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January 31, 2007

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DIVISION OF AIR
RESOURCES MANAGEMENT

Air Modeling and Data Analysis Section
Division of Air Resource Management
Florida Department of Environmental Protection
2600 Blair Stone Road, MS 5500
Tallahassee, Florida 32399-2400

Attn: Thomas G. Rogers, Administrator

RE: BART DETERMINATION REPORT FOR THE MOSAIC RIVERVIEW FACILITY

Dear Mr. Rogers:

The enclosed report presents the Best Available Retrofit Technology (BART) exemption modeling and the BART determination analyses for the Mosaic Riverview (Facility ID 0570008) facility. This report is being provided to the Florida Department of Environmental Protection (FDEP) to satisfy any remaining requirements under the BART Rule (40 CFR 51, Subpart P) and Rule 62-296.340 of the Florida Administrative Code (F.A.C.) as it pertains to this facility. The source information and methodologies used for the BART exemption and the BART determination modeling analyses for the Riverview facility are presented in the document entitled "Revised Air Modeling Protocol to Evaluate Best Available Retrofit Technology (BART) Options for Affected Mosaic Fertilizer, LLC Facilities", which is provided as Appendix A to this report.

As presented in the report, based on the BART exemption modeling analysis, performed in accordance with the procedures contained in 40 CFR 51, Appendix Y, the Mosaic Riverview facility was found to be not exempt from the requirements for BART determination. As a result, a BART determination analysis was performed as required under Rule 62-296.340(3), F.A.C.

A CD containing the air modeling files used for the BART modeling analyses is included with this report. Should you have any questions, please contact me or Steve at (352) 336-5600.

Sincerely yours,

Sal Mohammad
Project Engineer

Steven R. Marks, CCM
Associate; Manager, Air Modeling

SKM/all

Cc: Jeff Stewart, Mosaic
Dave Turley, Mosaic

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BART DETERMINATION ANALYSIS
FOR
MOSAIC FERTILIZER, LLC
RIVERVIEW FACILITY

Prepared For:
Mosaic Fertilizer, LLC
P.O. Box 2000
Mulberry, Florida 33860

Prepared By:
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January 2007
0637643

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LIST OF ACRONYMS AND ABBREVIATIONS

AAQS	Ambient Air Quality Standards
AOR	annual operating report
APH	air preheater
BACT	Best Available Control Technology
Btu/gal	British thermal units per gallon
Btu/lb	British thermal units per pound
CAA	Clean Air Act
CFR	Code of Federal Regulations
CO	carbon monoxide
DNCG	dilute non-condensable gas
EPA	U.S. Environmental Protection Agency
ESP	electrostatic precipitator
F	fluoride
°F	degrees Fahrenheit
ft/s	feet per second
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FGR	flue gas recirculation
FR	fuel reburning
gal/hr	gallons per hour
gal/yr	gallons per year
GEP	Good Engineering Practice
H_2O	water
HAP	hazardous air pollutant
HCl	hydrogen chloride
Hg	mercury
HSH	highest, second-highest
km	kilometer
LAER	lowest achievable emission rate
lbs/hr	pounds per hour
lb/MMBtu	pounds per million British thermal units

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LIST OF ACRONYMS AND ABBREVIATIONS (cont'd)

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LIST OF ACRONYMS AND ABBREVIATIONS (cont'd)

SIP	State Implementation Plan
SNCR	selective non-catalytic reduction
SOG	stripper off gas
SO_2	sulfur dioxide
SO_3	sulfur trioxide
SR	State Road
TPD	tons per day
TPH	tons per hour
TPY	tons per year
TRS	total reduced sulfur
TSM	total selected metals
μm	micrometer
$\mu g/m^3$	micrograms per cubic meter
VOC	volatile organic compound

1.0 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 described in Rule 62-296.340 of the Florida Administrative Code (F.A.C.), effective January 31, 2007. 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.

Based on FDEP guidelines, 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 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, BART evaluation, and proposed BART determination(s) for the BART-eligible emissions units at the Mosaic Fertilizer, LLC (Mosaic) Riverview facility. A description of the BART-eligible emissions units is presented in Section 2.0. Results of the BART exemption analysis are presented in Section 3.0. Regulatory requirements for the BART determination (control options) analysis are presented in Section 4.0. The BART determination analysis is presented in Section 5.0.

The source information and methodologies used for the BART exemption analysis and the control technology determination are the same as those presented in the document entitled "Revised Air

Modeling Protocol to Evaluate Best Available Retrofit Technology (BART) Options for Affected Mosaic Fertilizer, LLC Facilities", referred to in the document as the "BART Protocol". A copy of this document has been included for reference in Appendix A. The application information section of the FDEP application form No. 62-210.900 is attached in Appendix B.

2.0 DESCRIPTION OF BART-ELIGIBLE EMISSIONS UNITS

Mosaic Fertilizer, LLC (Mosaic) operates three sulfuric acid plants (SAPs), one phosphoric acid plant (PAP), two diammonium phosphate (DAP) plants, two monoammonium phosphate (MAP) plants, one material handling system, one auxiliary boiler, two animal feed plants, and a molten sulfur storage and handling system at the Riverview facility to produce phosphate fertilizers for agricultural use. The Riverview facility is located about 7 miles south of Tampa in Hillsborough County, Florida. The Mosaic Riverview facility is currently operating under the Title V Permit No. 0570008-045-AV, most recently issued on May 31, 2006.

A detailed BART-eligibility analysis was presented in the BART Protocol (see Appendix A) and based on this analysis, the list of BART-eligible, non-fugitive emissions units that emit visibility impairing pollutants of sulfur dioxide (SO_2), nitrogen oxides (NO_x), or particulate matter with an aerodynamic weight of less then 10 microns (PM_{10}) are as follows:

- EU004 No. 7 SAP
- EU005 No. 8 SAP
- EU006 No. 9 SAP
- EU022 No. 3 MAP Plant
- EU023 No. 4 MAP Plant
- EU024 South Cooler
- EU063 Molten Sulfur Storage Tank Nos. 1, 2, and 3
- EU066, 067, 068 Molten Sulfur Storage and Handling – Pits 7, 8, 9

The Nos. 3 and 4 MAP Plants at the South Cooler have been permanently shutdown and a request has been made with the FDEP to remove the units from the Title V permit. Therefore, these units can be removed from the BART-eligible source list and were not included in the BART analysis for Mosaic Riverview. A description of each of the remaining emissions units is presented in the following sections.

2.1 Nos. 7, 8, and 9 SAPs (EU004, EU005, and EU006)

Mosaic operates three Leonard-Monsanto design sulfur burning, double conversion, double-absorption SAPs at the Riverview facility – Nos. 7, 8, and 9. These plants have a design capacity of 3,200 tons per day (TPD), 2,700 TPD, and 3,400 TPD of 100-percent sulfuric acid

(H_2SO_4), respectively. In the process, molten sulfur is combusted (oxidized) with dry air in the sulfur furnace. The resulting sulfur dioxide (SO_2) gas is catalytically converted (further oxidized) to sulfur trioxide (SO_3) over a catalyst bed in a converter tower. The SO_3 is then absorbed in sulfuric acid. The remaining SO_2, not previously oxidized, is passed over a final converter bed of catalyst and the SO_3 produced is then absorbed in H_2SO_4. The remaining gases exit to the atmosphere through a high-efficiency mist eliminator to the atmosphere. The plants also incorporate a Waste Heat Boiler System for generating steam from the energy produced by the combustion of molten sulfur in air.

The current 24-hour average SO_2 emission limits for the all three plants is 3.5 pounds per ton (lb/ton) of 100-percent H_2SO_4, equivalent to 467.0 pounds per hour (lb/hr), 393.8 lb/hr, and 495.8 lb/hr, respectively. The current sulfuric acid mist (SAM) emission limit for the No. 7 SAP is 0.12 lb/ton of 100-percent H_2SO_4 equivalent to 16 lb/hr. The SAM emission limits for the Nos. 8 and 9 SAPs are 11.3 lb/hr and 14.2 lb/hr, respectively. These limits have all been based on recently issued Best Available Control Technology (BACT) determinations. Currently there are no NO_x emission limits for any of the SAPs.

2.2 Molten Sulfur Storage Tank Nos. 1, 2, and 3 (EU063)

The Molten Sulfur system at the Riverview facility consists of three storage tanks, three covered storage pits, a ship unloading dock, truck loading station and associated transfer pumps and piping for storage and handling of molten sulfur. The three storage tanks – Nos. 1, 2, and 3, each has a capacity of 19,845 tons.

Molten sulfur from ships may be transferred to any combination of the three molten sulfur storage tanks at a combined maximum total of 2,277,081 tons of molten sulfur per any consecutive 12-month period. These tanks transfer molten sulfur to the molten sulfur storage pits at the SAPs and also to the molten sulfur truck loading station.

A wet scrubber is used to control PM emissions from the molten sulfur storage tanks. PM emissions from the molten sulfur storage tanks and the truck loading station are limited to a total of 0.03 grain per dry standard cubic feet (gr/dscf).

2.3 Molten Sulfur Storage Pit Nos. 7, 8, and 9 (EU066, EU067, and EU068)

The three molten sulfur storage pits (Nos. 7, 8, and 9) at the Riverview facility are located at the three SAPs, and receive molten sulfur from the molten sulfur storage tanks and/or by truck. Each of the storage pits may receive molten sulfur at a constant rate of 336 tons per hour.

Molten sulfur storage pit Nos. 7, 8, and 9 are each allowed to transfer molten sulfur to SAP Nos. 7, 8, and 9, respectively, at a maximum throughput rate of 492,361 tons per any consecutive 12-month period.

The three molten sulfur storage pits are uncontrolled (i.e., emissions from the pits do not pass through a control device), although they are covered.

3.0 BART EXEMPTION ANALYSIS AND RESULTS

A BART modeling protocol for the affected Mosaic facilities was submitted to the FDEP in September 2006 and a revised protocol was submitted in January 2007. Initial visibility modeling was conducted to determine if the BART-eligible source could be exempt from BART based on its impacts. The baseline emissions used for the exemption modeling and the exemption modeling results are presented in the sections below:

3.1 Emission Rates

Emission rates used in the Mosaic Riverview BART analysis are presented in the BART protocol (see Appendix A).

3.2 Modeling Methodology

The CALPUFF model, Version 5.756, was used to predict the maximum visibility impairment at the three PSD Class I areas located within 300 km of the Mosaic Riverview facility. 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 the Mosaic Riverview BART 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 U.S. Environmental Protection Agency (EPA) under the 1999 Regional Haze Rule (RHR) and referred to as the "1999 IMPROVE" algorithm. 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. A detailed description of the new IMPROVE algorithm and its implementation is presented in Subsection 3.4 of the Protocol.

Both the 1999 IMPROVE algorithm and the new IMPROVE algorithm were used to calculate the natural background light extinction at the Class I areas for the Mosaic Riverview BART modeling analysis. Visibility impacts were predicted at each PSD Class I area using receptors provided by the National Park Service and are represented in Figures 4-1 through 4-5 of the Protocol.

3.3 BART Exemption Modeling Results

Summaries of the visibility impairment values for the Mosaic Riverview BART-eligible emission units estimated using the 1999 IMPROVE algorithm, are presented in Tables 3-1 and 3-2. The 98th percentile 24-hour average visibility impairment values (i.e., 8th highest) for the years 2001, 2002, and 2003; and the 22nd highest 24-hour average visibility impairment value over the 3 years are presented in Table 3-1. This table also presents the number of days and receptors for which the visibility impairment was predicted to be greater than 0.5 dv. The eight highest visibility impairment values predicted at the PSD Class I areas are presented in Table 3-2.

As shown in Tables 3-1 and 3-2, the highest 8th highest visibility impairment values predicted for each year at the Everglades NP and the St. Marks NWA 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 these PSD Class I areas are also less than 0.5 dv. However, at the Chassahowitzka NWA, the highest 8th highest visibility impairment value is predicted to be 0.80 dv in 2002 and the 22nd highest visibility impairment value predicted over the 3-year period is 0.77 dv.

