.1	27.4	164.6
SAM O. PURDOM GENERATING STATION [b]									
Boiler No. 7	SPBLR7	621	0.1	21	0.3	3	54.3	23.3	77.6

[a] Based on maximum actual PM emissions from stack test results.
[b] Based on maximum allowable PM emissions from Title V permit No. 1290001-007-AV (stack tests not performed since unit operated less than 400 hours/year).
[c] Based on filterable PM emissions.

TABLE 2-5a
PM SPECIATION SUMMARY - HOPKINS GENERATING STATION, UNIT NO. 1

PM Category	Emission Unit [a]	Units	Total	Coarse PM	Soil (Fine PM)	Elemental Carbon (EC)	Inorganic (as H_2SO_4)	Organic
PM Filterable [b]	Boiler No. 1	lb/hr	39.2	10.64	26.49	2.12	NA	NA
		%	100%	27%	67%	5%	NA	NA
PM Condensable [c]	Boiler No. 1	lb/hr	9.03	NA	NA	NA	7.68	1.35
		%	100%	NA	NA	NA	85%	15%
Total PM_{10} (filterable+condensable)	Boiler No. 1	lb/hr	48.3	10.64	26.49	2.12	7.68	1.35
		%	100%	22.0%	54.9%	4.4%	15.9%	2.8%
Total PM_{10} (filterable+Organic Condensable PM)	Boiler No. 1	lb/hr	40.6	10.64	26.49	2.12	0.0	1.35
Modeled PM Speciation % (SO_4 modeled separately)		%	100%	26.2%	65.2%	5.2%	0.0%	3.4%

PM Particle Size Distribution for CALPUFF Assessment

Species Name	AP-42 (Table 1.3-4) Particle Size (microns)	Cumulative (%)	Cumulative Normalized PM10 (%)	Individual Categories: Filterable (%)	Individual Categories: Organic Condensable	Emission Rate (lb/hr): Filterable	Emission Rate (lb/hr): Organic Condensable	Emission Rate (lb/hr): Total
Total PM_{10}						39.2	1.4	40.6
PM0063	0.63	20.0%	28.2%	28.2%	50.0%	11.1	0.7	11.7
PM0100	1	39.0%	54.9%	26.8%	50.0%	10.5	0.7	11.2
PM0125	1.25	43.0%	60.6%	5.6%	0	2.2	0.0	2.2
PM0250	2.5	52.0%	73.2%	12.7%	0	5.0	0.0	5.0
PM0600	6	58.0%	81.7%	8.5%	0	3.3	0.0	3.3
PM1000	10	71.0%	100.0%	18.3%	0	7.2	0.0	7.2
Totals				100.0%	100.0%	39.2	1.4	40.6

Total Modeled PM_{10} 40.6

[a] Heat input rate for unit and fuel heat content 903 MMBtu/hr
150,000 Btu/gal fuel oil

[b] PM fine consists of PM soil and PM elemental carbon

PM fine based on ratio of PM2.5 (fine) to PM10 (filterable) emission factor (Table 1.3-4, AP-42)

	lb/1000 gal		
PM2.5	4.3 x sulfur content factor	Ratio =	0.73 PM2.5/PM10
PM10	5.9 x sulfur content factor		

PM elemental carbon based on EPA's "Catalog of Global Emissions Inventories and Emission Inventory Tools for Black Carbon", Table 5, January 2002 DRAFT
0.074 of PM2.5

PM elemental carbon	0.05 PM elemental carbon/PM10
PM soil= PM2.5 - PM elemental carbon	0.67 PM soil/PM10
PM2.5	0.73 PM2.5/PM10
PM coarse= PM10 - PM2.5	

[c] Condensable PM (Table 1.3-2, AP-42)

	lb/1000 gal	lb/MMBtu	
Total	1.5	0.0100	
Inorganic	1.275	0.0085	(0.85 of Total)
Organic	0.225	0.0015	(0.15 of Total)

TABLE 2-5b
PM SPECIATION SUMMARY - HOPKINS GENERATING STATION, UNIT 2

PM Category	Emission Unit [a]	Units	Total	Coarse PM	Soil (Fine PM)	Elemental Carbon (EC)	Inorganic (as H_2SO_4)	Organic
PM Filterable [b]	Boiler No. 2	lb/hr	164.6	44.62	111.05	8.87	NA	NA
		%	100%	27%	67%	5%	NA	NA
PM Condensable [c]	Boiler No. 2	lb/hr	23.25	NA	NA	NA	19.76	3.49
		%	100%	NA	NA	NA	85%	15%
Total PM_{10} (filterable+condensable)	Boiler No. 2	lb/hr	187.8	44.62	111.05	8.87	19.76	3.49
		%	100%	23.8%	59.1%	4.7%	10.5%	1.9%
Total PM_{10} (filterable+Organic Condensable PM)	Boiler No. 2	lb/hr	168.0	44.62	111.05	8.87	0.0	3.49
Modeled PM Speciation % (SO_4 modeled separately)		%	100%	26.6%	66.1%	5.3%	0.0%	2.1%

PM Particle Size Distribution for CALPUFF Assessment

Species	Size Distribution by Category (%)					Emission Rate (lb/hr)		
	AP-42 (Table 1.3-4)		Cumulative	Individual Categories				
Name	Particle Size (microns)	Cumulative (%)	Normalized PM1((%)	Filterable (%)	Organic Condensable	Filterable	Organic Condensable	Total
Total PM_{10}						164.6	3.5	168.0
PM0063	0.63	20.0%	28.2%	28.2%	50.0%	46.4	1.7	48.1
PM0100	1	39.0%	54.9%	26.8%	50.0%	44.0	1.7	45.8
PM0125	1.25	43.0%	60.6%	5.6%	0	9.3	0.0	9.3
PM0250	2.5	52.0%	73.2%	12.7%	0	20.9	0.0	20.9
PM0600	6	58.0%	81.7%	8.5%	0	13.9	0.0	13.9
PM1000	10	71.0%	100.0%	18.3%	0	30.1	0.0	30.1
Totals				100.0%	100.0%	164.6	3.5	168.0

Total Modeled PM_{10} 168.0

[a] Heat input rate for unit and fuel heat content: 2325 MMBtu/hr; 150,000 Btu/gal fuel oil

[b] PM fine consists of PM soil and PM elemental carbon
PM fine based on ratio of PM2.5 (fine) to PM10 (filter emission factor (Table 1.3-4, AP-42)

	lb/1000 gal	
PM2.5	4.3 x sulfur content factor	Ratio = 0.73 PM2.5/PM10
PM10	5.9 x sulfur content factor	

PM elemental carbon based on EPA's "Catalog of Global Emissions Inventories and Emission Inventory Tools for Black Carbon", Table 5, January 2002 DRAFT
0.074 of PM2.5

PM elemental carbon	0.05 PM elemental carbon/PM10
PM soil= PM2.5 - PM elemental carbon	0.67 PM soil/PM10
PM2.5	0.73 PM2.5/PM10
PM coarse= PM10 - PM2.5	

[c] Condensable PM (Table 1.3-2, AP-42)

	lb/1000 gal	lb/MMBtu	
Total	1.5	0.0100	
Inorganic	1.275	0.0085	(0.85 of Total)
Organic	0.225	0.0015	(0.15 of Total)

TABLE 2-6
PM SPECIATION SUMMARY - PURDOM GENERATING STATION, UNIT 7

PM	Emission Unit [a]	Units	Total	Coarse PM	Soil (Fine PM)	Elemental Carbon (EC)	Inorganic (as H_2SO_4)	Organic
PM Filterable [b]	Boiler No. 7	lb/hr	77.6	21.05	52.39	4.19	NA	NA
		%	100%	27%	67%	5%	NA	NA
PM Condensable [c]	Boiler No. 7	lb/hr	6.21	NA	NA	NA	5.28	0.93
		%	100%	NA	NA	NA	85%	15%
Total PM_{10} (filterable+condensable)	Boiler No. 7	lb/hr	83.8	21.05	52.39	4.19	5.28	0.93
		%	100%	25.1%	62.5%	5.0%	6.3%	1.1%
Total PM_{10} (filterable+Organic Condensable PM)	Boiler No. 7	lb/hr	78.6	21.05	52.39	4.19	0.0	0.93
Modeled PM Speciation % (SO_4 modeled separately)		%	100%	26.8%	66.7%	5.3%	0.0%	1.2%

PM Particle Size Distribution for CALPUFF Assessment

Species	Size Distribution by Category (%)					Emission Rate (lb/hr)		
	AP-42 (Table 1.3-4)		Cumulative	Individual Categories				
Name	Particle Size (microns)	Cumulative (%)	Normalized PM1((%)	Filterable (%)	Organic Condensable	Filterable	Organic Condensable	Total
Total PM_{10}						77.6	0.9	78.6
PM0063	0.63	20.0%	28.2%	28.2%	50.0%	21.9	0.5	22.3
PM0100	1	39.0%	54.9%	26.8%	50.0%	20.8	0.5	21.2
PM0125	1.25	43.0%	60.6%	5.6%	0	4.4	0.0	4.4
PM0250	2.5	52.0%	73.2%	12.7%	0	9.8	0.0	9.8
PM0600	6	58.0%	81.7%	8.5%	0	6.6	0.0	6.6
PM1000	10	71.0%	100.0%	18.3%	0	14.2	0.0	14.2
Totals				100.0%	100.0%	77.6	0.9	78.6

Total Modeled PM_{10} 78.6

[a] Heat input rate for unit and fuel heat content 621 MMBtu/hr
150,000 Btu/gal fuel oil

[b] PM fine consists of PM soil and PM elemental carbon

		lb/1000 gal			
PM fine based on ratio of PM2.5 (fine) to PM10 (filter	PM2.5	4.3	x sulfur content factor	Ratio =	0.73 PM2.5/PM10
emission factor (Table 1.3-4, AP-42)	PM10	5.9	x sulfur content factor		

PM elemental carbon based on EPA's "Catalog of Global Emissions Inventories and Emission Inventory Tools for Black Carbon", Table 5, January 2002 DRAFT
0.074 of PM2.5

PM elemental carbon	0.05 PM elemental carbon/PM10
PM soil= PM2.5 - PM elemental carbon	0.67 PM soil/PM10
PM2.5	0.73 PM2.5/PM10
PM coarse= PM10 - PM2.5	

[c] Condensable PM (Table 1.3-2, AP-42)

	lb/1000 gal	lb/MMBtu	
CPM	1.5	0.0100	
Inorganic CPM	1.275	0.0085	(0.85 of Total)
Organic CPM	0.225	0.0015	(0.15 of Total)

3.0 GEOPHYSICAL AND METEOROLOGICAL DATA

3.1 Modeling Domain and Terrain

CALMET data sets have been developed by EarthTech that are based on the following 3 years of Fifth Generation Mesoscale Model (MM5) meteorological data assembled by VISTAS:

- 2001 MM5 data set at 12-km grid (developed by EPA),
- 2002 MM5 data set at 12-km grid (developed by VISTAS), and
- 2003 MM5 data set at 36-km grid (developed by Midwest Regional Planning Organization).

For the finer grid modeling analysis (refined analysis), the 4-km spacing Florida CALMET domain will be used. VISTAS has prepared a total of five sub-regional 4-km spacing CALMET domains. Domain 2 covers all Florida sources and Class I areas that can be potentially affected by the Florida sources.

Golder Associates Inc. (Golder) obtained these data sets from the FDEP. As indicated in Section 1.3, for this protocol, the exemption modeling will be based on the finer grid modeling since the Hopkins and Purdom Generating Stations are large sources that are likely to exceed the initial screening thresholds. Therefore, only the refined analysis will be performed to determine whether the source is exempt from BART.

3.2 Land Use and Meteorological Database

The CALMET meteorological data sets to be used in the exemption modeling have been supplied by VISTAS. The CALMET data sets contain hourly meteorological data and land use parameters.

3.3 Air Quality Database

3.3.1 Ozone Concentrations

For these analyses, observed ozone data for 2001-2003 from CASTNet and Aerometric Information Retrieval System (AIRS) stations will be used. These data sets have been obtained from EarthTech's website as recommended by FDEP.

3.3.2 Ammonia Concentrations

A fixed monthly background ammonia concentration of 0.5 parts per billion (ppb) will be used based on FDEP's recommendation.

3.4 Natural Conditions at Class I Area

Based on VISTAS' recommendation, Visibility Method 6 will be used in all BART-related modeling, which will compute extinction coefficients for hygroscopic species (modeled and background) using a monthly f(RH) in lieu of calculating hourly RH factors. Monthly RH values from Table A-3 of EPA's *Guidance for Estimating Natural Visibility Conditions under the Regional Haze Rule* (Haze Guideline) will be used. Monthly RH factors for the Class I areas within 300 km of the City of Tallahassee plants are as follows:

Month	St. Marks NWA	Okefenokee NWA	Chassahowitzka NWA
January	3.7	3.5	3.8
February	3.4	3.2	3.5
March	3.4	3.1	3.4
April	3.4	3.0	3.2
May	3.5	3.6	3.3
June	4.0	3.7	3.9
July	4.1	3.7	3.9
August	4.4	4.1	4.2
September	4.2	4.0	4.1
October	3.8	3.8	3.9
November	3.7	3.5	3.7
December	3.8	3.6	3.9

Method 6 requires input of natural background (BK) concentrations of ammonium sulfate ($BKSO_4$), ammonium nitrate ($BKNO_3$), coarse particulates (BKPMC), organic carbon (BKOC), soil (BKSOIL), and elemental carbon (BKEC) in micrograms per cubic meter ($\mu g/m^3$). The model then calculates the natural background light extinction and haze index based on these values.