As a result, the new IMPROVE algorithm was used to re-calculate the visibility impacts at the Chassahowitzka NWA and the results are presented in Tables 3-3 and 3-4. As shown in Tables 3-3 and 3-4, at the Chassahowitzka NWA, the highest 8th highest visibility impairment value is predicted to be 0.623 dv in 2002 and the 22nd highest visibility impairment value predicted over the 3-year period is 0.585 dV.

Based on these results, the Mosaic Riverview facility is subject to the BART requirements and a BART determination analysis is required for each of the BART-eligible emissions units at the facility. Since the visibility impacts due to the facility were found to be more than 0.5 dv only at the Chassahowitzka NWA, the BART determination analysis will include only the Chassahowitzka NWA.

Visibility impacts at the Chassahowitzka NWA due to each BART-eligible unit were determined using the new IMPROVE algorithm and are presented in Table 3-5. The 8th highest impact of each unit is also shown in a bar-graph in Figure 3-1. The contribution of the individual visibility impairing particulate species to the 8^{th} highest visibility impact is presented in Table 3-6.

TABLE 3-1
SUMMARY OF BART EXEMPTION MODELING RESULTS, MOSAIC FERTILIZER, LLC, RIVERVIEW FACILITY
1999 IMPROVE ALGORITHM

Class I Area	Distance from Source to Nearest Class I Area Boundary (km)	Number of Days and Receptors with Visibility Impacts >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)	
Chassahowitzka NWA	87	15	113	0.665	17	113	0.801	27	113	0.776	0.767
Everglades NP	239	1	6	0.289	5	478	0.402	1	7	0.349	0.349
St. Marks NWA	291	6	101	0.439	3	99	0.360	1	101	0.351	0.396

TABLE 3-2
BART EXEMPTION ANALYSIS RESULTS FOR MOSAIC FERTILIZER, LLC, RIVERVIEW FACILITY
VISIBILITY IMPACT RANKINGS AT CLASS I AREAS
1999 IMPROVE ALGORITHM

Class I Area	Predicted Change in Visibility Impact (dv)			
	Rank	**2001**	**2002**	**2003**
Chassahowitzka NWR	1	1.478	1.750	1.129
	2	1.303	1.689	1.077
	3	0.997	1.101	0.955
	4	0.768	0.927	0.919
	5	0.768	0.869	0.913
	6	0.762	0.848	0.891
	7	0.689	0.811	0.873
	8	0.665	0.801	0.776
Saint Marks NWR	1	0.759	0.564	0.656
	2	0.665	0.526	0.434
	3	0.596	0.516	0.432
	4	0.554	0.449	0.406
	5	0.531	0.409	0.394
	6	0.518	0.396	0.372
	7	0.476	0.396	0.364
	8	0.439	0.360	0.351
Everglades NP	1	0.513	0.736	0.524
	2	0.404	0.678	0.460
	3	0.387	0.676	0.416
	4	0.373	0.555	0.384
	5	0.350	0.500	0.376
	6	0.342	0.462	0.369
	7	0.341	0.431	0.352
	8	0.289	0.402	0.349

TABLE 3-3
SUMMARY OF BART EXEMPTION MODELING RESULTS, MOSAIC FERTILIZER, LLC, RIVERVIEW FACILITY
NEW IMPROVE ALGORITHM

Class I Area	Distance from Source to Nearest Class I Area Boundary (km)	Number of Days and Receptors with Visibility Impacts >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)	
Chassahowitzka NWA	87	8	NA	0.532	11	NA	0.623	16	NA	0.622	0.585

TABLE 3-4
BART EXEMPTION ANALYSIS RESULTS FOR MOSAIC RIVERVIEW
VISIBILITY IMPACT RANKINGS AT THE CNWA
NEW IMPROVE ALGORITHM

Class I Area	Predicted Change in Visibility Impact (dv)			
	Rank	2001	2002	2003
Chassahowitzka NWA	1	1.148	1.373	0.870
	2	1.010	1.366	0.830
	3	0.776	0.852	0.740
	4	0.597	0.713	0.720
	5	0.591	0.685	0.700
	6	0.585	0.659	0.700
	7	0.532	0.642	0.670
	8	0.532	0.623	0.622

TABLE 3-5
MOSAIC RIVERVIEW - VISIBILITY IMPACTS AT CNWA USING NEW IMPROVE ALGORITHM
8th HIGHEST IMPACT OF EACH INDIVIDUAL BART-ELIGIBLE UNIT

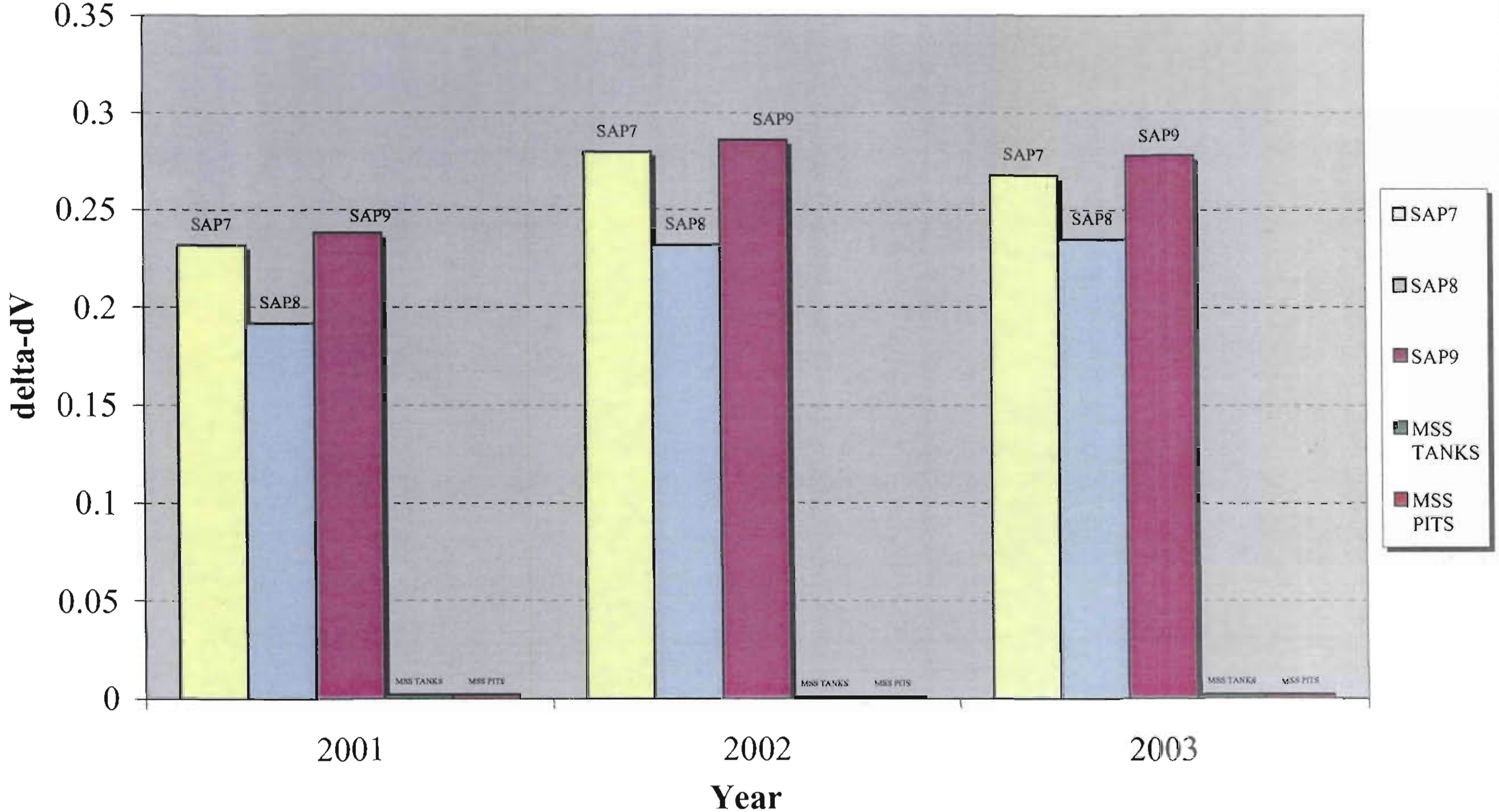
Emission Unit	Unit ID	Predicted 8th Highest Visibility Impacts (dv) 2001	2002	2003
SAP7	SAP7	0.184	0.223	0.214
SAP8	SAP8	0.152	0.185	0.187
SAP9	SAP9	0.189	0.228	0.222
MSS TANKS	MSS TANKS	0.001	0.001	0.002
MSS PITS	MSS PITS	0.002	0.001	0.003

TABLE 3-6
BART ANALYSIS FOR MOSAIC RIVERVIEW - VISIBILITY IMPACTS AT CNWA USING NEW IMPROVE ALGORITHM
CONTRIBUTION OF VISIBILITY IMPAIRING PARTICLE SPECIES TYPES

		Percent Contribution to 8th Highest Visibility Impact (dv)											
		2001				2002				2003			
		Visibility	Contribution of [a]			Visibility	Contribution of [a]			Visibility	Contribution of [a]		
Emission Unit	Unit ID	Impact (dv)	SO_4 (%)	NO_3 (%)	PM_{10} (%)	Impact (dv)	SO_4 (%)	NO_3 (%)	PM_{10} (%)	Impact (dv)	SO_4 (%)	NO_3 (%)	PM_{10} (%)
SAP7	SAP7	0.184	100.0	0.0	0.0	0.223	99.6	0.4	0.0	0.214	99.8	0.2	0.0
SAP8	SAP8	0.152	100.0	0.0	0.0	0.185	99.8	0.2	0.0	0.187	99.8	0.2	0.0
SAP9	SAP9	0.189	100.0	0.0	0.0	0.228	99.7	0.3	0.0	0.222	99.8	0.2	0.0
MSS TANKS	MSS TANKS	0.001	75.1	0.0	24.9	0.001	75.5	0.0	24.5	0.002	86.1	0.0	13.9
MSS PITS	MSS PITS	0.002	0.0	0.0	100.0	0.001	0.0	0.0	100.0	0.003	0.0	0.0	100.0

[a] Visibility impairing sulfate particles are formed due to SO_2 and H_2SO_4 emissions, nitrate particles are formed due to NOx emissions, and other non-hygroscopic PM_{10} particles are a result of fine filterable PM_{10}, coarse filterable PM_{10}, elemental carbon, and condensable secondary organic aerosol emissions.

Figure 3-1
Visibility Impacts (dv) at Chassahowitzka NWA
8th Highest Impact of Each Unit



4.0 REQUIREMENTS FOR ANALYSIS OF BART CONTROL OPTIONS

The visibility regulations define BART as follows:

> *Best Available Retrofit Technology (BART)* means an emission limitation based on the degree of reduction achievable through the application of the best system of continuous emission reduction for each pollutant which is emitted by ... [a BART-eligible source]. The emission limitation must be established, on a case-by-case basis, taking into consideration the technology available, the costs of compliance, the energy and non-air quality environmental impacts of compliance, any pollution control equipment in use or in existence at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology.

The BART analysis identifies the best system of continuous emission reduction taking into account:

1. The available retrofit control options,
2. Any pollution control equipment in use at the source (which affects the availability of options and their impacts),
3. The costs of compliance with control options,
4. The remaining useful life of the facility,
5. The energy and non-air quality environmental impacts of control options, and
6. The visibility impacts analysis.

Once it is determined that a source is subject to BART for a particular pollutant; then, for each affected emission unit, BART must be established for that pollutant. The BART determination must address air pollution control measures for each emissions unit or pollutant-emitting activity subject to review.

For volatile organic compounds (VOC) and PM sources subject to maximum achievable control technology (MACT) standards under 40 CFR 63, the analysis may be streamlined (at the discretion of the State) by including a discussion of the MACT controls and whether any major new technologies have been developed subsequent to the MACT standards. There are many VOC and PM sources that are well controlled because they are regulated by the MACT standards, which EPA developed under Clean Air Act (CAA) section 112. For a few MACT standards, this may also be true for SO_2. Any source subject to MACT standards must meet a level that is as stringent as the best-controlled 12 percent of sources in the industry. EPA believes that, in many cases, it will be unlikely that States will identify emission controls more stringent than the MACT standards without identifying control options that would cost many thousands of dollars per ton. Unless there are new technologies subsequent to the MACT standards which would lead to cost-effective increases in the level of control, EPA believes the State may rely on the MACT standards for purposes of BART.

EPA believes that the same rationale also holds true for emissions standards developed for municipal waste incinerators under the CAA section 111(d), and for many new source review/prevention of significant deterioration (NSR/PSD) determinations and NSR/PSD settlement agreements. However, EPA does not believe that technology determinations from the 1970s or early 1980s, including new source performance standards (NSPS), should be considered to represent best control for existing sources, as best control levels for recent plant retrofits are more stringent than these older levels.

Where the source is relying on these standards to represent a BART level of control, a discussion of whether any new technologies have subsequently become available should be provided.

The five basic steps of a case-by-case BART analysis are:

STEP 1—Identify All Available Retrofit Control Technologies,

STEP 2—Eliminate Technically Infeasible Options,

STEP 3—Evaluate Control Effectiveness of Remaining Control Technologies,

STEP 4—Evaluate Impacts and Document the Results, and

STEP 5—Evaluate Visibility Impacts.

Each of these steps is described briefly in the following sections.

STEP 1—Identify All Available Retrofit Control Technologies

Available retrofit control options are those air pollution control technologies with a practical potential for application to the emissions unit and the regulated pollutant under evaluation. In identifying "all" options, the most stringent option and a reasonable set of options for analysis that reflects a comprehensive list of available technologies must be identified. It is not necessary to list all permutations of available control levels that exist for a given technology—the list is complete if it includes the maximum level of control each technology is capable of achieving.

Air pollution control technologies can include a wide variety of available methods, systems, and techniques for control of the affected pollutant. Technologies required as BACT or LAER are available for BART purposes and must be included as control alternatives. The control alternatives can include not only existing controls for the source category in question but also take into account technology transfer of controls that have been applied to similar source categories and gas streams. Technologies which have not yet been applied to (or permitted for) full scale operations are not needed to be considered and purchase or construction of a process or control device that has not already been demonstrated in practice is not expected.

Where a NSPS exists for a source category (which is the case for most of the categories affected by BART), a level of control equivalent to the NSPS as one of the control options, should be included. The NSPS standards are codified in 40 CFR 60.

Potentially applicable retrofit control alternatives can be categorized in three ways.

- Pollution prevention: use of inherently lower-emitting processes/practices, including the use of control techniques (*e.g.* low-NO_X burners) and work practices that prevent emissions and result in lower "production-specific" emissions (note that it is not our intent to direct States to switch fuel forms, *e.g.* from coal to gas),
- Use of (and where already in place, improvement in the performance of) add-on controls, such as scrubbers, fabric filters, thermal oxidizers and other devices that control and reduce emissions after they are produced, and
- Combinations of inherently lower-emitting processes and add-on controls.

In the course of the BART review, one or more of the available control options may be eliminated from consideration because they are demonstrated to be technically infeasible or to have unacceptable energy, cost, or non-air quality environmental impacts on a case-by-case (or site-specific) basis.

The EPA does not consider BART as a requirement to redesign the source when considering available control alternatives. For example, where the source subject to BART is a coal-fired electric generator, EPA does not require the BART analysis to consider building a natural gas-fired electric turbine although the turbine may be inherently less polluting on a per unit basis.

For emission units subject to a BART review, there will often be control measures or devices already in place. For such emission units, it is important to include control options that involve improvements to existing controls and not to limit the control options only to those measures that involve a complete replacement of control devices.

If a BART source has controls already in place which are the most stringent controls available (note that this means that all possible improvements to any control devices have been made), then it is not necessary to comprehensively complete each following step of the BART analysis. As long these most stringent controls available are made federally enforceable for the purpose of implementing BART for that source, the remaining analyses may be skipped, including the visibility analysis in Step 5. Likewise, if a source commits to a BART determination that consists of the most stringent controls available, then there is no need to complete the remaining analyses.

STEP 2—Eliminate Technically Infeasible Options

In Step 2, the source evaluates the technical feasibility of the control options identified in Step 1. The source should document a demonstration of technical infeasibility and should explain, based on physical, chemical, or engineering principles, why technical difficulties would preclude the successful use of the control option on the emissions unit under review. The source may then eliminate such technically infeasible control options from further consideration in the BART analysis.

Control technologies are technically feasible if either (1) they have been installed and operated successfully for the type of source under review under similar conditions, or (2) the technology could be applied to the source under review. Two key concepts are important in determining whether a technology could be applied: "availability" and "applicability." A technology is considered "available" if the source owner may obtain it through commercial channels, or it is otherwise available within the common sense meaning of the term. An available technology is "applicable" if it can reasonably be installed and operated on the source type under consideration. A technology that is available and applicable is technically feasible.

Where it is concluded that a control option identified in Step 1 is technically infeasible, the source should demonstrate that the option is either commercially unavailable, or that specific circumstances preclude its application to a particular emission unit. Generally, such a demonstration involves an evaluation of the characteristics of the pollutant-bearing gas stream and the capabilities of the technology. Alternatively, a demonstration of technical infeasibility may involve a showing that there are un-resolvable technical difficulties with applying the control to the source (e.g., size of the unit, location of the proposed site, operating problems related to specific circumstances of the source, space constraints, reliability, and adverse side effects on the rest of the facility). Where the resolution of technical difficulties is merely a matter of increased cost, the technology should be considered as technically feasible. The cost of a control alternative is considered later in the process.

STEP 3—Evaluate Control Effectiveness of Remaining Control Technologies

Step 3 involves evaluating the control effectiveness of all the technically feasible control alternatives identified in Step 2 for the pollutant and emissions unit under review. Two key issues in this process include:

1. Ensure that the degree of control is expressed using a metric that ensures an "apples to apples" comparison of emissions performance levels among options, and
2. Give appropriate treatment and consideration of control techniques that can operate over a wide range of emission performance levels.

This issue is especially important when comparing inherently lower-polluting processes to one another or to add-on controls. In such cases, it is generally most effective to express emissions performance as an average steady state emissions level per unit of product produced or processed. Examples of common metrics are:

- Pounds of SO_2 emissions per million Btu heat input, and
- Pounds of NO_X emissions per ton of cement produced.

Many control techniques, including both add-on controls and inherently lower polluting processes, can perform at a wide range of levels. Scrubbers and high and low efficiency electrostatic precipitators (ESPs) are two of the many examples of such control techniques that can perform at a wide range of levels. It is important in analyzing the technology that one takes into account the most stringent emission control level that the technology is capable of achieving. The recent regulatory decisions and performance data (e.g., manufacturer's data, engineering estimates and the experience of other sources) should be considered when identifying an emissions performance level or levels to evaluate.

For retrofitting existing sources in addressing BART, one should consider ways to improve the performance of existing control devices, particularly when a control device is not achieving the level of control that other similar sources are achieving in practice with the same device. For example, one should consider improving performance when sources with electrostatic precipitators (ESPs) are performing below currently achievable levels.

STEP 4—Evaluate Impacts and Document the Results

After identifying the available and technically feasible control technology options, the following analyses should be conducted when making the BART determination:

1. Costs of compliance,
2. Energy impacts,
3. Non-air quality environmental impacts, and
4. Remaining useful life.

The source should discuss and, where possible, quantify both beneficial and adverse impacts. In general, the analysis should focus on the direct impact of the control alternative.

Costs of Compliance

To conduct a cost analysis, the following steps are used:

1. Identify the emissions units being controlled,
2. Identify design parameters for emission controls, and
3. Develop cost estimates based upon those design parameters.

It is important to clearly identify the emission unit being controlled, that is, to specify a well-defined area or process segment within the plant. In some cases, multiple emission units can be controlled jointly. Then, the control system design parameters should be specified. The value selected for the design parameter should ensure that the control option will achieve the level of emission control being evaluated. The source should include documentation of the assumptions regarding design parameters in the analysis. Examples of supporting references include the EPA OAQPS *Control Cost Manual* and background information documents used for NSPS and hazardous pollutant emission standards.

Once the control technology alternatives and achievable emissions performance levels have been identified, the source must develop estimates of capital and annual costs. The basis for equipment cost estimates also should be documented, either with data supplied by an equipment vendor (i.e., budget estimates or bids) or by a referenced source (such as the *OAQPS Control Cost Manual,* 5th Edition, February 1996, EPA 453/B–96–001). In order to maintain and improve consistency, cost estimates should be based on the *OAQPS Control Cost Manual,* where possible. The *Control Cost Manual* addresses most control technologies in sufficient detail for a BART analysis. The cost analysis should also take into account any site-specific design or other conditions identified above that affect the cost of a particular BART technology option.

Cost effectiveness, in general, is a criterion used to assess the potential for achieving an objective in the most economical way. For purposes of air pollutant analysis, "effectiveness" is measured in terms of tons of pollutant emissions removed, and "cost" is measured in terms of annualized control costs. The EPA recommends two types of cost-effectiveness calculations—average cost effectiveness, and incremental cost effectiveness.

Average cost effectiveness means the total annualized costs of control divided by annual emissions reductions (the difference between baseline annual emissions and the estimate of emissions after controls). Because costs are calculated in (annualized) dollars per year ($/yr) and emission rates are calculated in tons per year (tons/yr), the result is an average cost-effectiveness number in (annualized) dollars per ton ($/ton) of pollutant removed.

The baseline emissions rate should represent a realistic depiction of anticipated annual emissions for the source. In general, for the existing sources subject to BART, the anticipated annual emissions will be estimated based upon actual emissions from a baseline period.

When future operating parameters (e.g., limited hours of operation or capacity utilization, type of fuel, raw materials or product mix or type) are projected to differ from past practice, and if this projection has a deciding effect in the BART determination, then these parameters or assumptions are to be translated into enforceable limitations. In the absence of enforceable limitations, baseline emissions are calculated based upon continuation of past practice.

In addition to the average cost effectiveness of a control option, the incremental cost effectiveness should also be calculated. The incremental cost effectiveness calculation compares the costs and performance level of a control option to those of the next most stringent option, as shown in the following formula (with respect to cost per emissions reduction):

Incremental Cost Effectiveness (dollars per incremental ton removed) =

[(Total annualized costs of control option) − (Total annualized costs of next control option)] ÷ [(Control option annual emissions) − (Next control option annual emissions)]

Energy Impacts

The energy requirements of the control technology should be analyzed to determine whether the use of that technology results in energy penalties or benefits. If such benefits or penalties exist, they should be quantified to the extent practicable. Because energy penalties or benefits can usually be quantified in terms of additional cost or income to the source, the energy impacts analysis can, in most cases, simply be factored into the cost impacts analysis.

The energy impact analysis should consider only direct energy consumption and not indirect energy impacts. The energy requirements of the control options should be shown in terms of total (and in certain cases, also incremental) energy costs per ton of pollutant removed. Then these units can be converted into dollar costs and, where appropriate, can be factored into the control cost analysis. Indirect energy impacts (such as energy to produce raw materials for construction of control equipment) are generally not considered.

The energy impact analysis may also address concerns over the use of locally scarce fuels. The designation of a scarce fuel may vary from region to region. However, in general, a scarce fuel is one which is in short supply locally and can be better used for alternative purposes, or one that may not be reasonably available to the source either at the present time or in the near future.