According to FDEP recommendations, the natural background light extinction may be based on haze index (HI) values (in dv) for either the annual average or the 20-percent best visibility days provided by EPA in Appendix B of the Haze Guideline document (using the 10^{th} percentile HI value). For this BART analysis, the annual average HI values will be used to determine natural background light extinction of the Class I areas. The light extinction coefficient in inverse megameters (Mm^{-1}) is based on the concentration of the visibility impairing components and the extinction efficiency, in square meters per gram (m^2/g), for each component.

Per VISTAS and FDEP recommendations, the natural background light extinction that is equivalent to EPA-provided background HI values for each Class I area, based on the annual average, will be estimated using the following background values:

- Rayleigh scattering = 10 Mm^{-1};
- Concentrations of $BKSO_4$, $BKNO_3$, BKPMC, BKEC, and BKEC = 0.0; and
- BKSOIL concentration, which is estimated from the extinction coefficient that corresponds to EPA's HI value (corresponding to the annual average) and then subtracting the Rayleigh scattering of 10 Mm^{-1} (assumes that the extinction efficiency of soil is 1 m^2/g).

According to Appendix B of the Haze Guideline document, the annual average background light extinction coefficients for each PSD Class I area and corresponding calculated BKSOIL concentrations are as follows:

- Saint Marks NWA – 21.53 Mm^{-1} (equivalent to 7.67 dv); 11.53 $\mu g/m^3$;
- Okefenokee NWA – 21.40 Mm^{-1} (equivalent to 7.61 dv); 11.40 $\mu g/m^3$; and
- Chassahowitzka NWA – 21.45 Mm^{-1} (equivalent to 7.63 dv); 11.45 $\mu g/m^3$.

Currently, the atmospheric light extinction is estimated by an algorithm developed by the Interagency Monitoring of Protected Visual Environments (IMPROVE) committee, which was adopted by the EPA under the 1999 Regional Haze Rule (RHR). This algorithm for estimating light extinction from particle speciation data tends to underestimate light extinction for the highest haze conditions and overestimate it for the lowest haze conditions and does not include light extinction due to sea salt, which is important at sites near the sea coasts. As a result of these limitations, the IMPROVE Steering Committee recently developed a new algorithm (the "new IMPROVE algorithm") for estimating light extinction from particulate matter component concentrations, which provides a better correspondence between measured visibility and that calculated from particulate matter component concentrations.

The new algorithm splits the total sulfate, nitrate, and organic carbon compound concentrations into two fractions, representing small and large size distributions of those compounds. New terms added to the algorithm are light absorption by NO_2 gas and light scattering due to fine sea salt accompanied by its own hygroscopic scattering enhancement factor and Class I area specific Rayleigh scattering values rounded off to the nearest whole number. The EPA and the Federal Land Managers (FLM) from the National Park Service and the U.S. Fish and Wildlife Service have determined that adding site-specific data (e.g., sea salt and site-specific Rayleigh scattering) to the old IMPROVE algorithm, for a hybrid approach, is not recommended and is allowing the optional use of the new IMPROVE algorithm.

As one or more of the Class I areas within 300 km of the Hopkins and Purdom Stations are located near the sea coast, the new IMPROVE algorithm may additionally be used to calculate the natural background at these Class I areas. The new IMPROVE algorithm accounts for the background sea-salt concentrations and site-specific Rayleigh scattering. Since the new IMPROVE equation cannot be directly implemented using the existing version of the CALPUFF model without additional post-processing or model revision, VISTAS has developed a methodology for implementing the new IMPROVE equation using existing CALPUFF/CALPOST output in a spreadsheet. This spreadsheet, known as the CALPOST-IMPROVE Processor, will be used to re-calculate visibility impacts due to BART-eligible units if the visibility impacts determined using the old IMPROVE equation are predicted to be greater than 0.5 dv.

Because ambient NO_2 concentrations due to the Hopkins and Purdom Stations are not being modeled, light absorption by NO_2 gas, which is a new term added to the new IMPROVE algorithm, will not be considered for the BART modeling analysis.

The following Class I area specific Rayleigh scattering (in Mm^{-1}) and sea salt concentrations (in $\mu g/m^3$) values will be used to evaluate the visibility impacts using the new CALPOST-IMPROVE Processor:

- Saint Marks NWA – 11 Mm^{-1} ; 0.03 $\mu g/m^3$.
- Okefenokee NWA – 11 Mm^{-1} ; 0.09 $\mu g/m^3$.
- Chassahowitzka NWA – 11 Mm^{-1} ; 0.08 $\mu g/m^3$.

4.0 AIR QUALITY MODELING METHODOLOGY

For predicting maximum visibility impairment at the Class I areas, the CALPUFF modeling system will be used. For BART-related visibility impact assessments, the CALPUFF model, Version 5.756 (060725), is recommended for use by EPA and VISTAS. Recent technical enhancements, including changes to the over-water boundary layer formulation and coastal effects modules (sponsored by the Minerals Management Service), are included in this version. The CALPUFF model is a non-steady-state long-range transport Lagrangian puff dispersion model applicable for estimating visibility impacts. The methods and assumptions used in the CALPUFF model will be based on the latest recommendations for CALPUFF analysis as presented in the VISTAS modeling protocol, Interagency Workgroup on Air Quality Models (IWAQM) Phase 2 Summary Report and the Federal Land Managers' Air Quality Related Values Work Group (FLAG) document. This model is also maintained by EPA on the Support Center for Regulatory Air Models (SCRAM) website.

4.1 Modeling Domain Configuration

The 4-km spacing Florida domain will be used for the BART exemption modeling and if required, modeling to evaluate visibility benefits of different BART control measures. VISTAS has prepared five sub-regional 4-km spacing CALMET domains. Domain 2 covers sources in Florida and Class I areas that are affected by the sources in Florida.

4.2 CALMET Meteorological Domain

The refined CALMET domain, to be used for City of Tallahassee's BART modeling has been provided by the FDEP. The major features used in preparing these CALMET data have been described in Section 4.0 of the VISTAS BART common modeling protocol.

4.3 CALPUFF Computational Domain and Receptors

The computational domain to be used for the refined modeling will be equal to the full extent of the meteorological domain. Visibility impacts will be predicted at each PSD Class I area using receptors provided by the Federal Land Managers. The receptors to be used for each of the PSD Class I areas are the National Park Service's (NPS) complete receptor sets and are presented in Figures 4-1 through 4-3. In addition, at the request of the FDEP, for the Purdom Station which is located about 1 km from the St. Marks Class I area, an additional set of receptors were added to provide more coverage in the Class I area when predicting impacts for this station only. These receptors are presented in Figure 4-4.

4.4 CALPUFF Modeling Options

The major CALPUFF modeling options recommended in the IWAQM guidance (EPA, 1988; Pages B-1 through B-8), in addition to the recommendations in Section 4.3.3 of the VISTAS BART modeling protocol will be used. An example CALPUFF input file showing the modeling options is presented in Appendix B.

4.5 Light Extinction and Haze Impact Calculations

The CALPOST program will be used to calculate the light extinction and the haze impact. The Method 6 technique, which is recommended by the BART guideline document, will be used to compute change in light extinction.

4.6 QA/QC

Quality assurance procedures will be established to ensure that the setup and execution of the CALPUFF model and processing of the modeling results satisfy the regulatory objectives of the BART program. The meteorological datasets to be used in the modeling were developed and provided by VISTAS and therefore, no further QA will be required for these.

The CALPUFF modeling options are described in Section 4.4. The site-specific source data program will be independently confirmed by an independent modeler not involved in the initial setup of the modeling files. This verification will include:

- Units of measure;
- Verification of the correct source and receptor locations, including datum and projection;
- Confirmation of the switch selections relative to modeling guidance;
- Checks of the program switches and file names of the various processing steps; and
- Confirmation of the use of the proper version and level of each model.

In addition, all the data and program files needed to reproduce the modeling results will be supplied with the modeling report.

The source and emission data will be independently verified by Golder and the City of Tallahassee. The source coordinates and related projection/datum parameters will be checked using the CALPUFF GUI's COORDS software and other comparable coordinate translation software such as CORPSCON and National Park Services Conversion Utilities software.

The POSTUTIL and CALPOST post-processor input files will be carefully checked to make sure of the following:

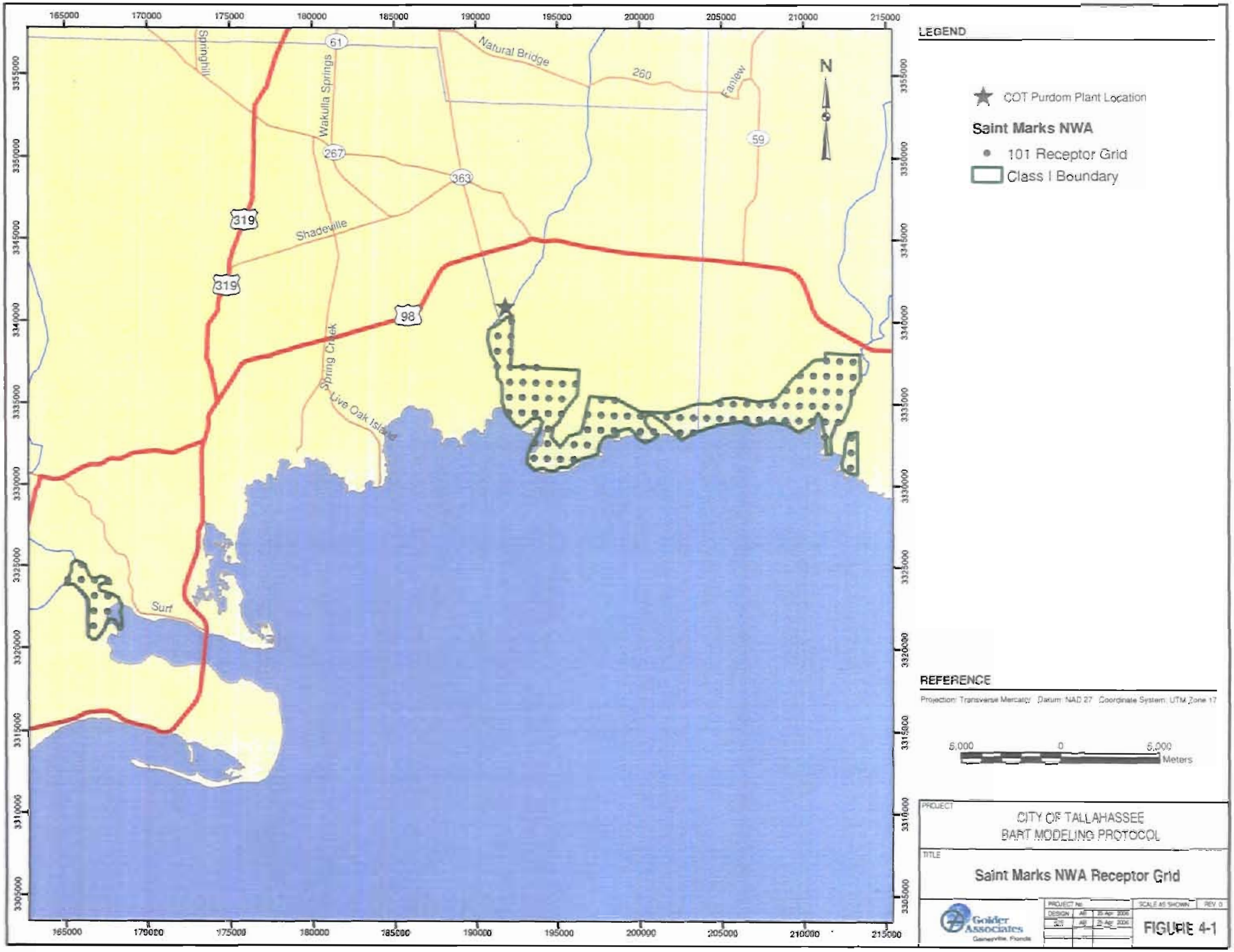
- Appropriate CALPUFF concentrations files are used in the POSTUTIL run;
- The PM species categories are computed using the appropriate fractions;
- Background light extinction computation method selected as Method 6;
- Correct monthly relative humidity adjustment factors used for the appropriate Class I area;
- Background light extinction values as described in Section 3.4 of this protocol;
- Appropriate species names for coarse and fine PM;
- Appropriate Rayleigh scattering term used; and
- Appropriate Class I receptors selected for each Class I area-specific CALPOST run.