Non-Air Quality Environmental Impacts

In the non-air quality related environmental impacts portion of the BART analysis, environmental impacts other than air quality due to emissions of the pollutant in question are addressed. Such environmental impacts include solid or hazardous waste generation and discharges of polluted water from a control device.

Any significant or unusual environmental impacts associated with a control alternative that has the potential to affect the selection or elimination of a control alternative should be identified. Some control technologies may have potentially significant secondary environmental impacts. Scrubber effluent, for example, may affect water quality and land use. Alternatively, water availability may affect the feasibility and costs of wet scrubbers. Other examples of secondary environmental impacts could include hazardous waste discharges, such as spent catalysts or contaminated carbon.

In general, the analysis need only address those control alternatives with any significant or unusual environmental impacts that have the potential to affect the selection of a control alternative, or elimination of a more stringent control alternative. Thus, any important relative environmental impacts (both positive and negative) of alternatives can be compared with each other.

Remaining Useful Life

The requirement to consider the "remaining useful life" of the source for BART determinations may be treated as one element of the overall cost analysis. The "remaining useful life" of a source, if it represents a relatively short time period, may affect the annualized costs of retrofit controls. For example, the methods for calculating annualized costs in EPA's *OAQPS Control Cost Manual* require the use of a specified time period for amortization that varies based upon the type of control. If the remaining useful life will clearly not exceed this time period, the remaining useful life has an effect on control costs and on the BART determination process. Where the remaining useful life is less than the time period for amortizing costs, this shorter time period should be considered in the cost calculations.

The remaining useful life is the difference between:

1. The date that controls will be put in place (capital and other construction costs incurred before controls are put in place can be rolled into the first year, as suggested in EPA's *OAQPS Control Cost Manual*); and
2. The date the facility permanently stops operations. Where this affects the BART determination, this date should be assured by a federally- or State-enforceable restriction preventing further operation.

The EPA recognizes that there may be situations where a source operator intends to shut down a source by a given date, but wishes to retain the flexibility to continue operating beyond that date in the event, for example, that market conditions change. Where this is the case, the BART analysis may account for this, but it must maintain consistency with the statutory requirement to install BART within 5 years. Where the source chooses not to accept a federally enforceable condition requiring the source to shut down by a given date, it is necessary to determine whether a reduced time period for the remaining useful life changes the level of controls that would have been required as BART.

STEP 5—Evaluate Visibility Impacts

The following is an approach EPA suggests to determine visibility impacts (the degree of visibility improvement for each source subject to BART) for the BART determination. Once it is determined that a source is subject to BART, a visibility improvement determination for the source must be conducted as part of the BART determination.

The permitting agency has flexibility in making this determination; i.e., in setting absolute thresholds, target levels of improvement, or *de minimis* levels; since the dv improvement must be weighed among the five factors, and the agency is free to determine the weight and significance to be assigned to each factor. For example, a 0.3 dv improvement may merit a stronger weighting in one case versus another, so one "bright line" may not be appropriate.

CALPUFF or other appropriate dispersion model must be used to determine the visibility improvement expected at a Class I area from the potential BART control technology applied to the source. Modeling should be conducted for SO_2, NO_x, and direct PM emissions ($PM_{2.5}$ and/or PM_{10}). There are several steps for determining the visibility impacts from an individual source using a dispersion model:

- Develop a modeling protocol.
- For each source, run the model, at pre-control and post-control emission rates according to the accepted methodology in the protocol. Use the 24-hour average actual emission rate from the highest emitting day of the meteorological period modeled (for the pre-control scenario). Calculate the model results for each receptor as the change in dv compared against natural visibility conditions. Post-control emission rates are calculated as a percentage of pre-control emission rates. For example, if the 24-hour pre-control emission rate is 100 lb/hr of SO_2, then the post control rate is 5 lb/hr if the control efficiency being evaluated is 95 percent.
- Make the net visibility improvement determination. Assess the visibility improvement based on the modeled change in visibility impacts for the pre-control and post-control emission scenarios. The assessment of visibility improvements due to BART controls is flexible and can be done by one or more methods. The frequency, magnitude, and duration components of impairment may be considered. Suggestions for making the determination are:
  - Use of a comparison threshold, as is done for determining if BART-eligible sources should be subject to a BART determination. Comparison thresholds can be used in a number of ways in evaluating visibility improvement (*e.g.* the number of days or hours that the threshold was exceeded, a single threshold for determining whether a change in impacts is significant, or a threshold representing an x percent change in improvement).
  - Compare the 98^{th} percent days for the pre- and post-control runs.

Each of the modeling options may be supplemented with source apportionment data or source apportionment modeling.

Selecting the "Best" Alternative

From the alternatives evaluated in Step 3, EPA recommends developing a chart (or charts) displaying for each of the alternatives the following:

1. Expected emission rate (tons per year, pounds per hour);
2. Emissions performance level (*e.g.*, percent pollutant removed, emissions per unit product, lb/MMBtu, ppm);
3. Expected emissions reductions (tons per year);
4. Costs of compliance—total annualized costs ($), cost effectiveness ($/ton), and incremental cost effectiveness ($/ton), and/or any other cost-effectiveness measures (such as $/dv);
5. Energy impacts;
6. Non-air quality environmental impacts; and
7. Modeled visibility impacts.

The source has the discretion to determine the order in which evaluation of control options for BART takes place. The source should provide a justification for adopting the technology selected as the "best" level of control, including an explanation of the CAA factors that led to the choice of one option over other control levels.

In the case where the source is conducting a BART determination for two regulated pollutants on the same source, if the result is two different BART technologies that do not work well together, then a different technology or combination of technologies can be substituted.

Even if the control technology is cost effective, there may be cases where the installation of controls would affect the viability of continued plant operations. There may be unusual circumstances that justify taking into consideration the conditions of the plant and the economic effects of requiring the use of a given control technology. These effects would include effects on product prices, the market share, and profitability of the source. Where there are such unusual circumstances that are judged to affect plant operations, the conditions of the plant and the economic effects of requiring the use of a control technology may be taken into consideration. Where these effects are judged to have a severe impact on plant operations, they may be considered in the selection process, but an economic analysis that demonstrates, in sufficient detail for public review, the specific economic effects, parameters, and reasoning may have to be provided. Any analysis may also consider whether other competing plants in the same industry have been required to install BART controls if this information is available.

5.0 BART ANALYSIS

5.1 BART for SO_2 Emissions From Nos. 7, 8, and 9 SAPs

The Nos. 7, 8, and 9 SAPs are Leonard-Monsanto design, double-conversion, double-absorption plants, with a maximum production capacity of 3,200 TPD, 2,700 TPD, and 3,400 TPD of 100-percent H_2SO_4, respectively. The production capacity of No. 7 SAP was increased in 1998 from 2,200 TPD to 3,200 TPD and a SO_2 BACT emission limit of 3.5 lb/ton of H_2SO_4, 24-hour average, was established for the unit. Nos. 8 and 9 SAPs were part of the facility expansion in 2001, and the units were subject to BACT determination for SO_2 emissions and an emission limit of 3.5 lb/ton of H_2SO_4, 24-hour average, was established for each of the SAPs.

As shown in Table 3-5, the highest 8th highest visibility impacts due to the Nos. 7, 8, and 9 SAPs are 0.22, 0.19, and 0.23 dv, respectively. Individual visibility impairing particle species contributions presented in Table 3-4, show that more than 99 percent of each of the SAP's visibility impact is due to sulfate particles. Since sulfate particles are formed due to SO_2 and SAM emissions, it is clear that control of SO_2 emissions from these plants may be the best strategy to reduce visibility impact due to each unit.

However, these plants already have a BACT-established SO_2 emissions limit. The BACT limit for No. 7 SAP was established in 1998, and for Nos. 8 and 9 SAPs in 2001. The existing double absorption technology with a four-stage converter is considered to be the BACT for SAPs in the phosphate fertilizer industry. Nos. 8 and 9 SAPs use cesium promoted vanadium catalyst in the fourth stage of the converter. A BART analysis is presented in the following sections to demonstrate that the existing controls at the Nos. 7, 8, and 9 SAPs are BART for SO_2 emissions from these units.

5.1.1 Available Retrofit Technologies

In the Nos. 7, 8, and 9 SAPs, sulfur is burned with dried atmospheric oxygen to produce SO_2. The SO_2 is catalytically oxidized to SO_3 over a catalyst bed. The SO_3 is then absorbed in sulfuric acid to produce additional sulfuric acid. The remaining SO_2, not previously oxidized, is passed over a final converter bed of catalyst and the SO_3 produced is then absorbed into sulfuric acid. The process results in emissions of SO_2, SAM, and a small amount of NO_x.

As part of the BART analysis, a review was performed of previous SO_2 BACT determinations for sulfuric acid plants listed in the RACT/BACT/LAER Clearinghouse (RBLC) on EPA's webpage. A summary of BACT determinations for sulfuric acid plants from this review is presented in Table 5-1. Determinations issued during the last 10 years are shown in the table. From the review of previous BACT determinations, it is evident that SO_2 BACT determinations for sulfuric acid plants have largely been based on double-absorption process technology. BACT determinations have been in the range of 3.5 to 4.0 lb/ton for SO_2 emissions.

All three of the SAPs at Riverview are double-absorption plants. The existing double-absorption technology is considered to be state-of-the-art in reducing SO_2 emissions from H_2SO_4 plants and is already in operation at the Nos. 7, 8, and 9 SAPs. The No. 8 and No. 9 SAPs were subject to a BACT determination when the production capacity of the facility was expanded and the continued use of double-absorption technology with the addition of cesium promoted vanadium catalyst into the 4^{th} pass of the converter was determined to be BACT for SO_2 emissions. Cesium catalyst is similar to the traditional vanadium catalyst except that cesium salts are added to lower the activation temperature and increase SO_2 conversion efficiency. Higher conversion efficiency allows the plants to increase production rates by increasing burner SO_2 concentrations while at the same time lowering stack SO_2 emissions.

The No. 7 SAP was also subject to a BACT determination for SO_2 emissions when the unit was expanded from 2,200 TPD to 3,200 TPD and the continued use of double-absorption technology with additional vanadium catalyst was determined to be BACT for SO_2 emissions The catalyst volume was increased from 371,000 liters to approximately 586,000 liters.

All three SAPs are currently subject to a BACT emission limit of 3.5 lb/ton 100-percent H_2SO_4 as a 24-hour average SO_2 emissions.

5.1.2 <u>Control Technology Feasibility</u>

The available feasible SO_2 controls for the Nos. 7, 8, and 9 SAPs are identified in Table 5-2. As shown, there are four types of available SO_2 abatement methods. Each abatement method is described below.

5.1.2.1 Sorbent Injection

Sorbent injection has been used on boilers and involves the injection of a dry sorbent into the furnace, economizer, or in the flue gas duct after the preheater where the temperature is about 300 degrees Fahrenheit (°F). In furnace injection, a finely grained sorbent, limestone ($CaCO_3$) or hydrated lime [$Ca(OH)_2$] is distributed quickly and evenly over the entire cross section in the upper part of the furnace in a location where the temperature is in the range of 1,380 to 2,280°F. The sorbent reacts with SO_2 and O_2 to form $CaSO_4$. $CaSO_4$ is then captured in a particulate control device together with unused sorbent and fly ash. Temperatures over 2,280°F result in sintering of the surface on the sorbent, destroying the structure of the pores and reducing the active surface area.

In an economizer sorbent injection system, hydrated lime is injected into the flue gas stream near the economizer zone where the temperature is in the range of 570 to 1,200°F. At this temperature, SO_2 reacts with the sorbent to form $CaSO_3$.

In duct sorbent injection, the aim is to distribute the sorbent evenly in the flue gas duct after the air preheater, where the temperature is about 300°F. At the same time, the flue gas is humidified with water. As with the furnace and economizer designs, the end products are collected in a particulate control device.

There are many factors that influence the performance of a duct sorbent injection process. These include sorbent reactivity, quantity of injected sorbent, relative humidity of the flue gas, gas and solids residence time in the duct, and quantity of recycled, unreacted sorbent from the particulate control device. The most efficient way of achieving good conditions is to establish a dedicated reaction chamber.

Although demonstrated on boilers, sorbent injection has never been used at a SAP to control SO_2. Nor is there a suitable injection location that would not interfere with the H_2SO_4 recovery process. Therefore, since this is not a proven technique for SO_2 control from a SAP, this technique was not considered further.

5.1.2.2 Process Modification

The most common process modification control technique applied to SAPs is the double-absorption process. In the double-absorption process, SO_2 is formed in the furnace (sulfur burner). The SO_2 is then converted to SO_3 gas in the primary converter stages and is sent to an interpass absorber where most of the SO_3 is removed to form H_2SO_4. The remaining unconverted SO_2 is forwarded to the final stages in the converter to change much of the remaining SO_2 by oxidation to SO_3; whence, it is sent to the final absorber for removal of the remaining SO_3. There are no byproducts or waste scrubbing materials created, only additional H_2SO_4.

SO_2 to SO_3 conversion efficiencies of 99.7 percent and higher are achievable, whereas most single-absorption plants have SO_2 conversion efficiencies ranging from only 95 to 98 percent. Furthermore, double-absorption permits higher converter inlet SO_2 concentrations than are used in single-absorption plants because the final conversion stages effectively remove any residual SO_2 from the interpass absorber. This type of SO_2 control would require a new converter and a second absorbing tower, to achieve the necessary conversion with the double-absorption process.

5.1.2.3 Gas Absorption/Wet Scrubber

Absorption is a mass transfer operation in which one or more soluble components of a gas mixture are dissolved in a liquid that has low volatility under the process conditions. The pollutant diffuses from the gas into the liquid when the liquid contains less than the equilibrium concentration of the gaseous component. The difference between the actual and the equilibrium concentration provides the driving force for absorption. Devices that are based on absorption principles include wet scrubbers such as packed towers, plate columns, venturi scrubbers, and spray chambers. Specific applications of these technologies to SAPs are described below.

In cases where very low SO_2 emissions limits are required (i.e., substantially lower than NSPS limits), tail-gas scrubbing in addition to the double-absorption system have been employed. Hydrogen peroxide scrubbing has been employed at SAPs. In addition, ammonia scrubbing has been employed at some single-absorption SAPs in other facilities.

In hydrogen peroxide scrubbing, dilute H_2SO_4 and hydrogen peroxide are circulated over a packed bed countercurrent to the stream of SO_2 containing tail-gas. SO_2 is absorbed in the solution where a rapid, high-yield reaction takes place to produce H_2SO_4. The acid produced in the scrubber becomes part of the plant's total production by blending with high-strength acid in the drying or absorbing towers. Thus, there is no by-product or purge stream to dispose of with this process. Although this technique has been applied to SAPs, the high cost of hydrogen peroxide makes this technique economically infeasible.

The ammonia scrubbing process uses anhydrous ammonia (NH_3) and water makeup in a two-stage scrubbing system to remove SO_2 from acid plant tail gas. Excess ammonium sulfite-bisulfite solution is reacted with H_2SO_4 in a stripper to evolve SO_2 gas and produce an ammonium sulfate byproduct solution. The SO_2 is returned to the SAP while the solution is recycled to the MAP/DAP fertilizer production units.

As of 1979, one new plant (two units) and a new unit added to an existing plant were known to employ an ammonia scrubbing system for tail gas SO_2 emissions control. There are existing single-absorption SAPs at other facilities, such as CF Industries, that employ ammonia scrubbing.

Molecular sieves are also known as Zeolite traps. Zeolites are naturally occurring rock composed of aluminum, silicon, and oxygen. Zeolite has a natural porosity because it has a crystal structure with windows, cages, and supercages. These internal voids, when engineered to have specific opening size ranges, can trap and hold a variety of molecules which enter the structural matrix. The trapped molecules are held in the cavities by physical and chemical bonding. Zeolites possess properties of attrition resistance, temperature stability, inertness to regeneration techniques, and uniform pore size which make them ideal absorbents. However, they lack the ability to catalyze the oxidation of SO_2 to SO_3 and, thus, cannot desulfurize flue-gases at normal operating temperatures.

5.1.2.4 Flue Gas Desulfurization

The processes that transform gaseous SO_2 from flue gas to primarily solid sulfur compounds that are collected for safe disposal or beneficial use are referred to as flue gas desulfurization (FGD) processes. Although similar in concept, these processes are characterized as wet or dry, and they differ as to the sorbents used and byproducts produced. Several FGD systems are described below.

Spray dryer FGD is one of the principal methods of SO_2 control used today. Calcium oxide (quick lime) mixed with water produces a calcium hydroxide slurry, which is injected into a spray dryer where it is dried by the hot flue gas and reacts with the gas to remove SO_2. The dry product is collected both at the bottom of the spray tower and in the downstream particulate removal device where more SO_2 may be removed. Pilot testing has indicated that SO_2 removal of 80 to 90 percent is possible, and over 90 percent removal is possible under certain conditions. However, a fabric filter may have to be added to maintain particulate emission standards. Since this option would require an additional particulate control device, this would be more expensive than the wet scrubbing options. Use of spray dryer FGD in a SAP has not been demonstrated.

The dual alkali SO_2 removal system is a regenerative process designed for disposal of wastes in a solid/slurry form. The process consists of three basic steps: gas scrubbing, a reactor system, and solids dewatering. The scrubbing system utilizes a sodium hydroxide and sodium sulfite solution. Upon absorption of SO_2 in the scrubber, a solution of sodium bisulfite and sodium sulfite is produced. The scrubber effluent containing the dissolved sodium salts is reacted outside the scrubber with lime or limestone to produce a precipitate of calcium salts containing calcium sulfate. The precipitate slurry from the reactor system is dewatered and the solids are deposed of in a landfill. The liquid fraction containing soluble salts is recirculated back to the absorber. Dual alkali systems can achieve efficiencies of 90 to 95 percent.

Wet FGD systems using lime or limestone scrubbing are very popular in the U.S. and are the predominant SO_2 control technology used by the utilities industry. Other wet FGDs include forced or inhibited oxidation and magnesium-enhanced lime FGD. These systems create solid and liquid waste streams, which must be treated before disposal. SO_2 control efficiencies for wet limestone FGD range from 50 to 98 percent, depending on the type of device and design, with an average of 90 percent.

A significant impediment to applying a wet FGD system to a SAP is the economic impact, reflected in an increase in capital costs, annual operating costs, and the cost per ton of H_2SO_4 manufactured. No SAP is known to have employed a wet FGD as a control technology. In the PSD permits issued to Cargill Riverview and Piney Point Phosphates in recent years, FGD systems were dismissed as not being practical or economically feasible. As a result of these considerations, FGD systems were not considered further as BART.

5.1.2.5 Oxidation

SO_2 oxidation with activated carbon is an alternative to double-absorption technology that has been applied to SAPs for SO_2 control. In this process, the dry gas leaving the final absorbing tower is humidified then passed through a reactor filled with activated carbon. The activated carbon oxidizes the SO_2 to H_2SO_4, which is retained in the pores of the carbon. Clean, but wet, tail-gas is discharged to the stack. Periodically, the carbon bed is regenerated by flushing with water. This produces a weak H_2SO_4 stream that can be recycled back to the contact plant as dilution water.

One application of this technology is the Centaur process, which uses low-temperature wet carbon catalysis/adsorption in place of the standard final pass and absorption tower. The Centaur process has been demonstrated on a pilot scale at a sulfur burning plant. Emissions as low as 1 lb SO_2 per ton of acid are theoretically possible. However, the process has not yet been optimized and might result in a separate excess weak H_2SO_4 stream (beyond plant water makeup needs) that might require treatment and disposal. Process optimization and building wastewater treatment facilities would delay expansion of the plant. Also, the high cost involved in building, maintenance, and operation of the wastewater treatment facility makes it a less favorable option. Furthermore, all three SAPs at

Riverview are double-absorption plants, and since this control technique has only been applied to single-absorption plants, this technique was not considered further.

5.1.2.6 Summary of Technically Feasible Options

The available SO_2 controls for the Nos. 7, 8, and 9 SAPs are identified in Table 5-2. As shown, there are four primary types of SO_2 abatement methods that are technically feasible, with various techniques within each method. Options deemed to be technically infeasible are identified in the table, and were not considered further.

5.1.3 Control Effectiveness of Options

Each technically feasible control method identified in Subsection 5.1.2 is listed in Table 5-2 with its associated control efficiency estimate and ranked based on control efficiency.

5.1.4 Impacts of Control Technology Options

5.1.4.1 Cost of Compliance

To achieve SO_2 emissions below those achieved by the No. 7, No. 8, and No. 9 sulfuric acid double-absorption plants, add-on control equipment such as tailgas scrubbers would be required. This would add considerable capital and operating costs to the present system. Mosaic has estimated the cost of installing and operating an ammonia scrubbing system on any one of the Nos. 7, 8, and 9 SAPs, which is presented in Table 5-3. This would require installation of new ammonia absorber vessels, a new turbine and blower to account for the additional pressure drop through the system, and new mist eliminators.

Based on a cost quote received in 2004, the cost for installation of an ammonia scrubber on one double absorption SAP is $8 million, which includes installation but does not include blower and mist eliminators and certain other items. Converting the cost quote to 2006 dollars, the estimated total capital cost of the ammonia scrubbing system on either of the No. 7, No. 8, or No. 9 SAP is almost $19 million. Using a standard capital recovery factor of 0.0944 (20 years @ 7% interest), the annualized cost of the capital investment is $1.8 million/yr. Additional annualized operating costs to operate the scrubbing system are estimated at $1.2 million/yr. The total annual cost is $3.0 million per year, as shown in Table 5-3.

This cost does not include any cost for handling or disposal of the liquid ammonium sulfate stream generated by the scrubbing process. One feasible technical option for disposal of the liquid stream would be to construct an ammonium sulfate crystallizer, storage warehouse and shipping unit in order to market the ammonium sulfate product. However, these additional facilities are estimated to cost at least an additional $20 million. There is also no guarantee that an adequate market for ammonium sulfate will exist, or the revenue from such an operation.

Regardless of the SO_2 reduction gained by ammonia scrubbing of the Nos. 7, 8, and 9 SAPs, the cost of these systems would be economically infeasible. Assuming 90% control efficiency, the ammonia scrubbing system would further reduce the current potential emission rates of Nos. 7, 8, and 9 SAPs from 467 lb/hr, 393.8 lb/hr, and 495.8 lb/hr (see Table 2-3 of the BART Protocol), respectively, to 46.7 lb/hr, 39.4 lb/hr, and 49.6 lb/hr, respectively.

Based on average actual annual SO_2 emissions from Nos. 7, 8, and 9 SAPs for the period 2002 to 2003, the ammonia scrubbing system would reduce the annual emissions by 1,171 TPY, 1,256 TPY, and 1,328 TPY, respectively. Based on the annualized cost of control of $ 3.0 million per year, these annual SO_2 emissions reductions would result in a cost effectiveness ranging from $2,260 to $2,560 for either plant. This is considered very high for a BACT determination. Also, based on 2 million tons per year of DAP/MAP production, the annualized cost of control of $3.0 million per year to add ammonia scrubbing to just one SAP would increase the cost to produce the DAP/MAP by $1.5/ton, which is unacceptable in today's marketplace

It is also emphasized that no other double absorption SAP located at a fertilizer manufacturing plant has been required to employ add-on flue gas desulfurization (FGD) equipment.

5.1.4.2 Energy Impacts

Annual energy consumption by the ammonia scrubber, new blower, mist eliminator, and auxiliary equipment are estimated to be 700 kilowatts per hour and the operating cost was estimated using a cost factor of $0.06 per kilowatt-hour of electricity. This energy cost was included in developing the direct operating cost in Subsection 5.1.4.1.