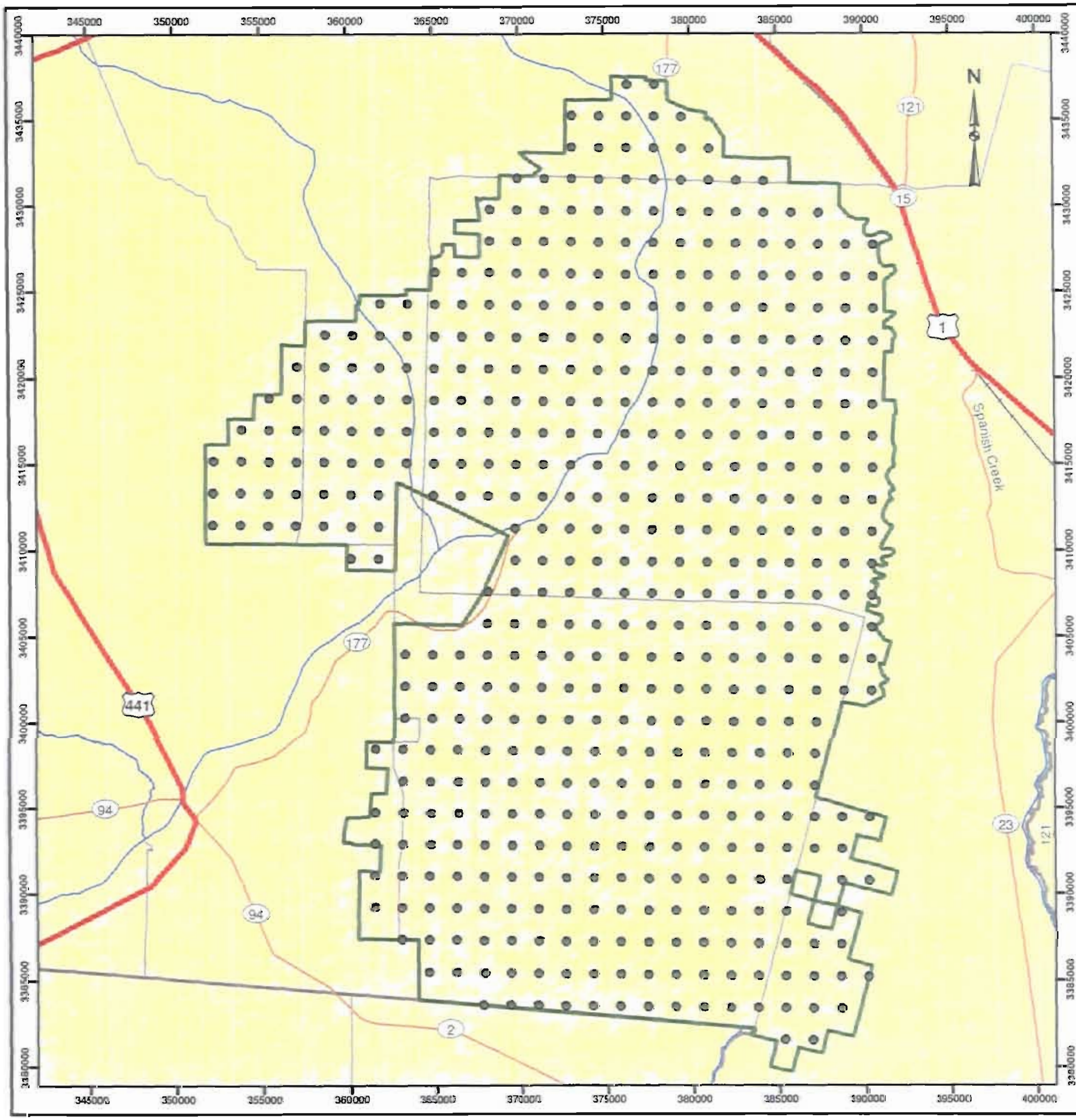
4.7 Modeling Report

A modeling report will be submitted containing the following information:

- Map of source location and Class I areas within 300 km of the source;
- Table showing visibility impacts at each Class I area within 300 km of the source;
- For the refined modeling analysis, a table showing the eight highest visibility impairment values ranked in a descending order for the prime Class I area(s) of interest; and
- All input and output files (excluding CALMET) used for either the exemption or determination modeling will be provided on CD.

The predicted visibility impairment results for the base emission case and selected BART emission scenarios, if applicable, will be included in the report to show the affect on visibility for each proposed control technology. Final recommendations for BART will also be presented, based on the analysis results of the five evaluation criteria presented in the regulations.


LEGEND
COT Purdom Plant Location
Saint Marks NWA
101 Receptor Grid
Class I Boundary
N
Natural Bridge
260
Fanlew
59
61
Springhill
Wakulla Springs
267
363
319
Shadeville
98
Spring Creek
Live Oak Island
Surf
165000
170000
175000
180000
185000
190000
195000
200000
205000
210000
215000
3355000
3350000
3345000
3340000
3335000
3330000
3325000
3320000
3315000
3310000
3305000
REFERENCE
Projection: Transverse Mercator Datum: NAD 27 Coordinate System: UTM Zone 17
5,000
0
5,000
Meters
PROJECT
CITY OF TALLAHASSEE
BART MODELING PROTOCOL
TITLE
Saint Marks NWA Receptor Grid
Golder Associates
Gainesville, Florida
SCALE AS SHOWN
REV 0
FIGURE 4-1



LEGEND

Okefenokee NWA

- 500 Receptor Grid
- Class I Boundary

REFERENCE

Projection: Transverse Mercator Datum: NAD 27 Coordinate System: UTM Zone 17

8,000 0 8,000 Meters

PROJECT

CITY OF TALLAHASSEE
BART MODELING PROTOCOL

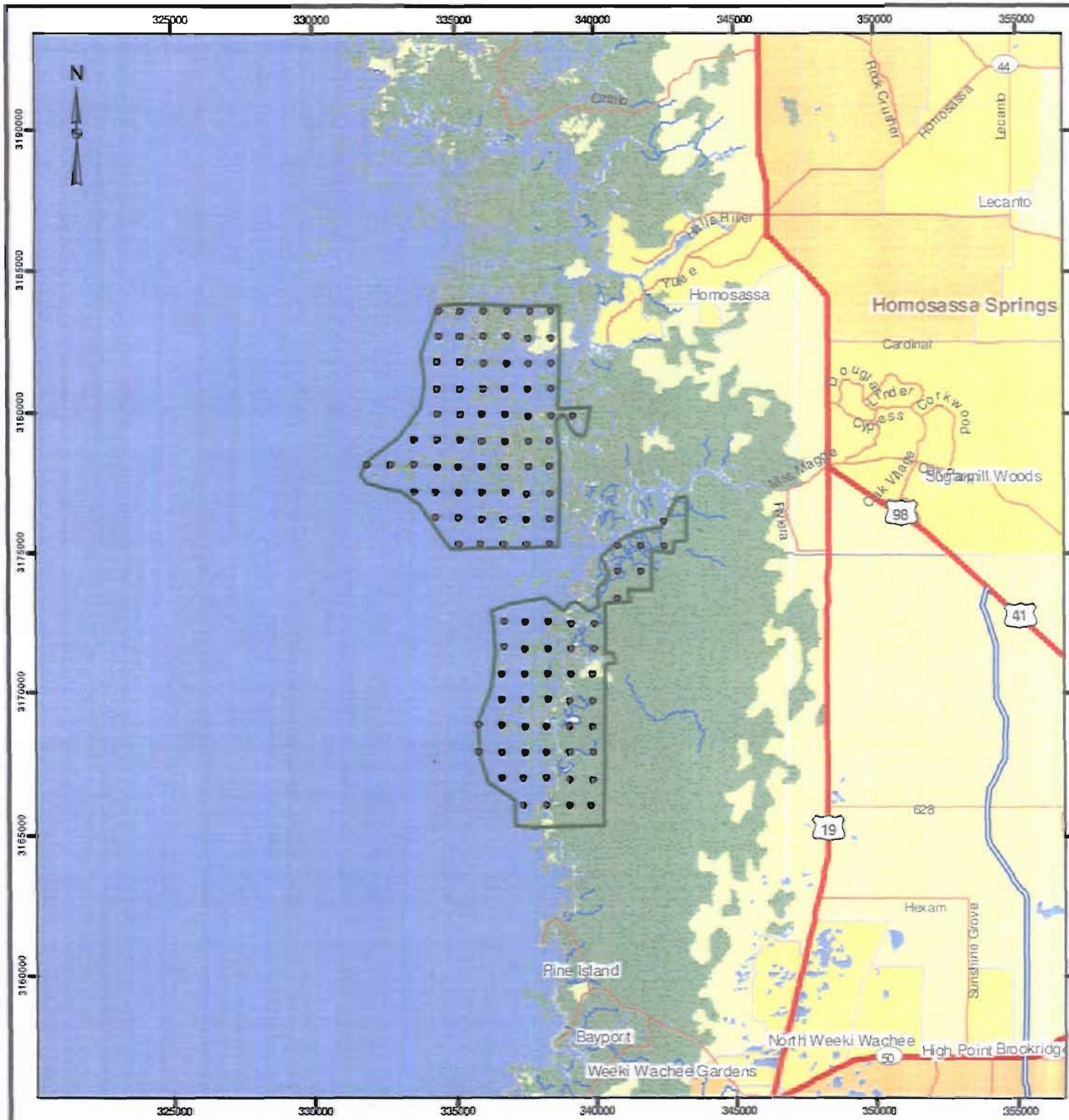
TITLE

Okefenokee NWA Receptor Grid

Golder Associates
Gainesville, Florida

PROJECT No.			SCALE AS SHOWN	REV. 0
DESIGN	AB	25 Apr. 2008		
GIS	AB	25 Apr. 2008		

FIGURE 4-2



LEGEND

Chassahowitzka NWA

- 113 Receptor Grid
- Class I Boundary

REFERENCE

Projection: Transverse Mercator Datum: NAD 27 Coordinate System: UTM Zone 17

5,000 0 5,000 Meters

PROJECT

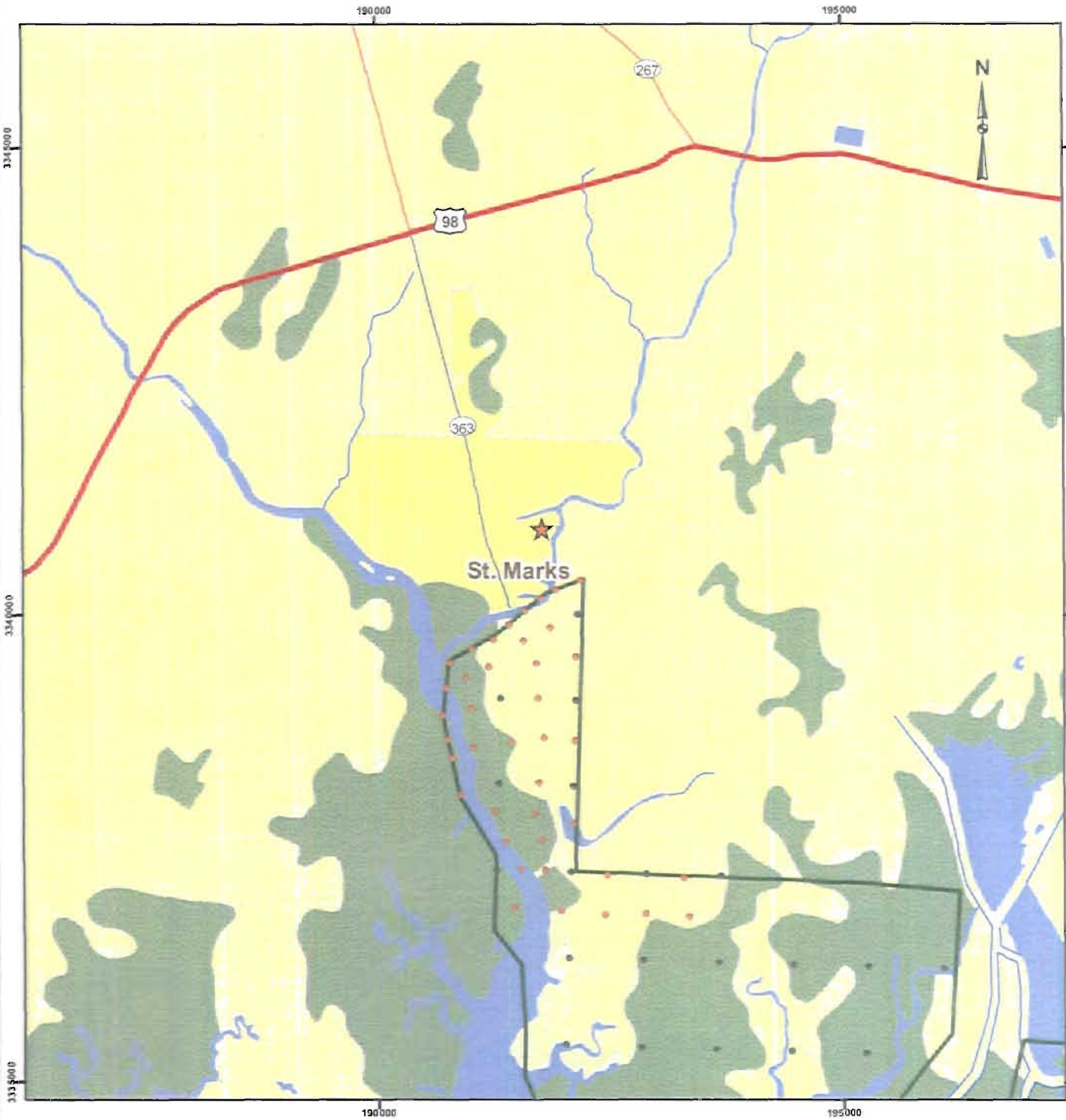
CITY OF TALLAHASSEE
BART MODELING PROTOCOL

TITLE

Chassahowitzka NWA Receptor Grid

Golder Associates
Gainesville, Florida

FIGURE 4-3



LEGEND

Saint Marks NWA

- 101 Receptor Grid
- 40 Refined Receptors
- Class I Boundary
- COT Purdom Plant Location