5.1.4.3 Non-Air Quality Environmental Impacts

Some of the technically feasible control techniques have a negative environmental impact due to waste streams created or additional water or energy demands. For instance, SO_2 oxidation can create an excess weak H_2SO_4 stream, which requires additional water for flushing of the carbon bed for regeneration. FGD systems create both solid and liquid waste streams that require additional treatment prior to disposal.

Of the feasible control techniques, the control technique with the least environmental impact is the double absorption process, as this process does not create any by-products or waste scrubbing materials.

5.1.4.4 Remaining Useful Life

Mosaic has no plan to shut down the Nos. 7, 8, and 9 SAP in the near future. A useful life of 20 years was used to calculate the annualized capital recovery cost.

5.1.5 Visibility Impacts

As shown in Table 3-5, the highest 8^{th} highest change visibility impact due to the Nos. 7, 8, and 9 SAP is 0.22, 0.19, and 0.23 dv, respectively. Assuming 90 percent control efficiency, an ammonia scrubber would further reduce the current baseline emission rates of Nos. 7, 8, and 9 SAPs from 467 lb/hr, 393.8 lb/hr and 495.8 lb/hr, respectively, to 46.7 lb/hr, 39.4 lb/hr and 49.6 lb/hr, respectively. Using these reduced SO_2 emission rates, the CALPUFF model was run for each of the Nos. 7, 8, and 9 SAPs and the highest 8^{th} highest visibility impact was determined to be 0.065 dv, 0.05 dv, and 0.06 dv, respectively, using the new IMPROVE algorithm. This is a reduction of only 0.155 dv, 0.14 dv, and 0.17 dv, respectively, from the baseline visibility impacts of the Nos. 7, 8, and 9 SAPs.

Based on these reductions in the change in haze index and the annualized operating cost of $3.0 million determined in Subsection 5.1.4.1, the cost effectiveness of adding an ammonia scrubber to each of the SAP Nos. 7, 8, and 9 can be estimated as $17.6 million or more for every 1-dv reduction in the visibility impact.

5.1.6 Selection of BART

Based on the high cost of reducing the visibility impact, it is considered economically infeasible to add tailgas scrubbing to the existing Nos. 7, 8, and 9 SAPs. An annual cost of $17.6 million results in only 1 dv reduction in the visibility impact. No other double absorption SAP located at a phosphate fertilizer plant has been required to employ add-on FGD equipment. As explained in Subsection 5.1.4.1, requiring ammonia scrubbing on the Nos. 7, 8, and 9 SAPs would put Mosaic at a significant economic disadvantage compared to its competitors, at a time when fertilizer prices are depressed and raw material costs (i.e., molten sulfur) have increased.

Therefore, Mosaic is proposing the current double-absorption system with cesium promoted vanadium catalyst in the converter as the BART for SO_2 emissions from the Nos. 8 and 9 SAPs, with a proposed BART SO_2 emission limit of 3.5 lb/ton of H_2SO_4, 24-hour average. Similarly for the No. 7 SAP, Mosaic proposes the current double-absorption system with additional vanadium catalyst as the BART for SO_2 emissions, with a proposed BART SO_2 emission limit of 3.5 lb/ton of H_2SO_4, 24-hour average

5.2 BART for NO_X Emissions From the Nos. 7, 8, and 9 SAPs

As shown in Table 3-4, the nitrate particles, which are formed by NO_x emissions, contribute less than 1 percent of the total visibility impact due to each of the Nos. 7, 8, and 9 SAPs. Since the double-absorption process results in a small amount of NO_x emissions, the NO_x emissions from the SAPs are very low. Currently, there are no NO_x emission limits for any of the SAPs.

Because of the low NO_x emissions from each of the units, add-on NO_x control technology would not result in significant emission reduction, but would have a significant economic impact on Mosaic. It is emphasized that there are no known add-on NO_x control techniques that have been applied to SAPs.

As a result, Mosaic proposes that BART for NO_x emissions from each of the Nos. 7, 8, and 9 SAPs is existing combustion process and good combustion practices.

5.3 BART for the Molten Sulfur Storage Tank Nos. 1, 2, and 3

The highest 8^{th} high change in haze index due to the molten sulfur storage tank Nos. 1, 2, and 3 is only 0.002 dv (see Table 3-5), more than 100 times lower than the visibility impacts due to any of the SAPs. Even the entire 0.002 dv reduction will not be able to achieve a meaningful reduction of the Mosaic Riverview BART-eligible source impact.

The PM emissions from the molten sulfur storage tanks, which account for 90-percent of the visibility impacts due to the tanks, are controlled by a wet scrubber. Any additional PM control equipment will add unnecessary economic burden for the purpose of achieving insignificant amount of reduction in the visibility impact. As a result, Mosaic proposes the existing wet scrubber as BART for PM controls from the molten sulfur storage tanks.

5.4 BART for Molten Sulfur Storage Pits 7, 8, and 9

Similar to the molten sulfur storage tanks, the highest 8^{th} high change in haze index due to the Nos. 7, 8, and 9 molten sulfur pits is only 0.003 dv. Since the entire 0.003 dv reduction will not achieve a meaningful reduction of the Mosaic Riverview BART-eligible source impact, any control of emissions from the molten sulfur pits will not be practical. Emissions from the molten sulfur pits are not controlled, although they are equipped with covers. Mosaic considers the covers on the pits as BART and proposes no additional control.

TABLE 5-1
SUMMARY OF BACT DETERMINATIONS FOR SULFUR DIOXIDE EMISSIONS FROM SULFURIC ACID PLANTS

Company Name	State	Permit No./RBLC ID	Permit Issue Date	Throughput	Emission Limit	Control Equipment
CF INDUSTRIES, INC.--PLANT CITY	FL	0570005-020-AC	8/19/2005	2,750 TPD	3.5 lb/ton (3-hr)	Double Absorption & Mist Eliminators
PCS PHOSPHATE COMPANY	NC	NC-0088	9/24/2003	1,850 TPD	4.0 lb/ton	Double Absorption Catalyst
IMC PHOSPHATES--NEW WALES	FL	FL-0253	7/12/2002	3,400 TPD	4.0 lb/ton (3-hr)	Double Absorption System
					3.5 lb/ton (24-hr)	
PCS PHOSPHATE COMPANY	NC	NC-0099	7/14/2000	2,000 TPD	4.0 lb/ton	Double Absorption
CARGILL FERTILIZER	FL	0570008-036-AC/PSD-FL-315	11/21/2001	3,400 TPD	4 lb/ton (3-hr)	Double Absorption System
					3.5 lb/ton (24-hr)	
US AGRI-CHEMICALS CORP.	FL	PSD-FL-278/FL-0237	2/6/2001	3,000 TPD	3.5 lb/ton (24-hr)	Double Absorption & Mist Eliminators
CARGILL FERTILIZER--RIVERVIEW	FL	0570008-014-AV	4/28/1999	2,700 TPD	4 lb/ton (3-hr)	Double Absorption
					3.5 lb/ton (24-hr)	Double Absorption
FARMLAND HYDRO, L. P. (NOW CARGILL GREEN BAY)	FL	1050053-019-AC/FL-0129	3/8/1999	2,750 TPD	3.5 lb/ton (24-hr)	Double Absorption Scrubber/Mist Eliminator
CARGILL FERTILIZER	FL	FL-0197	10/16/1998	3,200 TPD	3.5 lb/ton (24-hr)	Double Absorption Process
FARMLAND HYDRO, L. P. (NOW CARGILL GREEN BAY)	FL	1050053-019-AC	7/15/1998	250 TPD	401 lb/hr	Double Absorption Scrubber/Mist Eliminator
PINEY POINT PHOSPHATES INC.	FL	FL-0194	2/17/1998	2,000 TPD	4 lb/ton (3-hr)	Double Absorption
					3.5 lb/ton (48-hr)	Double Absorption
IMC -AGRICO - SOUTH PIERCE FACILITY	FL	FL-235	9/17/1997	3,000 TPD	4 lb/ton	Double Absorption Towers/Fiber Mist Eliminators
JR SIMPLOT COMPANY - DON SIDING PLANT	ID	T1-9507-114-1	4/5/2004	2,500 TPD	4 lb/ton	Double Contact Process
				1,750 TPD	4 lb/ton	Dynawave Reverse-Jet Scrubber followed by an ammox packed-bed ammonia scrubber
SEMINOLE FERTILIZER CORPORATION	FL	FL-PSD-191	12/31/1992	2,280 TPD	4 LB/TON H2SO4	DOUBLE ABSORPTION, DEMISTER
HESS OIL VIRGIN ISLAND CORP. - HOVIC	VI		12/14/1990	225 TPD	4 LB/T ACID PRODUCED	DOUBLE ABSORPTION TOWERS AND CEM

Reference: RACT/BACT/LAER Clearinghouse on EPA's Webpage, 2006.

TABLE 5-2
SO_2 CONTROL TECHNOLOGY FEASIBILITY ANALYSIS FOR THE SULFURIC ACID PLANTS

SO_2 Abatement Method	Technique Now Available	Estimated Efficiency	Technically Feasible and Demonstrated? (Y/N)	Rank Based on Control Efficiency	Employed by the Nos. 7, 8, and 9 SAPs? (Y/N)
Sorbent Injection	Sorbent Furnace Injection	50%	N	--	N
	Sorbent Economiser Injection	50%	N	--	N
	Sorbent Duct Injection	80%	N	--	N
Process Modification	Double-Absorption System	>99.7%	Y	1	Y
Gas Absorption/Wet Scrubbers	Ammonia Scrubbing	>90%	Y	3	N
	Hydrogen Peroxide Scrubbing	>90%	Y	3	N
	Molecular Sieves	>90%	N	--	N
Flue Gas Desulfurization	Sodium Sulfite-Bisulfite Scrubbing	>90%	Y	3	N
	Lime or Calcium Oxide Spray Dryers	80 - 90%	Y	4	N
	Wet Limestone FGD	50 - 98%	Y	2	N
Oxidation	SO_2 Oxidation with Activated Carbon	>90%	Y	3	N

TABLE 5-3
COST EFFECTIVENESS OF AMMONIA SCRUBBING, MOSAIC RIVERVIEW NOS. 7, 8, OR 9 SAP

Cost Items	Cost Factors[a]	Cost ($)
DIRECT CAPITAL COSTS (DCC):		
Purchased Equipment Cost (PEC)		
Absorber + packing + auxiliary equipment	100,000 SCFM[b]	9,400,000
New Blower	100,000 SCFM for providing 30"	250,000
Mist eliminator	~50 candles	300,000
Ammonia storage tank	not necessary	0
Instrumentation	10% of EC	995,000
Freight	5% of EC	497,500
Taxes	6% Sales Tax	597,000
Total PEC:		12,039,500
Direct Installation Costs		
Vendor quote	Included	0
Items excluded from vendor quote:		
Ductwork	100 ft @$300/ft	30,000
Liquid waste piping	1,000 ft @$110/ft	110000
Foundations	12% of PEC	1,444,740
Water/air/electrical supply & piping	10% of PEC	1,203,950
Thermal insulation and lagging	lump	75,000
Total Direct Installation Costs		2,863,690
Total DCC (PEC + Direct Installation):		14,903,190
INDIRECT CAPITAL COSTS (ICC):		
Engineering	2% of PEC (for excluded items)	240,790
Construction and field expenses	2% of PEC (for excluded items)	240,790
Contractor Fees	2% of PEC (for excluded items)	240,790
Startup	1% of PEC	120,395
Performance test +	1% of PEC	120,395
Contingencies (retrofit cost)	25% of PEC	3,009,875
Total ICC:		3,973,035
TOTAL CAPITAL INVESTMENT (TCI):	DCC + ICC	18,876,225
DIRECT OPERATING COSTS (DOC):		
(1) Operating Labor		
Operator	0.5 hr/shift, $16/hr, 8,760 hrs/yr	8,760
Supervisor	15% of operator cost	1,314
(2) Maintenance		
Labor	0.5 hr/shift, $16/hr, 8,760 hrs/yr	8,760
Materials	100% of maintenance labor	8,760
(3) Operating Materials		
Ammonia	48 lbs/hr, $65/ton	13,666
(4) Liquid Waste Disposal	103 lb/hr, $30/ton	13,534
(5) Electricity - Operating	$0.06/kWh, 700 kW, 8760 hr/yr	367,920
Total DOC:		422,714
INDIRECT OPERATING COSTS (IOC):		
Overhead	60% of oper. labor & maintenance	24,756
Property Taxes	1% of total capital investment	188,762
Insurance	1% of total capital investment	188,762
Administration	2% of total capital investment	377,525
Total IOC:		779,805
CAPITAL RECOVERY COSTS (CRC):	CRF of 0.0944 times TCI (20 yrs @ 7%)	1,781,916
ANNUALIZED COSTS (AC):	DOC + IOC + CRC	2,984,434

Footnotes:

[a] Unless otherwise specified, factors and cost estimates reflect OAQPS Cost Manual, Section 3, Sixth edition.