REFERENCE

Projection: Transverse Mercator Datum: NAD 27 Coordinate System: UTM Zone 17

1,500 0 1,500 Meters

PROJECT

CITY OF TALLAHASSEE
BART MODELING PROTOCOL

TITLE

Saint Marks NWA Refined Receptor Grid

Golder Associates
Gainesville, Florida

FIGURE 4-4

APPENDIX A

EXAMPLE CALPUFF INPUT FILE

```
EXAMPLE FACILITY XYZ - CALPUFF
IMPACTS AT SOURCE-SPECIFIC CLASS I AREAS
4-km FLORIDA DOMAIN (VISTAS REFINED DOMAIN 2), 2001
---------------- Run title (3 lines) ------------------------------------------

                    CALPUFF MODEL CONTROL FILE
                    --------------------------

-------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names

--------------
Default Name  Type          File Name
------------  ----          ---------
CALMET.DAT    input    * METDAT =              *
    or
ISCMET.DAT    input    * ISCDAT =              *
    or
PLMMET.DAT    input    * PLMDAT =              *
    or
PROFILE.DAT   input    * PRFDAT =              *
SURFACE.DAT   input    * SFCDAT =              *
RESTARTB.DAT  input    * RSTARTB=              *
--------------------------------------------------------------------------------
CALPUFF.LST   output   ! PUFLST = PUFFEXP.LST !
CONC.DAT      output   ! CONDAT = PUFFEXP.CON !
DFLX.DAT      output   * DFDAT  =              *
WFLX.DAT      output   * WFDAT  =              *

VISB.DAT      output   * VISDAT =              *
TK2D.DAT      output   * T2DDAT =              *
RHO2D.DAT     output   * RHODAT =              *
RESTARTE.DAT  output   * RSTARTE=              *
--------------------------------------------------------------------------------
Emission Files
--------------
PTEMARB.DAT   input    * PTDAT  =              *
VOLEMARB.DAT  input    * VOLDAT =              *
BAEMARB.DAT   input    * ARDAT  =              *
LNEMARB.DAT   input    * LNDAT  =              *
--------------------------------------------------------------------------------
Other Files
-----------
OZONE.DAT     input    ! OZDAT  =C:\BARTHRO3\2001FLOz.DAT !
VD.DAT        input    * VDDAT  =              *
CHEM.DAT      input    * CHEMDAT=              *
H2O2.DAT      input    * H2O2DAT=              *
HILL.DAT      input    * HILDAT=             *
HILLRCT.DAT   input    * RCTDAT=             *
COASTLN.DAT   input    * CSTDAT=             *
FLUXBDY.DAT   input    * BDYDAT=             *
BCON.DAT      input    * BCNDAT=             *
DEBUG.DAT     output   * DEBUG =             *
MASSFLX.DAT   output   * FLXDAT=             *
MASSBAL.DAT   output   * BALDAT=             *
FOG.DAT       output   * FOGDAT=             *
--------------------------------------------------------------------------------
All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case      ! LCFILES = T !
         F = UPPER CASE
NOTE: (1) file/path names can be up to 70 characters in length


Provision for multiple input files
----------------------------------

     Number of CALMET.DAT files for run (NMETDAT)
                                Default: 1       ! NMETDAT =   36  !

     Number of PTEMARB.DAT files for run (NPTDAT)
                                Default: 0       ! NPTDAT =  0  !

     Number of BAEMARB.DAT files for run (NARDAT).
```

```
                                             Default: 0        ! NARDAT =  0  !

     Number of VOLEMARB.DAT files for run (NVOLDAT)
                                             Default: 0        ! NVOLDAT =  0  !

!END!

-------------
Subgroup (0a)
-------------

  The following CALMET.DAT filenames are processed in sequence if NMETDAT>1

Default Name  Type          File Name
------------  ----          ---------
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-01A.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-01B.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-01C.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-02A.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-02B.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-02C.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-03A.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-03B.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-03C.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-04A.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-04B.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-04C.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-05A.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-05B.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-05C.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-06A.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-06B.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-06C.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-07A.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-07B.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-07C.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-08A.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-08B.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-08C.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-09A.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-09B.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-09C.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-10A.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-10B.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-10C.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-11A.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-11B.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-11C.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-12A.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-12B.DAT ! !END!
CALMET.DAT    input    ! METDAT =E:\FLA4KM\2001\MET2001-DOM2-12C.DAT ! !END!
-------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

    Option to run all periods found
    in the met. file     (METRUN)   Default: 0        ! METRUN =   0  !

         METRUN = 0 - Run period explicitly defined below
         METRUN = 1 - Run all periods in met. file

     Starting date:   Year (IBYR) -- No default        ! IBYR =  2001  !
     (used only if   Month (IBMO) -- No default        ! IBMO =  1  !
      METRUN = 0)      Day (IBDY) -- No default        ! IBDY =  1  !
                      Hour (IBHR) -- No default        ! IBHR =  1  !

     Base time zone         (XBTZ) -- No default       ! XBTZ = 5.0  !
        PST = 8., MST = 7.
        CST = 6., EST = 5.

     Length of run (hours) (IRLG) -- No default        ! IRLG = 8760 !

     Number of chemical species (NSPEC)
                                             Default: 5        ! NSPEC = 11   !
```

```
     Number of chemical species
     to be emitted  (NSE)              Default: 3        ! NSE = 9    !

     Flag to stop run after
     SETUP phase (ITEST)               Default: 2        ! ITEST =  2    !
     (Used to allow checking
     of the model inputs, files, etc.)
           ITEST = 1 - STOPS program after SETUP phase
           ITEST = 2 - Continues with execution of program
                       after SETUP

     Restart Configuration:

        Control flag (MRESTART)        Default: 0        ! MRESTART =  0    !

           0 = Do not read or write a restart file
           1 = Read a restart file at the beginning of
               the run
           2 = Write a restart file during run
           3 = Read a restart file at beginning of run
               and write a restart file during run

        Number of periods in Restart
        output cycle (NRESPD)          Default: 0        ! NRESPD =  0    !

           0 = File written only at last period
          >0 = File updated every NRESPD periods

     Meteorological Data Format (METFM)
                                       Default: 1        ! METFM =  1    !

           METFM = 1 - CALMET binary file (CALMET.MET)
           METFM = 2 - ISC ASCII file (ISCMET.MET)
           METFM = 3 - AUSPLUME ASCII file (PLMMET.MET)
           METFM = 4 - CTDM plus tower file (PROFILE.DAT) and
                       surface parameters file (SURFACE.DAT)

     PG sigma-y is adjusted by the factor (AVET/PGTIME)**0.2
     Averaging Time (minutes) (AVET)
                                       Default: 60.0     ! AVET = 60. !
     PG Averaging Time (minutes) (PGTIME)
                                       Default: 60.0     ! PGTIME = 60. !


!END!


-------------------------------------------------------------------------------

INPUT GROUP: 2 -- Technical options
--------------


     Vertical distribution used in the
     near field (MGAUSS)                     Default: 1     ! MGAUSS =  1    !
        0 = uniform
        1 = Gaussian

     Terrain adjustment method
     (MCTADJ)                                Default: 3     ! MCTADJ =  3    !
        0 = no adjustment
        1 = ISC-type of terrain adjustment
        2 = simple, CALPUFF-type of terrain
            adjustment
        3 = partial plume path adjustment

     Subgrid-scale complex terrain
     flag (MCTSG)                            Default: 0     ! MCTSG =  0    !
        0 = not modeled
        1 = modeled

     Near-field puffs modeled as
     elongated 0 (MSLUG)                     Default: 0     ! MSLUG =  0    !
        0 = no
```

```
   1 = yes (slug model used)

Transitional plume rise modeled ?
(MTRANS)                             Default: 1      ! MTRANS =  1   !
   0 = no  (i.e., final rise only)
   1 = yes (i.e., transitional rise computed)

Stack tip downwash? (MTIP)           Default: 1      ! MTIP =  1  !
   0 = no  (i.e., no stack tip downwash)
   1 = yes (i.e., use stack tip downwash)

Vertical wind shear modeled above
stack top? (MSHEAR)                  Default: 0      ! MSHEAR =  0  !
   0 = no  (i.e., vertical wind shear not modeled)
   1 = yes (i.e., vertical wind shear modeled)

Puff splitting allowed? (MSPLIT)     Default: 0      ! MSPLIT =  0  !
   0 = no (i.e., puffs not split)
   1 = yes (i.e., puffs are split)

Chemical mechanism flag (MCHEM)      Default: 1      ! MCHEM =  1   !
   0 = chemical transformation not
       modeled
   1 = transformation rates computed
       internally (MESOPUFF II scheme)
   2 = user-specified transformation
       rates used
   3 = transformation rates computed
       internally (RIVAD/ARM3 scheme)
   4 = secondary organic aerosol formation
       computed (MESOPUFF II scheme for OH)

Aqueous phase transformation flag (MAQCHEM)
(Used only if MCHEM = 1, or 3)       Default: 0      ! MAQCHEM =  0   !
   0 = aqueous phase transformation
       not modeled
   1 = transformation rates adjusted
       for aqueous phase reactions

Wet removal modeled ? (MWET)         Default: 1      ! MWET =  1   !
   0 = no
   1 = yes

Dry deposition modeled ? (MDRY)      Default: 1      ! MDRY =  1   !
   0 = no
   1 = yes
   (dry deposition method specified
    for each species in Input Group 3)

Method used to compute dispersion
coefficients (MDISP)                 Default: 3      ! MDISP =  3   !

   1 = dispersion coefficients computed from measured values
       of turbulence, sigma v, sigma w
   2 = dispersion coefficients from internally calculated
       sigma v, sigma w using micrometeorological variables
       (u*, w*, L, etc.)
   3 = PG dispersion coefficients for RURAL areas (computed using
       the ISCST multi-segment approximation) and MP coefficients in
       urban areas
   4 = same as 3 except PG coefficients computed using
       the MESOPUFF II eqns.
   5 = CTDM sigmas used for stable and neutral conditions.
       For unstable conditions, sigmas are computed as in
       MDISP = 3, described above.  MDISP = 5 assumes that
       measured values are read

Sigma-v/sigma-theta, sigma-w measurements used? (MTURBVW)
(Used only if MDISP = 1 or 5)         Default: 3      ! MTURBVW =  3  !
   1 = use sigma-v or sigma-theta measurements
       from PROFILE.DAT to compute sigma-y
       (valid for METFM = 1, 2, 3, 4)
   2 = use sigma-w measurements
       from PROFILE.DAT to compute sigma-z
       (valid for METFM = 1, 2, 3, 4)
```

```
   3 = use both sigma-(v/theta) and sigma-w
       from PROFILE.DAT to compute sigma-y and sigma-z
       (valid for METFM = 1, 2, 3, 4)
   4 = use sigma-theta measurements
       from PLMMET.DAT to compute sigma-y
       (valid only if METFM = 3)

Back-up method used to compute dispersion
when measured turbulence data are
missing (MDISP2)                      Default: 3     ! MDISP2 =  3  !
(used only if MDISP = 1 or 5)
   2 = dispersion coefficients from internally calculated
       sigma v, sigma w using micrometeorological variables
       (u*, w*, L, etc.)
   3 = PG dispersion coefficients for RURAL areas (computed using
       the ISCST multi-segment approximation) and MP coefficients in
       urban areas
   4 = same as 3 except PG coefficients computed using
       the MESOPUFF II eqns.

PG sigma-y,z adj. for roughness?      Default: 0     ! MROUGH =  0  !
(MROUGH)
   0 = no
   1 = yes

Partial plume penetration of          Default: 1     ! MPARTL =  1  !
elevated inversion?
(MPARTL)
   0 = no
   1 = yes

Strength of temperature inversion     Default: 0     ! MTINV =  0  !
provided in PROFILE.DAT extended records?
(MTINV)
   0 = no (computed from measured/default gradients)
   1 = yes

PDF used for dispersion under convective conditions?
                                      Default: 0     ! MPDF =  0  !
(MPDF)
   0 = no
   1 = yes

Sub-Grid TIBL module used for shore line?
                                      Default: 0     ! MSGTIBL = 0  !
(MSGTIBL)
   0 = no
   1 = yes

Boundary conditions (concentration) modeled?
                                      Default: 0     ! MBCON = 0  !
(MBCON)
   0 = no
   1 = yes


Analyses of fogging and icing impacts due to emissions from
arrays of mechanically-forced cooling towers can be performed
using CALPUFF in conjunction with a cooling tower emissions
processor (CTEMISS) and its associated postprocessors.  Hourly
emissions of water vapor and temperature from each cooling tower
cell are computed for the current cell configuration and ambient
conditions by CTEMISS. CALPUFF models the dispersion of these
emissions and provides cloud information in a specialized format
for further analysis. Output to FOG.DAT is provided in either
'plume mode' or 'receptor mode' format.

Configure for FOG Model output?
                                      Default: 0     ! MFOG =  0  !
(MFOG)
   0 = no
   1 = yes  - report results in PLUME Mode format
   2 = yes  - report results in RECEPTOR Mode format
```

```
     Test options specified to see if
     they conform to regulatory
     values? (MREG)                         Default: 1      ! MREG =  1   !

        0 = NO checks are made
        1 = Technical options must conform to USEPA
            Long Range Transport (LRT) guidance
                       METFM     1 or 2
                       AVET      60. (min)
                       PGTIME    60. (min)
                       MGAUSS    1
                       MCTADJ    3
                       MTRANS    1
                       MTIP      1
                       MCHEM     1 or 3 (if modeling SOx, NOx)
                       MWET      1
                       MDRY      1
                       MDISP     2 or 3
                       MPDF      0 if MDISP=3
                                 1 if MDISP=2
                       MROUGH    0
                       MPARTL    1
                       SYTDEP    550. (m)
                       MHFTSZ    0


!END!


-------------------------------------------------------------------------------

INPUT GROUP: 3a, 3b -- Species list
-------------------

------------
Subgroup (3a)
------------

  The following species are modeled:

! CSPEC =          SO2 !         !END!
! CSPEC =          SO4 !         !END!
! CSPEC =          NOX !         !END!
! CSPEC =         HNO3 !         !END!
! CSPEC =          NO3 !         !END!
! CSPEC =       PM0063 !         !END!
! CSPEC =       PM0100 !         !END!
! CSPEC =       PM0125 !         !END!
! CSPEC =       PM0250 !         !END!
! CSPEC =       PM0600 !         !END!
! CSPEC =       PM1000 !         !END!

                                                        Dry                 OUTPUT GROUP
    SPECIES          MODELED          EMITTED        DEPOSITED                NUMBER
     NAME          (0=NO, 1=YES)    (0=NO, 1=YES)    (0=NO,                 (0=NONE,
   (Limit: 12                                         1=COMPUTED-GAS        1=1st CGRUP,
    Characters                                        2=COMPUTED-PARTICLE   2=2nd CGRUP,
    in length)                                        3=USER-SPECIFIED)     3= etc.)

!          SO2  =         1,              1,            1,                  0   !
!          SO4  =         1,              1,            2,                  0   !
!          NOX  =         1,              1,            1,                  0   !
!         HNO3  =         1,              0,            1,                  0   !
!          NO3  =         1,              0,            2,                  0   !
!       PM0063  =         1,              1,            2,                  1   !
!       PM0100  =         1,              1,            2,                  1   !
!       PM0125  =         1,              1,            2,                  1   !
!       PM0250  =         1,              1,            2,                  1   !
!       PM0600  =         1,              1,            2,                  1   !
!       PM1000  =         1,              1,            2,                  1   !

!END!

-------------
Subgroup (3b)
```

```
-------------
  The following names are used for Species-Groups in which results
  for certain species are combined (added) prior to output.  The
  CGRUP name will be used as the species name in output files.
  Use this feature to model specific particle-size distributions
  by treating each size-range as a separate species.
  Order must be consistent with 3(a) above.

! CGRUP =           PM10 !      !END!

INPUT GROUP: 4 -- Map Projection and Grid control parameters
--------------

     Projection for all (X,Y):
     -------------------------

     Map projection
     (PMAP)                      Default: UTM    ! PMAP = LCC  !

         UTM :  Universal Transverse Mercator
         TTM :  Tangential Transverse Mercator
         LCC :  Lambert Conformal Conic
          PS :  Polar Stereographic
          EM :  Equatorial Mercator
        LAZA :  Lambert Azimuthal Equal Area

     False Easting and Northing (km) at the projection origin
     (Used only if PMAP= TTM, LCC, or LAZA)
     (FEAST)                     Default=0.0     ! FEAST  = 0.000  !
     (FNORTH)                    Default=0.0     ! FNORTH = 0.000  !

     UTM zone (1 to 60)
     (Used only if PMAP=UTM)
     (IUTMZN)                    No Default      ! IUTMZN =  0 !

     Hemisphere for UTM projection?
     (Used only if PMAP=UTM)
     (UTMHEM)                    Default: N      ! UTMHEM = N  !
         N   :  Northern hemisphere projection
         S   :  Southern hemisphere projection

     Latitude and Longitude (decimal degrees) of projection origin
     (Used only if PMAP= TTM, LCC, PS, EM, or LAZA)
     (RLAT0)                     No Default      ! RLAT0 =  40N !
     (RLON0)                     No Default      ! RLON0 =  97W !

         TTM :  RLON0 identifies central (true N/S) meridian of projection
                RLAT0 selected for convenience
         LCC :  RLON0 identifies central (true N/S) meridian of projection
                RLAT0 selected for convenience
         PS  :  RLON0 identifies central (grid N/S) meridian of projection
                RLAT0 selected for convenience
         EM  :  RLON0 identifies central meridian of projection
                RLAT0 is REPLACED by 0.0N (Equator)
         LAZA:  RLON0 identifies longitude of tangent-point of mapping plane
                RLAT0 identifies latitude of tangent-point of mapping plane

     Matching parallel(s) of latitude (decimal degrees) for projection
     (Used only if PMAP= LCC or PS)
     (XLAT1)                     No Default      ! XLAT1 = 33N  !
     (XLAT2)                     No Default      ! XLAT2 = 45N  !

         LCC :  Projection cone slices through Earth's surface at XLAT1 and XLAT2
         PS  :  Projection plane slices through Earth at XLAT1
                (XLAT2 is not used)

     ----------
     Note:  Latitudes and longitudes should be positive, and include a
            letter N,S,E, or W indicating north or south latitude, and
            east or west longitude.  For example,
            35.9  N Latitude  =  35.9N
            118.7 E Longitude = 118.7E


     Datum-region
```

```
------------

The Datum-Region for the coordinates is identified by a character
string. Many mapping products currently available use the model of the
Earth known as the World Geodetic System 1984 (WGS-84). Other local
models may be in use, and their selection in CALMET will make its output
consistent with local mapping products. The list of Datum-Regions with
official transformation parameters is provided by the National Imagery and
Mapping Agency (NIMA).

NIMA Datum - Regions(Examples)
------------------------------------------------------------------------------
WGS-84    WGS-84 Reference Ellipsoid and Geoid, Global coverage (WGS84)
NAS-C     NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS (NAD27)
NAR-C     NORTH AMERICAN 1983 GRS 80 Spheroid, MEAN FOR CONUS (NAD83)
NWS-84    NWS 6370KM Radius, Sphere
ESR-S     ESRI REFERENCE 6371KM Radius, Sphere

Datum-region for output coordinates
(DATUM)                    Default: WGS-G      ! DATUM = NWS-84 !


METEOROLOGICAL Grid:

     Rectangular grid defined for projection PMAP,
     with X the Easting and Y the Northing coordinate

            No. X grid cells (NX)      No default     ! NX = 263   !
            No. Y grid cells (NY)      No default     ! NY = 206    !
         No. vertical layers (NZ)      No default     ! NZ =  10   !

           Grid spacing (DGRIDKM)      No default     ! DGRIDKM = 4. !
                                       Units: km

                 Cell face heights
                     (ZFACE(nz+1))     No defaults
                                       Units: m
      ! ZFACE = 0.,20.,40.,80.,160.,320.,640.,1200.,2000.,3000.,4000. !

            Reference Coordinates
           of SOUTHWEST corner of
                 grid cell(1, 1):

            X coordinate (XORIGKM)     No default     ! XORIGKM =  721.995 !
            Y coordinate (YORIGKM)     No default     ! YORIGKM = -1598.000 !
                                      Units: km


COMPUTATIONAL Grid:

     The computational grid is identical to or a subset of the MET. grid.
     The lower left (LL) corner of the computational grid is at grid point
     (IBCOMP, JBCOMP) of the MET. grid.  The upper right (UR) corner of the
     computational grid is at grid point (IECOMP, JECOMP) of the MET. grid.
     The grid spacing of the computational grid is the same as the MET. grid.

        X index of LL corner (IBCOMP)      No default     ! IBCOMP =  1  !
                  (1 <= IBCOMP <= NX)

        Y index of LL corner (JBCOMP)      No default     ! JBCOMP =  1  !
                  (1 <= JBCOMP <= NY)


        X index of UR corner (IECOMP)      No default     ! IECOMP = 263 !
                  (1 <= IECOMP <= NX)

        Y index of UR corner (JECOMP)      No default     ! JECOMP = 206 !
                  (1 <= JECOMP <= NY)


SAMPLING Grid (GRIDDED RECEPTORS):

     The lower left (LL) corner of the sampling grid is at grid point
     (IBSAMP, JBSAMP) of the MET. grid.  The upper right (UR) corner of the
```

```
sampling grid is at grid point (IESAMP, JESAMP) of the MET. grid.
The sampling grid must be identical to or a subset of the computational
grid.  It may be a nested grid inside the computational grid.
The grid spacing of the sampling grid is DGRIDKM/MESHDN.

   Logical flag indicating if gridded
   receptors are used (LSAMP)         Default: T      ! LSAMP = F !
   (T=yes, F=no)

   X index of LL corner (IBSAMP)      No default      ! IBSAMP =  1   !
    (IBCOMP <= IBSAMP <= IECOMP)

   Y index of LL corner (JBSAMP)      No default      ! JBSAMP =  1   !
    (JBCOMP <= JBSAMP <= JECOMP)


   X index of UR corner (IESAMP)      No default      ! IESAMP =  263 !
    (IBCOMP <= IESAMP <= IECOMP)

   Y index of UR corner (JESAMP)      No default      ! JESAMP =  206  !
    (JBCOMP <= JESAMP <= JECOMP)


  Nesting factor of the sampling
   grid (MESHDN)                      Default: 1      ! MESHDN =  1  !
   (MESHDN is an integer >= 1)

!END!

-------------------------------------------------------------------------------

INPUT GROUP: 5 -- Output Options
--------------
                                           *                     *
     FILE                        DEFAULT VALUE          VALUE THIS RUN
     ----                        -------------          --------------

   Concentrations (ICON)               1                !  ICON =  1   !
   Dry Fluxes (IDRY)                   1                !  IDRY =  0   !
   Wet Fluxes (IWET)                   1                !  IWET =  0   !
   Relative Humidity (IVIS)            1                !  IVIS =  0   !
    (relative humidity file is
     required for visibility
     analysis)
   Use data compression option in output file?
   (LCOMPRS)                        Default: T          ! LCOMPRS = T !

   *
    0 = Do not create file, 1 = create file


    DIAGNOSTIC MASS FLUX OUTPUT OPTIONS:

       Mass flux across specified boundaries
       for selected species reported hourly?
       (IMFLX)                       Default: 0          ! IMFLX =  0  !
         0 = no
         1 = yes (FLUXBDY.DAT and MASSFLX.DAT filenames
                  are specified in Input Group 0)

       Mass balance for each species
       reported hourly?
       (IMBAL)                       Default: 0          ! IMBAL =  0  !
         0 = no
         1 = yes (MASSBAL.DAT filename is
              specified in Input Group 0)


    LINE PRINTER OUTPUT OPTIONS:

       Print concentrations (ICPRT)  Default: 0          ! ICPRT =  0   !
       Print dry fluxes (IDPRT)      Default: 0          ! IDPRT =  0   !
       Print wet fluxes (IWPRT)      Default: 0          ! IWPRT =  0   !
```

```
        (0 = Do not print, 1 = Print)

        Concentration print interval
        (ICFRQ) in hours                Default: 1          ! ICFRQ =  24   !
        Dry flux print interval
        (IDFRQ) in hours                Default: 1          ! IDFRQ =  1    !
        Wet flux print interval
        (IWFRQ) in hours                Default: 1          ! IWFRQ =  1    !

        Units for Line Printer Output
        (IPRTU)                         Default: 1          ! IPRTU =  3    !
                         for            for
                    Concentration    Deposition
            1 =        g/m**3         g/m**2/s
            2 =       mg/m**3        mg/m**2/s
            3 =       ug/m**3        ug/m**2/s
            4 =       ng/m**3        ng/m**2/s
            5 =      Odour Units

        Messages tracking progress of run
        written to the screen ?
        (IMESG)                         Default: 2          ! IMESG =  2    !
          0 = no
          1 = yes (advection step, puff ID)
          2 = yes (YYYYJJJHH, # old puffs, # emitted puffs)


      SPECIES (or GROUP for combined species) LIST FOR OUTPUT OPTIONS

                    ---- CONCENTRATIONS ----   ------ DRY FLUXES ------   ------ WET FLUXES ------   --
MASS FLUX --
   SPECIES
   /GROUP           PRINTED?  SAVED ON DISK?   PRINTED?  SAVED ON DISK?   PRINTED?  SAVED ON DISK?   SAVED
ON DISK?
   -------          ------------------------   ------------------------   ------------------------   ------
---------
!          SO2 =       0,            1,            0,            1,            0,            1,          0   !
!          SO4 =       0,            1,            0,            1,            0,            1,          0   !
!          NOX =       0,            1,            0,            1,            0,            1,          0   !
!         HNO3 =       0,            1,            0,            1,            0,            1,          0   !
!          NO3 =       0,            1,            0,            1,            0,            1,          0   !
!         PM10 =       0,            1,            0,            1,            0,            1,          0   !

      OPTIONS FOR PRINTING "DEBUG" QUANTITIES (much output)

        Logical for debug output
        (LDEBUG)                                 Default: F     ! LDEBUG = F !

        First puff to track
        (IPFDEB)                                 Default: 1     ! IPFDEB =  1  !

        Number of puffs to track
        (NPFDEB)                                 Default: 1     ! NPFDEB =  1  !

        Met. period to start output
        (NN1)                                    Default: 1     ! NN1 =  1   !

        Met. period to end output
        (NN2)                                    Default: 10    ! NN2 =  10  !

!END!


-------------------------------------------------------------------------------


INPUT GROUP: 6a, 6b, & 6c -- Subgrid scale complex terrain inputs
-------------------------


---------------
Subgroup (6a)
---------------
        Number of terrain features (NHILL)       Default: 0     ! NHILL =  0   !

        Number of special complex terrain
```

```
        receptors  (NCTREC)                        Default: 0      ! NCTREC =  0   !

        Terrain and CTSG Receptor data for
        CTSG hills input in CTDM format ?
        (MHILL)                                    No Default      ! MHILL =  2   !
        1 = Hill and Receptor data created
            by CTDM processors & read from
            HILL.DAT and HILLRCT.DAT files
        2 = Hill data created by OPTHILL &
            input below in Subgroup (6b);
            Receptor data in Subgroup (6c)

        Factor to convert horizontal dimensions  Default: 1.0    ! XHILL2M = 1. !
        to meters (MHILL=1)

        Factor to convert vertical dimensions    Default: 1.0    ! ZHILL2M = 1. !
        to meters (MHILL=1)

        X-origin of CTDM system relative to      No Default      ! XCTDMKM = 0.0E00 !
        CALPUFF coordinate system, in Kilometers (MHILL=1)

        Y-origin of CTDM system relative to      No Default      ! YCTDMKM = 0.0E00 !
        CALPUFF coordinate system, in Kilometers (MHILL=1)

! END !

---------------
Subgroup (6b)
---------------

                          1 **
     HILL information


HILL          XC        YC       THETAH  ZGRID  RELIEF    EXPO 1    EXPO 2   SCALE 1    SCALE 2
AMAX1     AMAX2
 NO.          (km)      (km)     (deg.)   (m)     (m)      (m)       (m)       (m)        (m)       (m)
(m)
----          ----      ----     ------  -----  ------    ------    ------   -------    -------    ----
-     -----

---------------
Subgroup (6c)
---------------

    COMPLEX TERRAIN RECEPTOR INFORMATION

                         XRCT         YRCT        ZRCT          XHH
                         (km)         (km)         (m)
                        ------       -----       ------         ----


-------------------
1
     Description of Complex Terrain Variables:
          XC, YC  = Coordinates of center of hill
          THETAH  = Orientation of major axis of hill (clockwise from
                    North)
          ZGRID   = Height of the  0  of the grid above mean sea
                    level
          RELIEF  = Height of the crest of the hill above the grid elevation
          EXPO 1  = Hill-shape exponent for the major axis
          EXPO 2  = Hill-shape exponent for the major axis
          SCALE 1 = Horizontal length scale along the major axis
          SCALE 2 = Horizontal length scale along the minor axis
          AMAX    = Maximum allowed axis length for the major axis
          BMAX    = Maximum allowed axis length for the major axis

          XRCT, YRCT = Coordinates of the complex terrain receptors
          ZRCT    = Height of the ground (MSL) at the complex terrain
                    Receptor
          XHH     = Hill number associated with each complex terrain receptor
                    (NOTE: MUST BE ENTERED AS A REAL NUMBER)

   **
```

```
     NOTE: DATA for each hill and CTSG receptor are treated as a separate
           input subgroup and therefore must end with an input group terminator.

-------------------------------------------------------------------------------


INPUT GROUP: 7 -- Chemical parameters for dry deposition of gases
--------------

      SPECIES     DIFFUSIVITY      ALPHA STAR      REACTIVITY    MESOPHYLL RESISTANCE     HENRY'S LAW
COEFFICIENT
        NAME        (cm**2/s)                                           (s/cm)
(dimensionless)
      -------     -----------      ----------      ----------    --------------------     --------------
---------


!         SO2 =     0.1509,          1000,              8,                0,                 0.04 !
!         NOX =     0.1656,             1,              8,                5,                  3.5 !
!        HNO3 =     0.1628,             1,             18,                0,           0.00000008 !

!END!


-------------------------------------------------------------------------------


INPUT GROUP: 8 -- Size parameters for dry deposition of particles
--------------

     For SINGLE SPECIES, the mean and standard deviation are used to
     compute a deposition velocity for NINT (see group 9) size-ranges,
     and these are then averaged to obtain a mean deposition velocity.

     For GROUPED SPECIES, the size distribution should be explicitly
     specified (by the 'species' in the group), and the standard deviation
     for each should be entered as 0.  The model will then use the
     deposition velocity for the stated mean diameter.

      SPECIES     GEOMETRIC MASS MEAN        GEOMETRIC STANDARD
       NAME            DIAMETER                   DEVIATION
                       (microns)                  (microns)
      -------     -------------------        ------------------
!         SO4 =         0.48,                      2.    !
!         NO3 =         0.48,                      2.    !
!      PM0063 =         0.63,                      0.    !
!      PM0100 =         1.00,                      0.    !
!      PM0125 =         1.25,                      0.    !
!      PM0250 =         2.50,                      0.    !
!      PM0600 =         6.00,                      0.    !
!      PM1000 =        10.00,                      0.    !

!END!


-------------------------------------------------------------------------------


INPUT GROUP: 9 -- Miscellaneous dry deposition parameters
--------------

     Reference cuticle resistance (s/cm)
     (RCUTR)                           Default: 30      !  RCUTR = 30.0 !
     Reference ground resistance  (s/cm)
     (RGR)                             Default: 10      !    RGR = 10.0 !
     Reference pollutant reactivity
     (REACTR)                          Default: 8       ! REACTR = 8.0 !