[b] Based on actual costs of ammonia scrubbers on single-absorption SAPs at CF Industries, FL.

APPENDIX A

AIR MODELING PROTOCOL

TO EVALUATE

BEST AVAILABLE RETROFIT TECHNOLOGY (BART) OPTIONS

FOR MOSAIC RIVERVIEW FACILITY

REVISED
AIR MODELING PROTOCOL TO EVALUATE BEST AVAILABLE RETROFIT TECHNOLOGY (BART) OPTIONS FOR AFFECTED MOSAIC FERTILIZER, LLC FACILITIES

Prepared For:
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Gainesville, Florida 32653-1500

January 2007
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1.0 INTRODUCTION

1.1 Objectives

Under 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 U.S. Environmental Protection Agency (EPA) has issued final rules and 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 put in place between August 7, 1962 and 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 equal to or less than 10 microns (PM_{10})].

The Florida Department of Environmental Protection (FDEP) has adopted EPA's visibility protection rules and guidelines contained in 40 CFR 51, Subpart P. FDEP's BART Rules are described in 62-296.340 of the Florida Administrative Code (F.A.C.), effective January 31, 2007.

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 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.

FDEP has identified five Mosaic facilities as BART-eligible sources with multiple BART-eligible emissions units. The Mosaic Bartow facility, which was not included in FDEP's list, has one BART-eligible emissions unit and will be included in the BART analysis of the Mosaic facilities. Mosaic facilities with BART-eligible emissions units include:

- Mosaic Riverview – Facility ID 0570008;
- Mosaic Green Bay – Facility ID 1050053;
- Mosaic South Pierce – Facility ID 1050055;
- Mosaic New Wales – Facility ID 1050059; and
- Mosaic Bartow – Facility ID 1050046.

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 entire 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 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 Mosaic's 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 "common" 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 Mosaic facilities follows the general procedures recommended by VISTAS.

1.2 Location of Source

An area map showing the Mosaic facilities and PSD Class I areas within 300 km of each facility is presented in Figure 1-1. The PSD Class I areas and their distances from the Mosaic plants are as follows:

- Central Florida Minerals Operation (CFMO)
  Chassahowitzka National Wilderness Area (NWA) - 108 km
  Everglades National Park (NP) - 222 km

- Mosaic Riverview - Chassahowitzka NWA – 87 km
  Everglades NP - 239 km
  St. Marks NWA – 291 km

- Mosaic Green Bay - Chassahowitzka NWA – 112 km
  Everglades NP - 223 km

- Mosaic South Pierce - Chassahowitzka NWA- 115 km
  Everglades NP - 217 km

- Mosaic New Wales - Chassahowitzka NWA- 104 km
  Everglades NP - 226 km

- Mosaic Bartow - Chassahowitzka NWA- 106 km
  Everglades NP - 229 km
  Okefenokee NWA – 296 km

The general locations of the Mosaic facilities, in UTM East and North coordinates, all in UTM Zone 17, are as follows:

- CFMO- 414.7 km East, 3,080.3 km North
- Mosaic Riverview - 362.9 km East, 3,082.5 km North
- Mosaic Green Bay - 409.5 km East, 3,080.1 km North
- Mosaic South Pierce - 408.2 km East, 3,073.2 km North
- Mosaic New Wales - 396.6 km East, 3,078.9 km North
- Mosaic Bartow - 409.8 km East, 3,086.6 km North

Physical locations of the Mosaic facilities are as follows:

- CFMO- Hillsborough, Manatee, Polk, & Hardee Counties
- Mosaic Riverview - 8813 US Hwy 41 South, Riverview, Hillsborough County
- Mosaic Green Bay - 4390 CR 640 West, Bartow, Polk County
- Mosaic South Pierce - 7450 Hwy 630, Mulberry, Polk County
- Mosaic New Wales - 3095 Hwy 640 West, Mulberry, Polk County
- Mosaic Bartow - 3200 Hwy 60 West, Bartow, Polk County

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 activity as the "BART exemption analysis" and the second activity 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.

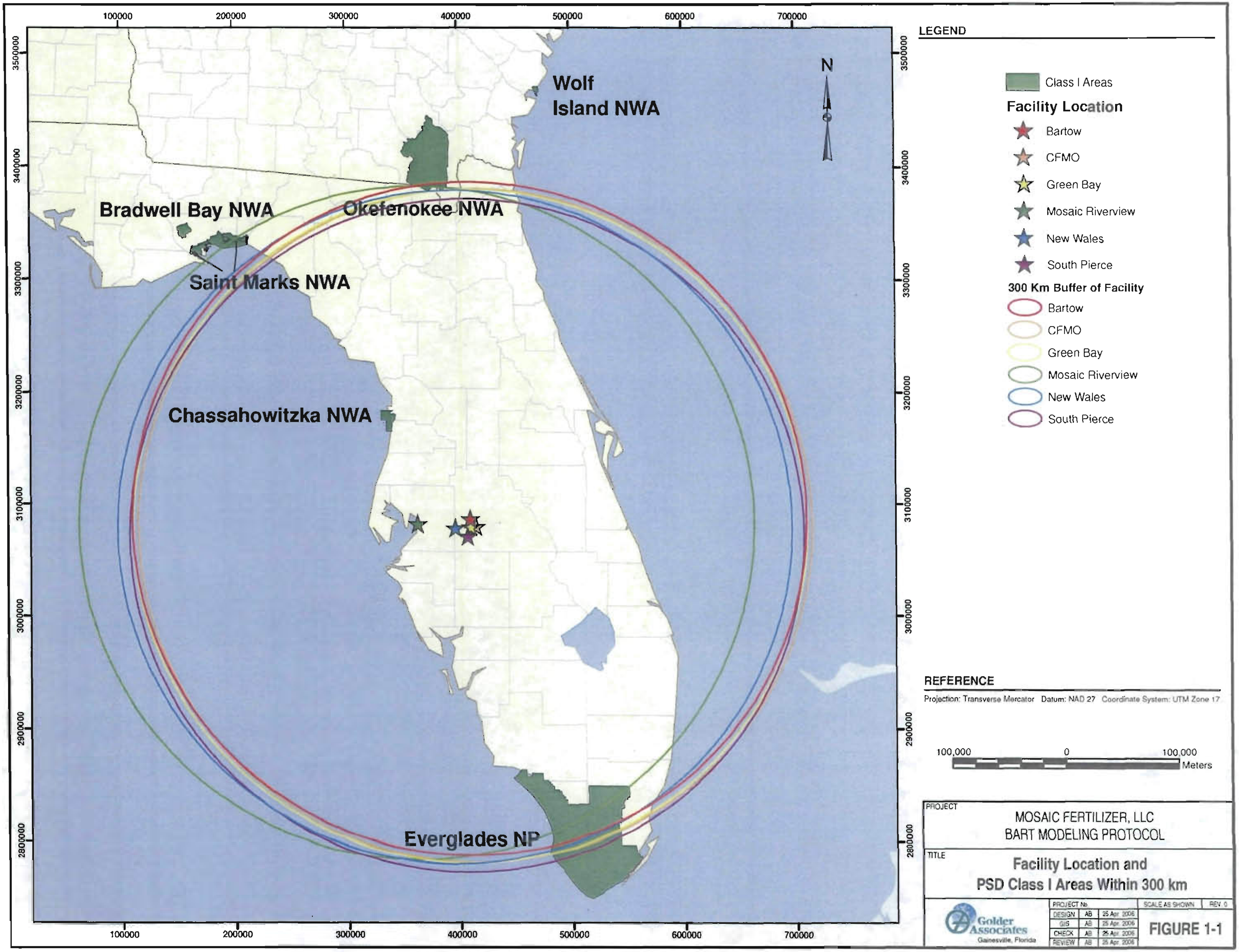
Based on VISTAS recommendations regarding BART exemption analysis, "initial screening" and "refined" analyses can be performed to determine whether a BART-eligible source is subject to or exempt from BART. The initial screening analysis, which is based on a coarse scale 12-km regional VISTAS domain, 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 analyzed by a finer grid resolution. For the Mosaic BART analyses, only the refined analysis will be performed to determine whether the facilities are exempt from BART. All Class I areas within 300 km of each Mosaic facility 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 control analysis, 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.


Wolf Island NWA
Okefenokee NWA
Bradwell Bay NWA
Saint Marks NWA
Chassahowitzka NWA
Everglades NP
N
100000
200000
300000
400000
500000
600000
700000
2800000
2900000
3000000
3100000
3200000
3300000
3400000
3500000
LEGEND
Class I Areas
Facility Location
Bartow
CFMO
Green Bay
Mosaic Riverview
New Wales
South Pierce
300 Km Buffer of Facility
Bartow
CFMO
Green Bay
Mosaic Riverview
New Wales
South Pierce
REFERENCE
Projection: Transverse Mercator Datum: NAD 27 Coordinate System: UTM Zone 17
100,000 0 100,000
Meters
PROJECT
MOSAIC FERTILIZER, LLC
BART MODELING PROTOCOL
TITLE
Facility Location and
PSD Class I Areas Within 300 km
Golder Associates
Gainesville, Florida
PROJECT No.
SCALE AS SHOWN
REV. 0
DESIGN AB 25 Apr 2006
GIS AB 25 Apr 2006
CHECK AB 25 Apr 2006
REVIEW AB 25 Apr 2006
FIGURE 1-1

2.0 SOURCE DESCRIPTION

2.1 Source Applicability

The FDEP published a list of potential BART-eligible sources (updated January 11, 2007), 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 list contains more than 100 potential BART-eligible emissions units at Mosaic facilities. These facilities are on the FDEP list since they are in one of the 26 major source categories identified in the BART regulation (phosphate rock processing plants or chemical process plants) and have potential emissions of visibility impairment pollutants [i.e., SO_2, NO_x, and particulate matter (PM)] from its BART-eligible emissions units that are greater than 250 TPY.

From detailed information obtained from Mosaic, a BART-eligibility analysis was performed to verify the applicability of the BART rule to the facilities as well as the list of BART-eligible units at each facility. This analysis consisted of a three-step procedure.

First, each facility is a BART-eligible source since it is classified under the source category of "Phosphate Rock Processing Plants" or "Chemical Process Plants".

Second, each emissions unit and each facility 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 visibility impairing pollutants, such as volatile organic compounds (VOCs) and ammonia, have been determined by FDEP to have no significant effect on regional haze in Florida.