     Number of particle-size intervals used to
     evaluate effective particle deposition velocity
     (NINT)                            Default: 9       !   NINT =  9   !

     Vegetation state in unirrigated areas
     (IVEG)                            Default: 1       !   IVEG =  1   !
        IVEG=1 for active and unstressed vegetation
        IVEG=2 for active and stressed vegetation
```

```
        IVEG=3 for inactive vegetation

!END!

-------------------------------------------------------------------------------


INPUT GROUP: 10 -- Wet Deposition Parameters
---------------


                      Scavenging Coefficient -- Units: (sec)**(-1)

       Pollutant      Liquid Precip.       Frozen Precip.
       ---------      --------------       --------------
!          SO2 =         3.0E-05,             0.0E00 !
!          SO4 =         1.0E-04,            3.0E-05 !
!         HNO3 =         6.0E-05,             0.0E00 !
!          NO3 =         1.0E-04,            3.0E-05 !
!       PM0063 =         1.0E-04,            3.0E-05 !
!       PM0100 =         1.0E-04,            3.0E-05 !
!       PM0125 =         1.0E-04,            3.0E-05 !
!       PM0250 =         1.0E-04,            3.0E-05 !
!       PM0600 =         1.0E-04,            3.0E-05 !
!       PM1000 =         1.0E-04,            3.0E-05 !

!END!


-------------------------------------------------------------------------------


INPUT GROUP: 11 -- Chemistry Parameters
---------------

     Ozone data input option (MOZ)     Default: 1            ! MOZ =  1   !
     (Used only if MCHEM = 1, 3, or 4)
        0 = use a monthly background ozone value
        1 = read hourly ozone concentrations from
            the OZONE.DAT data file

     Monthly ozone concentrations
     (Used only if MCHEM = 1, 3, or 4 and
      MOZ = 0 or MOZ = 1 and all hourly O3 data missing)
     (BCKO3) in ppb                    Default: 12*80.
     !  BCKO3 = 12*50. !

     Monthly ammonia concentrations
     (Used only if MCHEM = 1, or 3)
     (BCKNH3) in ppb                   Default: 12*10.
     !  BCKNH3 = 12*0.5 !

     Nighttime SO2 loss rate (RNITE1)
     in percent/hour                   Default: 0.2          ! RNITE1 = .2 !

     Nighttime NOx loss rate (RNITE2)
     in percent/hour                   Default: 2.0          ! RNITE2 = 2.0 !

     Nighttime HNO3 formation rate (RNITE3)
     in percent/hour                   Default: 2.0          ! RNITE3 = 2.0 !

     H2O2 data input option (MH2O2)    Default: 1            ! MH2O2 =  1   !
     (Used only if MAQCHEM = 1)
        0 = use a monthly background H2O2 value
        1 = read hourly H2O2 concentrations from
            the H2O2.DAT data file

     Monthly H2O2 concentrations
     (Used only if MQACHEM = 1 and
      MH2O2 = 0 or MH2O2 = 1 and all hourly H2O2 data missing)
     (BCKH2O2) in ppb                  Default: 12*1.
     !  BCKH2O2 = 12*1 !
```

```
--- Data for SECONDARY ORGANIC AEROSOL (SOA) Option
    (used only if MCHEM = 4)

    The SOA module uses monthly values of:
         Fine particulate concentration in ug/m^3 (BCKPMF)
         Organic fraction of fine particulate     (OFRAC)
         VOC / NOX ratio (after reaction)         (VCNX)
    to characterize the air mass when computing
    the formation of SOA from VOC emissions.
    Typical values for several distinct air mass types are:

       Month    1    2    3    4    5    6    7    8    9   10   11   12
               Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec

    Clean Continental
       BCKPMF   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.
       OFRAC  .15  .15  .20  .20  .20  .20  .20  .20  .20  .20  .20  .15
       VCNX    50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.

    Clean Marine (surface)
       BCKPMF  .5   .5   .5   .5   .5   .5   .5   .5   .5   .5   .5   .5
       OFRAC  .25  .25  .30  .30  .30  .30  .30  .30  .30  .30  .30  .25
       VCNX    50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.

    Urban - low biogenic (controls present)
       BCKPMF 30.  30.  30.  30.  30.  30.  30.  30.  30.  30.  30.  30.
       OFRAC  .20  .20  .25  .25  .25  .25  .25  .25  .20  .20  .20  .20
       VCNX     4.   4.   4.   4.   4.   4.   4.   4.   4.   4.   4.   4.

    Urban - high biogenic (controls present)
       BCKPMF 60.  60.  60.  60.  60.  60.  60.  60.  60.  60.  60.  60.
       OFRAC  .25  .25  .30  .30  .30  .55  .55  .55  .35  .35  .35  .25
       VCNX    15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.

    Regional Plume
       BCKPMF 20.  20.  20.  20.  20.  20.  20.  20.  20.  20.  20.  20.
       OFRAC  .20  .20  .25  .35  .25  .40  .40  .40  .30  .30  .30  .20
       VCNX    15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.

    Urban - no controls present
       BCKPMF 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
       OFRAC  .30  .30  .35  .35  .35  .55  .55  .55  .35  .35  .35  .30
       VCNX     2.   2.   2.   2.   2.   2.   2.   2.   2.   2.   2.   2.

    Default: Clean Continental
    ! BCKPMF = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00 !
    ! OFRAC  = 0.15, 0.15, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.15 !
    ! VCNX   = 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00 !

!END!

-------------------------------------------------------------------------------

INPUT GROUP: 12 -- Misc. Dispersion and Computational Parameters
---------------

    Horizontal size of puff (m) beyond which
    time-dependent dispersion equations (Heffter)
    are used to determine sigma-y and
    sigma-z (SYTDEP)                           Default: 550.   ! SYTDEP = 5.5E02 !

    Switch for using Heffter equation for sigma z
    as above (0 = Not use Heffter; 1 = use Heffter
    (MHFTSZ)                                   Default: 0      ! MHFTSZ =  0   !

    Stability class used to determine plume
    growth rates for puffs above the boundary
    layer (JSUP)                               Default: 5      ! JSUP =  5   !

    Vertical dispersion constant for stable
    conditions (k1 in Eqn. 2.7-3)  (CONK1)     Default: 0.01   ! CONK1 = .01 !
```

```
Vertical dispersion constant for neutral/
unstable conditions (k2 in Eqn. 2.7-4)
(CONK2)                                    Default: 0.1     ! CONK2 = .1 !

Factor for determining Transition-point from
Schulman-Scire to Huber-Snyder Building Downwash
scheme (SS used for Hs < Hb + TBD * HL)
(TBD)                                      Default: 0.5     ! TBD = .5 !
   TBD < 0    ==> always use Huber-Snyder
   TBD = 1.5 ==> always use Schulman-Scire
   TBD = 0.5 ==> ISC Transition-point

Range of land use categories for which
urban dispersion is assumed
(IURB1, IURB2)                             Default: 10      ! IURB1 =  10  !
                                                    19      ! IURB2 =  19  !

Site characterization parameters for single-point Met data files ---------
(needed for METFM = 2,3,4)

   Land use category for modeling domain
   (ILANDUIN)                              Default: 20      ! ILANDUIN =  20  !

   Roughness length (m) for modeling domain
   (Z0IN)                                  Default: 0.25    ! Z0IN = .25 !

   Leaf area index for modeling domain
   (XLAIIN)                                Default: 3.0     ! XLAIIN = 3.0 !

   Elevation above sea level (m)
   (ELEVIN)                                Default: 0.0     ! ELEVIN = .0 !

   Latitude (degrees) for met location
   (XLATIN)                                Default: -999.   ! XLATIN = -999.0 !

   Longitude (degrees) for met location
   (XLONIN)                                Default: -999.   ! XLONIN = -999.0 !

Specialized information for interpreting single-point Met data files -----

   Anemometer height (m) (Used only if METFM = 2,3)
   (ANEMHT)                                Default: 10.     ! ANEMHT = 10.0 !

   Form of lateral turbulance data in PROFILE.DAT file
   (Used only if METFM = 4 or MTURBVW = 1 or 3)
   (ISIGMAV)                               Default: 1       ! ISIGMAV =  1  !
       0 = read sigma-theta
       1 = read sigma-v

   Choice of mixing heights (Used only if METFM = 4)
   (IMIXCTDM)                              Default: 0       ! IMIXCTDM =  0  !
       0 = read PREDICTED mixing heights
       1 = read OBSERVED mixing heights

Maximum length of a slug (met. grid units)
(XMXLEN)                                   Default: 1.0     ! XMXLEN = 1.0 !

Maximum travel distance of a puff/slug (in
grid units) during one sampling step
(XSAMLEN)                                  Default: 1.0     ! XSAMLEN = 1.0 !

Maximum Number of slugs/puffs release from
one source during one time step
(MXNEW)                                    Default: 99      ! MXNEW =  99   !

Maximum Number of sampling steps for
one puff/slug during one time step
(MXSAM)                                    Default: 99      ! MXSAM =  99   !

Number of iterations used when computing
the transport wind for a sampling step
that includes gradual rise (for CALMET
and PROFILE winds)
(NCOUNT)                                   Default: 2       ! NCOUNT =  2   !
```

```
Minimum sigma y for a new puff/slug (m)
(SYMIN)                                    Default: 1.0     ! SYMIN = 1.0   !

Minimum sigma z for a new puff/slug (m)
(SZMIN)                                    Default: 1.0     ! SZMIN = 1.0   !

Default minimum turbulence velocities sigma-v and sigma-w
for each stability class over land and over water (m/s)
(SVMIN(12) and SWMIN(12))

                 ----------  LAND  ----------         ---------  WATER  ----------
   Stab Class :  A    B    C    D    E    F           A    B    C    D    E    F
                ---  ---  ---  ---  ---  ---         ---  ---  ---  ---  ---  ---
Default SVMIN : .50, .50, .50, .50, .50, .50,        .37, .37, .37, .37, .37, .37
Default SWMIN : .20, .12, .08, .06, .03, .016,       .20, .12, .08, .06, .03, .016

      ! SVMIN = 0.500, 0.500, 0.500, 0.500, 0.500, 0.500, 0.370, 0.370, 0.370, 0.370, 0.370, 0.370!
      ! SWMIN = 0.200, 0.120, 0.080, 0.060, 0.030, 0.016, 0.200, 0.120, 0.080, 0.060, 0.030, 0.016!

Divergence criterion for dw/dz across puff
used to initiate adjustment for horizontal
convergence (1/s)
Partial adjustment starts at CDIV(1), and
full adjustment is reached at CDIV(2)
(CDIV(2))                                  Default: 0.0,0.0  ! CDIV = .0, .0 !

Minimum wind speed (m/s) allowed for
non-calm conditions. Also used as minimum
speed returned when using power-law
extrapolation toward surface
(WSCALM)                                   Default: 0.5     ! WSCALM = .5 !

Maximum mixing height (m)
(XMAXZI)                                   Default: 3000.   ! XMAXZI = 3000.0 !

Minimum mixing height (m)
(XMINZI)                                   Default: 50.     ! XMINZI = 50.0 !

Default wind speed classes --
5 upper bounds (m/s) are entered;
the 6th class has no upper limit
(WSCAT(5))                        Default    :
                                  ISC RURAL : 1.54, 3.09, 5.14, 8.23, 10.8 (10.8+)

                       Wind Speed Class :  1     2     3     4     5
                                          ---   ---   ---   ---   ---
                             ! WSCAT = 1.54, 3.09, 5.14, 8.23, 10.80 !

Default wind speed profile power-law
exponents for stabilities 1-6
(PLX0(6))                         Default    : ISC RURAL values
                                  ISC RURAL : .07, .07, .10, .15, .35, .55
                                  ISC URBAN : .15, .15, .20, .25, .30, .30

                        Stability Class :  A     B     C     D     E     F
                                          ---   ---   ---   ---   ---   ---
                              ! PLX0 = 0.07, 0.07, 0.10, 0.15, 0.35, 0.55 !

Default potential temperature gradient
for stable classes E, F (degK/m)
(PTG0(2))                         Default: 0.020, 0.035
                              ! PTG0 = 0.020,   0.035 !

Default plume path coefficients for
each stability class (used when option
for partial plume height terrain adjustment
is selected -- MCTADJ=3)
(PPC(6))                Stability Class :  A     B     C     D     E     F
                            Default  PPC : .50,  .50,  .50,  .50,  .35,  .35
                                          ---   ---   ---   ---   ---   ---
                              !  PPC = 0.50, 0.50, 0.50, 0.50, 0.35, 0.35 !

Slug-to-puff transition criterion factor
equal to sigma-y/length of slug
(SL2PF)                              Default: 10.       ! SL2PF = 10.0 !
```

```
Puff-splitting control variables ------------------------

  VERTICAL SPLIT
  --------------

  Number of puffs that result every time a puff
  is split - nsplit=2 means that 1 puff splits
  into 2
  (NSPLIT)                           Default:   3        ! NSPLIT =  3  !

  Time(s) of a day when split puffs are eligible to
  be split once again; this is typically set once
  per day, around sunset before nocturnal shear develops.
  24 values: 0 is midnight (00:00) and 23 is 11 PM (23:00)
  0=do not re-split    1=eligible for re-split
  (IRESPLIT(24))                     Default:  Hour 17 = 1
  !  IRESPLIT = 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0 !

  Split is allowed only if last hour's mixing
  height (m) exceeds a minimum value
  (ZISPLIT)                          Default: 100.       ! ZISPLIT = 100.0 !

  Split is allowed only if ratio of last hour's
  mixing ht to the maximum mixing ht experienced
  by the puff is less than a maximum value (this
  postpones a split until a nocturnal layer develops)
  (ROLDMAX)                          Default: 0.25       ! ROLDMAX = 0.25 !


  HORIZONTAL SPLIT
  ----------------

  Number of puffs that result every time a puff
  is split - nsplith=5 means that 1 puff splits
  into 5
  (NSPLITH)                          Default:   5        ! NSPLITH =  5  !

  Minimum sigma-y (Grid Cells Units) of puff
  before it may be split
  (SYSPLITH)                         Default:  1.0       ! SYSPLITH = 1.0 !

  Minimum puff elongation rate (SYSPLITH/hr) due to
  wind shear, before it may be split
  (SHSPLITH)                         Default:  2.        ! SHSPLITH = 2.0 !

  Minimum concentration (g/m^3) of each
  species in puff before it may be split
  Enter array of NSPEC values; if a single value is
  entered, it will be used for ALL species
  (CNSPLITH)                         Default:  1.0E-07   ! CNSPLITH = 1.0E-07 !

Integration control variables ------------------------

  Fractional convergence criterion for numerical SLUG
  sampling integration
  (EPSSLUG)                          Default:   1.0e-04  ! EPSSLUG = 1.0E-04 !

  Fractional convergence criterion for numerical AREA
  source integration
  (EPSAREA)                          Default:   1.0e-06  ! EPSAREA = 1.0E-06 !

  Trajectory step-length (m) used for numerical rise
  integration
  (DSRISE)                           Default:   1.0      ! DSRISE = 1.0 !

!END!


--------------------------------------------------------------------------------


INPUT GROUPS: 13a, 13b, 13c, 13d -- Point source parameters
--------------------------------
```

```
---------------
Subgroup (13a)
---------------

     Number of point sources with
     parameters provided below      (NPT1)  No default  !  NPT1 =  1 !

     Units used for point source
     emissions below                (IPTU)  Default: 1  !  IPTU =   3  !
           1 =        g/s
           2 =       kg/hr
           3 =       lb/hr
           4 =     tons/yr
           5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
           6 =     Odour Unit * m**3/min
           7 =     metric tons/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (13d)        (NSPT1) Default: 0  !  NSPT1 = 0  !

     Number of point sources with
     variable emission parameters
     provided in external file      (NPT2)  No default  !  NPT2 =  0  !

     (If NPT2 > 0, these point
     source emissions are read from
     the file: PTEMARB.DAT)

!END!

---------------
Subgroup (13b)
---------------
                                    a
          POINT SOURCE: CONSTANT DATA
          -----------------------------
                                                                       b          c
  Source       X          Y        Stack     Base     Stack    Exit  Exit     Bldg.  Emission
   No.     Coordinate Coordinate Height Elevation Diameter  Vel.  Temp.    Dwash   Rates
              (km)       (km)      (m)      (m)       (m)    (m/s) (deg. K)
  ------   ---------- ---------- ------  ------   -------- ----- -------- ----- --------
****************   EMISSION RATES ARE IN LB/HR    ****************SO2****SO4***NOX****HNO3**NO3**PM10

Project-Specific Source Input
--------

    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.

     SRCNAM  is a 12-character name for a source
             (No default)
     X       is an array holding the source data listed by the column headings
             (No default)
     SIGYZI  is an array holding the initial sigma-y and sigma-z (m)
             (Default: 0.,0.)
     FMFAC   is a vertical momentum flux factor (0. or 1.0) used to represent
             the effect of rain-caps or other physical configurations that
             reduce momentum rise associated with the actual exit velocity.
             (Default: 1.0  -- full momentum used)

    b
     0. = No building downwash modeled, 1. = downwash modeled
     NOTE: must be entered as a REAL number (i.e., with decimal point)

    c
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by IPTU
     (e.g. 1 for g/s).

---------------
Subgroup (13c)
```

BUILDING DIMENSION DATA FOR SOURCES SUBJECT TO DOWNWASH

```
Source                                                                        a
 No.       Effective building width and height (in meters) every 10 degrees
------     ----------------------------------------------------------------
      1  ! SRCNAM = BLR2        !
      1  !  HEIGHT =  11.28,  11.28,  11.28,  11.28,  11.28,  11.28,
                11.28,  11.28,  11.28,   7.93,   7.93,   7.93,
                 7.93,   7.93,   7.93,  11.28,  11.28,  11.28,
                11.28,  11.28,  11.28,  11.28,  11.28,  11.28,
                11.28,  11.28,  11.28,   7.93,   7.93,   7.93,
                 7.93,   7.93,   7.93,  11.28,  11.28,  11.28 !
      1  !  WIDTH =   45.44,  44.94,  43.07,  42.54,  44.67,  45.45,
                44.85,  42.89,  39.62,  26.50,  21.73,  16.30,
                13.98,  19.63,  24.68,  38.82,  42.34,  44.57,
                45.44,  44.94,  43.07,  42.54,  44.67,  45.45,
                44.85,  42.89,  39.62,  26.50,  21.73,  16.30,
                13.98,  19.63,  24.68,  38.82,  42.34,  44.57 !
      1  !  LENGTH =  35.15,  29.61,  23.18,  21.80,  28.39,  34.13,
                38.82,  42.34,  44.57,  36.22,  36.50,  35.67,
                35.03,  36.30,  36.47,  44.85,  42.89,  39.62,
                35.15,  29.61,  23.18,  21.80,  28.39,  34.13,
                38.82,  42.34,  44.57,  36.22,  36.50,  35.67,
                35.03,  36.30,  36.47,  44.85,  42.89,  39.62 !
      1  !  XBADJ =  -42.73, -41.87, -39.73, -39.27, -41.93, -43.32,
               -43.39, -42.14, -39.62, -19.16, -19.34, -18.93,
               -18.59, -19.17, -19.16,  -7.22,  -2.31,   2.68,
                 7.58,  12.25,  16.55,  17.47,  13.54,   9.19,
                 4.57,  -0.19,  -4.95, -17.06, -17.16, -16.74,
               -16.44, -17.13, -17.30, -37.63, -40.58, -42.30 !
      1  !  YBADJ =   13.16,   8.60,   3.77,  -1.18,  -6.08, -10.81,
               -15.20, -19.14, -22.49,   0.34,   0.15,  -0.04,
                -0.23,  -0.41,  -0.58, -23.98, -20.97, -17.33,
               -13.16,  -8.60,  -3.77,   1.18,   6.08,  10.81,
                15.20,  19.14,  22.49,  -0.34,  -0.15,   0.04,
                 0.23,   0.41,   0.58,  23.98,  20.97,  17.33 !
```

!END!

----

a Each pair of width and height values is treated as a separate input subgroup and therefore must end with an input group terminator.

Subgroup (13d)

POINT SOURCE: VARIABLE EMISSIONS DATA [a]

Use this subgroup to describe temporal variations in the emission rates given in 13b. Factors entered multiply the rates in 13b. Skip sources here that have constant emissions. For more elaborate variation in source parameters, use PTEMARB.DAT and NPT2 > 0.

```
IVARY determines the type of variation, and is source-specific:
(IVARY)                                 Default: 0
      0 =       Constant
      1 =       Diurnal cycle (24 scaling factors: hours 1-24)
      2 =       Monthly cycle (12 scaling factors: months 1-12)
      3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                               where first group is DEC-JAN-FEB)
      4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                               first group is Stability Class A,
                               and the speed classes have upper
                               bounds (m/s) defined in Group 12
      5 =       Temperature   (12 scaling factors, where temperature
                               classes have upper bounds (C) of:
                               0, 5, 10, 15, 20, 25, 30, 35, 40,
                               45, 50, 50+)
```

----
a
Data for each species are treated as a separate input subgroup and therefore must end with an input group terminator.

INPUT GROUPS: 14a, 14b, 14c, 14d -- Area source parameters

```
--------------------------------
```

```
---------------
Subgroup (14a)
---------------

     Number of polygon area sources with
     parameters specified below (NAR1)       No default  !  NAR1 =  0   !

     Units used for area source
     emissions below            (IARU)       Default: 1  !  IARU =   1  !
           1 =        g/m**2/s
           2 =       kg/m**2/hr
           3 =       lb/m**2/hr
           4 =     tons/m**2/yr
           5 =     Odour Unit * m/s  (vol. flux/m**2 of odour compound)
           6 =     Odour Unit * m/min
           7 =     metric tons/m**2/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (14d)        (NSAR1) Default: 0  !  NSAR1 =  0  !

     Number of buoyant polygon area sources
     with variable location and emission
     parameters (NAR2)                      No default  !  NAR2 =  0   !
     (If NAR2 > 0, ALL parameter data for
     these sources are read from the file: BAEMARB.DAT)

!END!

---------------
Subgroup (14b)
---------------
                                                a
          AREA SOURCE: CONSTANT DATA
          ----------------------------
                                                                 b
Source           Effect.   Base      Initial    Emission
 No.             Height  Elevation   Sigma z     Rates
                   (m)      (m)        (m)
-------          ------   ------    --------   ---------

--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.
    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by IARU
     (e.g. 1 for g/m**2/s).

---------------
Subgroup (14c)
---------------

           COORDINATES (UTM-km) FOR EACH VERTEX(4) OF EACH POLYGON
           --------------------------------------------------------
Source                                                                 a
```

```
 No.       Ordered list of X followed by list of Y, grouped by source
------     ----------------------------------------------------------


--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.


---------------
Subgroup (14d)
---------------
                                                  a
          AREA SOURCE: VARIABLE EMISSIONS DATA
          ---------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 14b.  Factors entered multiply the rates in 14b.
     Skip sources here that have constant emissions.  For more elaborate
     variation in source parameters, use BAEMARB.DAT and NAR2 > 0.

     IVARY determines the type of variation, and is source-specific:
     (IVARY)                                Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                    where first group is DEC-JAN-FEB)
           4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12
           5 =       Temperature   (12 scaling factors, where temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
                                    45, 50, 50+)


--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.


-------------------------------------------------------------------------------

INPUT GROUPS: 15a, 15b, 15c -- Line source parameters
---------------------------

---------------
Subgroup (15a)
---------------

     Number of buoyant line sources
     with variable location and emission
     parameters (NLN2)                           No default  !  NLN2 =  0   !

     (If NLN2 > 0, ALL parameter data for
      these sources are read from the file: LNEMARB.DAT)

     Number of buoyant line sources (NLINES)     No default   ! NLINES =  0  !

     Units used for line source
     emissions below              (ILNU)         Default: 1  !  ILNU =   1  !
           1 =        g/s
           2 =       kg/hr
           3 =       lb/hr
           4 =     tons/yr
           5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
           6 =     Odour Unit * m**3/min
           7 =     metric tons/yr

     Number of source-species
```

```
combinations with variable
emissions scaling factors
provided below in (15c)        (NSLN1) Default: 0   !  NSLN1 =   0   !

Maximum number of segments used to model
each line (MXNSEG)                            Default: 7    ! MXNSEG =   7   !

The following variables are required only if NLINES > 0.  They are
used in the buoyant line source plume rise calculations.

   Number of distances at which               Default: 6    ! NLRISE =   6   !
   transitional rise is computed

   Average building length (XL)               No default    ! XL = .0 !
                                              (in meters)

   Average building height (HBL)              No default    ! HBL = .0 !
                                              (in meters)

   Average building width (WBL)               No default    ! WBL = .0 !
                                              (in meters)

   Average line source width (WML)            No default    ! WML = .0 !
                                              (in meters)

   Average separation between buildings (DXL) No default    ! DXL = .0 !
                                              (in meters)

   Average buoyancy parameter (FPRIMEL)       No default    ! FPRIMEL = .0 !
                                              (in m**4/s**3)

!END!

---------------
Subgroup (15b)
---------------

         BUOYANT LINE SOURCE: CONSTANT DATA
         ----------------------------------
                                                                                      a
Source      Beg. X       Beg. Y       End. X     End. Y     Release    Base          Emission
 No.     Coordinate   Coordinate   Coordinate Coordinate   Height   Elevation         Rates
            (km)         (km)         (km)       (km)        (m)       (m)
------   ----------   ----------   ---------  ----------   -------  ---------     ---------

--------

    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.

    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by ILNTU
     (e.g. 1 for g/s).

---------------
Subgroup (15c)
---------------
                                                       a
         BUOYANT LINE SOURCE: VARIABLE EMISSIONS DATA
         ----------------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 15b.  Factors entered multiply the rates in 15b.
     Skip sources here that have constant emissions.

     IVARY determines the type of variation, and is source-specific:
     (IVARY)                                Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                    where first group is DEC-JAN-FEB)
```

```
          4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                   first group is Stability Class A,
                                   and the speed classes have upper
                                   bounds (m/s) defined in Group 12
          5 =       Temperature   (12 scaling factors, where temperature
                                   classes have upper bounds (C) of:
                                   0, 5, 10, 15, 20, 25, 30, 35, 40,
                                   45, 50, 50+)


--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.

-------------------------------------------------------------------------------


INPUT GROUPS: 16a, 16b, 16c -- Volume source parameters
---------------------------

---------------
Subgroup (16a)
---------------

     Number of volume sources with
     parameters provided in 16b,c (NVL1)     No default  !  NVL1 =  0   !

     Units used for volume source
     emissions below in 16b       (IVLU)     Default: 1  !  IVLU =   1  !
           1 =        g/s
           2 =       kg/hr
           3 =       lb/hr
           4 =     tons/yr
           5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
           6 =     Odour Unit * m**3/min
           7 =     metric tons/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (16c)      (NSVL1)    Default: 0  !  NSVL1 =  0  !

     Number of volume sources with
     variable location and emission
     parameters                   (NVL2)     No default  !  NVL2 =   0   !

     (If NVL2 > 0, ALL parameter data for
      these sources are read from the VOLEMARB.DAT file(s) )

!END!

---------------
Subgroup (16b)
---------------
                                              a
           VOLUME SOURCE: CONSTANT DATA
           ----------------------------
                                                                            b
        X UTM      Y UTM      Effect.   Base      Initial    Initial    Emission
     Coordinate Coordinate  Height   Elevation  Sigma y    Sigma z     Rates
        (km)       (km)       (m)       (m)        (m)        (m)
     ---------- ----------  ------    ------    --------   --------   --------


--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.

    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
```

modeled, but not emitted. Units are specified by IVLU
(e.g. 1 for g/s).

Subgroup (16c)

VOLUME SOURCE: VARIABLE EMISSIONS DATA [a]

Use this subgroup to describe temporal variations in the emission rates given in 16b. Factors entered multiply the rates in 16b. Skip sources here that have constant emissions. For more elaborate variation in source parameters, use VOLEMARB.DAT and NVL2 > 0.

IVARY determines the type of variation, and is source-specific:
(IVARY)   Default: 0

```
     0 =     Constant
     1 =     Diurnal cycle (24 scaling factors: hours 1-24)
     2 =     Monthly cycle (12 scaling factors: months 1-12)
     3 =     Hour & Season (4 groups of 24 hourly scaling factors,
                            where first group is DEC-JAN-FEB)
     4 =     Speed & Stab. (6 groups of 6 scaling factors, where
                            first group is Stability Class A,
                            and the speed classes have upper
                            bounds (m/s) defined in Group 12
     5 =     Temperature   (12 scaling factors, where temperature
                            classes have upper bounds (C) of:
                            0, 5, 10, 15, 20, 25, 30, 35, 40,
                            45, 50, 50+)
```

----

[a] Data for each species are treated as a separate input subgroup and therefore must end with an input group terminator.

INPUT GROUPS: 17a & 17b -- Non-gridded (discrete) receptor information
----

Subgroup (17a)

Number of non-gridded receptors (NREC)   No default   ! NREC = 744 !

!END!

Subgroup (17b)

NON-GRIDDED (DISCRETE) RECEPTOR DATA [a]

Receptor No.	X Coordinate (km)	Y Coordinate (km)	Ground Elevation (m)	Height Above Ground (m) [b]

RECEPTORS OBTAINED FROM THE NPS/FWS EXTRACTION PROGRAM
ALL RECEPTORS ARE LCC (KM)

PROJECT-SPECIFIC CLASS I AREA RECEPTORS

[a] Data for each receptor are treated as a separate input subgroup and therefore must end with an input group terminator.

[b] Receptor height above ground is optional. If no value is entered, the receptor is placed on the ground.

Department of Environmental Protection

Division of Air Resource Management

APPLICATION FOR AIR PERMIT - LONG FORM

I. APPLICATION INFORMATION

Air Construction Permit – Use this form to apply for an air construction permit at a facility operating under a federally enforceable state air operation permit (FESOP) or Title V air permit. Also use this form to apply for an air construction permit:

- For a proposed project subject to prevention of significant deterioration (PSD) review, nonattainment area (NAA) new source review, or maximum achievable control technology (MACT) review; or
- Where the applicant proposes to assume a restriction on the potential emissions of one or more pollutants to escape a federal program requirement such as PSD review, NAA new source review, Title V, or MACT; or
- Where the applicant proposes to establish, revise, or renew a plantwide applicability limit (PAL).

Air Operation Permit – Use this form to apply for:

- An initial federally enforceable state air operation permit (FESOP); or
- An initial/revised/renewal Title V air operation permit.

Air Construction Permit & Title V Air Operation Permit (Concurrent Processing Option) – Use this form to apply for both an air construction permit and a revised or renewal Title V air operation permit incorporating the proposed project.

To ensure accuracy, please see form instructions.

Identification of Facility

1. Facility Owner/Company Name: City of Tallahassee	
2. Site Name: Sam O. Purdom Generating Station	
3. Facility Identification Number: 1290001	
4. Facility Location...: Street Address or Other Locator: 667 Port Leon Drive City: St. Marks County: Wakulla County Zip Code: 32355	
5. Relocatable Facility? ☐ Yes ☒ No	6. Existing Title V Permitted Facility? ☒ Yes ☐ No

Application Contact

1. Application Contact Name: John K. Powell
2. Application Contact Mailing Address... Organization/Firm: City of Tallahassee, Environmental Resources Street Address: 3rd Floor, 300 South Adams Street City: Tallahassee State: FL Zip Code: 32301
3. Application Contact Telephone Numbers... Telephone: (850) 891-8851 ext. Fax: (850) 891-8277
4. Application Contact Email Address: PowellJ@talgov.com

Application Processing Information (DEP Use)

1. Date of Receipt of Application:	3. PSD Number (if applicable):
2. Project Number(s):	4. Siting Number (if applicable):

Purpose of Application

This application for air permit is submitted to obtain: (Check one)

Air Construction Permit

☒ Air construction permit.

☐ Air construction permit to establish, revise, or renew a plantwide applicability limit (PAL).

☐ Air construction permit to establish, revise, or renew a plantwide applicability limit (PAL), and separate air construction permit to authorize construction or modification of one or more emissions units covered by the PAL.

Air Operation Permit

☐ Initial Title V air operation permit.

☐ Title V air operation permit revision.

☐ Title V air operation permit renewal.

☐ Initial federally enforceable state air operation permit (FESOP) where professional engineer (PE) certification is required.

☐ Initial federally enforceable state air operation permit (FESOP) where professional engineer (PE) certification is not required.

Air Construction Permit and Revised/Renewal Title V Air Operation Permit (Concurrent Processing)

☐ Air construction permit and Title V permit revision, incorporating the proposed project.

☐ Air construction permit and Title V permit renewal, incorporating the proposed project.

Note: By checking one of the above two boxes, you, the applicant, are requesting concurrent processing pursuant to Rule 62-213.405, F.A.C. In such case, you must also check the following box:

☐ I hereby request that the department waive the processing time requirements of the air construction permit to accommodate the processing time frames of the Title V air operation permit.

Application Comment

This application is for the purpose of obtaining a BART determination for the BART-eligible emissions unit at the Purdom Generating Station.

FACILITY INFORMATION

Scope of Application

Emissions Unit ID Number	Description of Emissions Unit	Air Permit Type	Air Permit Proc. Fee
007	Boiler No. 7	AC1F	

Application Processing Fee

Check one: ☐ Attached - Amount: $__________________ ☒ Not Applicable

FACILITY INFORMATION

Owner/Authorized Representative Statement

Complete if applying for an air construction permit or an initial FESOP.

1.	Owner/Authorized Representative Name : **Robert E. McGarrah, Manager Power Production**
2.	Owner/Authorized Representative Mailing Address... Organization/Firm: **City of Tallahassee** Street Address: **2602 Jackson Bluff Road** City: **Tallahassee** State: **FL** Zip Code: **32304**
3.	Owner/Authorized Representative Telephone Numbers... Telephone: **(850) 891-5534** ext. Fax: **(850) 891-5162**
4.	Owner/Authorized Representative Email Address: **McGarraR@talgov.com**
5.	Owner/Authorized Representative Statement: *I, the undersigned, am the owner or authorized representative of the facility addressed in this air permit application. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof and all other requirements identified in this application to which the facility is subject. I understand that a permit, if granted by the department, cannot be transferred without authorization from the department, and I will promptly notify the department upon sale or legal transfer of the facility or any permitted emissions unit.* Signature [signed] 1/31/07 Date

FACILITY INFORMATION

Application Responsible Official Certification

Complete if applying for an initial/revised/renewal Title V permit or concurrent processing of an air construction permit and a revised/renewal Title V permit. If there are multiple responsible officials, the "application responsible official" need not be the "primary responsible official."

1. Application Responsible Official Name:
2. Application Responsible Official Qualification (Check one or more of the following options, as applicable): ☐ For a corporation, the president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or a duly authorized representative of such person if the representative is responsible for the overall operation of one or more manufacturing, production, or operating facilities applying for or subject to a permit under Chapter 62-213, F.A.C. ☐ For a partnership or sole proprietorship, a general partner or the proprietor, respectively. ☐ For a municipality, county, state, federal, or other public agency, either a principal executive officer or ranking elected official. ☐ The designated representative at an Acid Rain source.
3. Application Responsible Official Mailing Address... Organization/Firm: Street Address: City: State: Zip Code:
4. Application Responsible Official Telephone Numbers... Telephone: ( ) - ext. Fax: ( ) -
5. Application Responsible Official Email Address:
6. Application Responsible Official Certification: *I, the undersigned, am a responsible official of the Title V source addressed in this air permit application. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof and all other applicable requirements identified in this application to which the Title V source is subject. I understand that a permit, if granted by the department, cannot be transferred without authorization from the department, and I will promptly notify the department upon sale or legal transfer of the facility or any permitted emissions unit. Finally, I certify that the facility and each emissions unit are in compliance with all applicable requirements to which they are subject, except as identified in compliance plan(s) submitted with this application.* ________________ ____________ Signature Date

FACILITY INFORMATION

Professional Engineer Certification

1.	Professional Engineer Name: **Kennard F. Kosky** Registration Number: **14996**
2.	Professional Engineer Mailing Address... Organization/Firm: **Golder Associates Inc.**** Street Address: **6241 NW 23rd Street, Suite 500** City: **Gainesville** State: **FL** Zip Code: **32653**
3.	Professional Engineer Telephone Numbers... Telephone: **(352) 336-5600** ext.**516** Fax: **(352) 336-6603**
4.	Professional Engineer Email Address: **kkosky@golder.com**
5.	Professional Engineer Statement: *I, the undersigned, hereby certify, except as particularly noted herein*, that:* *(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollution control equipment described in this application for air permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and* *(2) To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.* *(3) If the purpose of this application is to obtain a Title V air operation permit (check here ☐, if so), I further certify that each emissions unit described in this application for air permit, when properly operated and maintained, will comply with the applicable requirements identified in this application to which the unit is subject, except those emissions units for which a compliance plan and schedule is submitted with this application.* *(4) If the purpose of this application is to obtain an air construction permit (check here ☒, if so) or concurrently process and obtain an air construction permit and a Title V air operation permit revision or renewal for one or more proposed new or modified emissions units (check here ☐, if so), I further certify that the engineering features of each such emissions unit described in this application have been designed or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application.* *(5) If the purpose of this application is to obtain an initial air operation permit or operation permit revision or renewal for one or more newly constructed or modified emissions units (check here ☐, if so), I further certify that, with the exception of any changes detailed as part of this application, each such emissions unit has been constructed or modified in substantial accordance with the information given in the corresponding application for air construction permit and with all provisions contained in such permit.* Kennard F. Kosky 1-31-07 Signature Date (seal)

* Attach any exception to certification statement.

** Board of Professional Engineers Certificate of Authorization #00001670