Based on this analysis, a revised list of BART-eligible emission units at the Mosaic facilities was prepared, which are presented in Tables 2-1 through 2-6. As shown in these tables, the potential annual SO_2, NO_x, and PM_{10} emissions from the BART-eligible emissions units total more than 250 TPY for each pollutant. Because the emissions of one or more pollutants are greater than the 250 TPY threshold, all of these pollutants will be included in the visibility impairment assessment for the facility. Since PM_{10} emissions from the non-fugitive emissions units are greater than 250 TPY, it is not necessary to quantity fugitive particulate matter (PM) emissions from the BART-eligible emissions units for source applicability under the BART regulation. Only the visibility impairing pollutants of SO_2, NO_x, and PM_{10} are required to be included in the visibility modeling analysis. Therefore, BART-eligible emission units that do not emit these pollutants will not be included in the modeling analysis. In addition, FDEP is not requiring fugitive emissions to be included in the modeling unless the source is relatively close to a PSD Class I area (i.e.: 50 km).

The Mosaic Bartow and Mulberry plants share the same facility ID (1050046) under the common name Mosaic Bartow. It was determined that there are no BART-eligible emission units at the Bartow plant and the No. 3 sulfuric acid plant is the only BART-eligible emission unit at the Mulberry plant. Therefore, the Mosaic Bartow facility should be included in the potential BART-eligible source list.

Based on discussions with FDEP, if a BART-eligible emission unit does not emit SO_2, NO_x, or PM_{10}, the emission unit is not required to undergo a BART control technology determination. Also, 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.

2.2 Stack Parameters

The stack height above ground, stack diameter, exit velocity, and exit temperature for the BART-eligible sources at each Mosaic facility are presented in Tables 2-7 to 2-11. Each emission location 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.

Emissions rates to be used for the visibility impairment analyses are presented in Tables 2-12 through 2-16. Detailed emissions calculations for the fuel-burning equipment, for which no permit allowable emissions rates or stack test data are available, are presented in Appendix A.

2.4 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*f(RH) and 4, respectively, where f(RH) is the relative humidity factor.

As shown in Tables 2-2 through 2-6, total PM_{10} emissions from the BART-eligible emissions units at each facility are much lower than the SO_2 emissions. Since PM_{10} emissions are much lower than SO_2 emissions, and the PM speciation profiles for the major PM emission sources are not known, as a conservative approach, all PM_{10} emissions will be considered as organic PM with extinction efficiency of 4.0. Sulfuric acid (H_2SO_4) mist emissions from the sulfuric acid plants (SAPs) will be considered as inorganic condensable PM and will be modeled as SO_4 with the extinction efficiency of 3*f(RH).

2.5 Building Dimension

Based on discussions with FDEP, building downwash effects will not be considered in the modeling because these effects are considered to be minimal in assessing impacts as the distance of the nearest PSD Class I area, which is more than 50 km from all the Mosaic facilities.

TABLE 2-1
BART ELIGIBILITY ANALYSIS FOR MOSAIC PHOSPHATES -- CENTRAL FLORIDA MINING OPERATIONS (CFMO)
FACILITY ID 1050034

EU ID	Emission Unit	BART Category [a]	Dates		In Existence on 8/7/1977 ? (Yes/No)	Began Operation After 8/7/1962 ? (Yes/No)	Meets BART Date Criteria ? (Yes/No)	Meets BART Date Criteria ? (Yes/No)	SO_2, NO_x, or PM Source ? (Yes/No)	BART Eligible ? (Yes/No)	Comments
			Start-Up Date	Initial Construction Date							
007	Soda Ash Storage & Handling	13		>8/7/77	No	Yes	No	No	--	NO	Did not exist on 8/7/77
008	Boiler @ Four Corners Mine	13		1993	No	Yes	No	No	--	NO	Did not exist on 8/7/77
009	Magnetite Storage Bin @ Four Corners Mine (009)	13		1990	No	Yes	No	No	--	NO	Did not exist on 8/7/77
010	Ferrosilicon Storage Bin @ Four Corners Mine	13		1990	No	Yes	No	No	--	NO	Did not exist on 8/7/77
011	Dryer No. 1 @ Noralyn Mine (011)	13	<1962		Yes	No	No	No	--	NO	Began operation before 8/7/62
012	Dryer No. 2 East @ Noralyn Mine (012)	13	<1962		Yes	No	No	No	--	NO	Began operation before 8/7/62
013	Silos 1, 2, 3, 12 @ Noralyn Mine (013)	13	<1962		Yes	No	No	No	--	NO	Began operation before 8/7/62
015	Ball Mill Transfers @ Noralyn Mine (015)	13		1979	No	Yes	No	No	--	NO	Did not exist on 8/7/77
016	Ball Mill No. 3 @ Noralyn Mine (016)	13	<1962		Yes	No	No	No	--	NO	Began operation before 8/7/62
017	Ball Mill No. 4 @ Noralyn Mine (017)	13	<1962		Yes	No	No	No	--	NO	Began operation before 8/7/62
018	No. 3 Ball Mill Loadouts @ Noralyn Mine (018)	13	<1962		Yes	No	No	No	--	NO	Began operation before 8/7/62
019	No. 4 Ball Mill Loadouts @ Noralyn Mine (019)	13	<1962		Yes	No	No	No	--	NO	Began operation before 8/7/62
020	A Track Railcar Loadout @ Noralyn Mine	13		>8/7/77	No	Yes	No	No	--	NO	Did not exist on 8/7/77
021	B Track Railcar Loadout @ Noralyn Mine	13		>8/7/77	No	Yes	No	No	--	NO	Did not exist on 8/7/77
022	Transfer Points To Conveyors C31 & C33 @ Noralyn	13	<1962		Yes	No	No	No	--	NO	Began operation before 8/7/62
023	Material Transfer Sources @ Noralyn	13		1991	No	Yes	No	No	--	NO	Did not exist on 8/7/77
024	Dry Phosphate Transfer @ Noralyn Mine (024)	13	<1962		Yes	No	No	No	--	NO	Began operation before 8/7/62
027	Fugitive Dust Sources	13	<1962		Yes	No	No	No	--	NO	Began operation before 8/7/62
028	Dry Unground Rock Truck Load Out System	13		1998	No	Yes	No	No	--	NO	Did not exist on 8/7/77
029	Flocculation System – Four Corners Mine	13		12/5/2001	No	Yes	No	No	--	NO	Did not exist on 8/7/77
030	Flocculation System – Fort Green Mine	13		12/5/2001	No	Yes	No	No	--	NO	Did not exist on 8/7/77

[a] BART Category 13 is "Phosphate Rock Processing Plants."

TABLE 2-2
BART ELIGIBILITY ANALYSIS FOR MOSAIC RIVERVIEW
FACILITY ID 0570008

EU ID	Emission Unit	BART Category [a]	Dates: Start-Up Date	Dates: Initial Construction Date	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 Emissions [b]: SO_2 (TPY)	NO_x (TPY)	PM_{10} (TPY)	Comments
004	No. 7 Sulfuric Acid Plant	13	--	1974	Yes	Yes	Yes	Yes	Yes	2,044.0	--	--	
005	No. 8 Sulfuric Acid Plant	13	--	1974	Yes	Yes	Yes	Yes	Yes	1724.6	--	--	
006	No. 9 Sulfuric Acid Plant	13		1974	Yes	Yes	Yes	Yes	Yes	2171.8	--	--	
007	DAP Manufacturing Plant	13	--	10/23/1978	No	Yes	No	--	NO	--	--		Did not exist on 8/7/1977
008	GTSP Ground Rock Handling	13	--	--	--	--	--	--		--	--	--	Shut down [c]
022	No. 3 MAP Plant	13	--	<8/7/77	Yes	Yes	Yes	Yes	Yes	--	--	21.25	
023	No. 4 MAP Plant	13	--	<8/7/77	Yes	Yes	Yes	Yes	Yes	--	--	21.25	
024	South Cooler	13	--	<8/7/77	Yes	Yes	Yes	Yes	Yes			51.0	
034	Phosphate Rock Railcar/Truck Unloading System	13	--	--	--	--	--	--		--	--	--	Shut down [c]
041	Sodium Silicofluoride/Sodium Fluoride Plant Dryer	13	--	--	--	--	--	--	--	--	--	--	Shut down [c]
043	Auxiliary Steam Boiler	13	--	12/27/1977	No	Yes	No	--	NO				Did not exist on 8/7/1977
051	West Bag Filter	13	--	8/31/1977	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
052	South Baghouse	13		8/31/1977	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
053	Vessel Loading System -- Tower Baghouse Exhaust	13	--	11/2/1987	No	Yes	No	--	NO				Did not exist on 8/7/1977
054	Sodium Silicofluoride/Sodium Fluoride Plant Handling	13	--	--	--	--	--	--	--	--	--	--	Shut down [c]
055	No. 5 DAP Plant	13	--	1980	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
058	Building #6 Belt to Conveyor #7 Transfer Point	13	--	11/2/1987	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
059	Conveyor #7 to Conveyor #8 Transfer Point with Baghouse	13	--	11/2/1987	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
060	Conveyor #8 to Conveyor #9 Transfer Point with Baghouse	13	--	11/2/1987	No	Yes	No	--	NO	--	--	-	Did not exist on 8/7/1977
061	East Vessel Loading Facility -- Shiphold/Chokefeed	13	--	11/2/1987	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
063	TANK Nos. 1, 2, and 3 for molten sulfur storage w/scrubber	13	--	<8/7/77	Yes	Yes	Yes	Yes	Yes	--	--	1.02	
066	Molten Sulfur Storage and Handling System -- Pit #7	13	--	<8/7/77	Yes	Yes	Yes	Yes	Yes	--	--	1.02	
067	Molten Sulfur Storage and Handling System -- Pit #8	13	--	<8/7/77	Yes	Yes	Yes	Yes	Yes	--	--	1.02	
068	Molten Sulfur Storage and Handling System -- Pit #9	13	--	<8/7/77	Yes	Yes	Yes	Yes	Yes	--	--	1.02	
070	GTSP Storage Building No. 2	13	--	--	--	--	--	--	--	--	--	--	Shut down [c]
071	GTSP Storage Building No. 4	13	--	--	--	--	--	--	--	--	--	--	Shut down [c]
072	GTSP Truck Loading Station	13		--	--	--	--	--	--	--	--	--	Shut down [c]
073	Phosphoric Acid Production Facility	13	--	--	Yes	Yes	Yes	No	Yes	--	--	--	Not a SO_2, NO_x, or PM source
074	Molten Sulfur Storage and Handling System -- Truck Load Stn	13	--	1994	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
078	Animal Feed Ingredient (AFI) Plant No. 1	13	--	1994	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
079	Diatomaceous Earth Silo	13	--	1994	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
080	Limestone Silo	13		1994	No	Yes	No		NO	--		--	Did not exist on 8/7/1977
081	Animal Feed Plant Loadout System	13		1994	No	Yes	No	--	NO		--	--	Did not exist on 8/7/1977
100	Raymond Mill No. 5	13	--	--	--	--	--	--	--	--		--	Shut down [c]
101	Raymond Mill No. 9	13	--	--	--	--	--	--	--	--	--	--	Shut down [c]
102	Ground Rock Handling/Storage System	13	--	--	--	--	--	--	--	--	--	--	Shut down [c]
103	Animal Feed Ingredient Plant No. 2	13	--	Nov-01	No	Yes	No	Yes	NO	--	--	--	Did not exist on 8/7/1977
104	Phosphogypsum Stack	13	--	--	Yes	Yes	Yes	No	Yes	--	--	--	Not a SO_2, NO_x, or PM source
106	No. 7 Rock Drying/Grinding Mill	13	--	--	--	--	--	--	--	--	--	--	Shut down [c]
108	Phosphogypsum Stack (no 2)	13	--	--	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
									Total TPY =	5,940.4	0.0	97.6	

[a] BART Category 13 is "Phosphate Rock Processing Plants."

[b] Permit No. 0570008-045-AV and 0570008-036-AC/PSD-FL-315

[c] Source has been permanently shutdown per Permit No. 0570008-045-AV

TABLE 2-3
BART ELIGIBILITY ANALYSIS FOR MOSAIC GREEN BAY
FACILITY ID 1050053

EU ID	Emission Unit	BART Category [a]	Dates: Start-Up Date	Dates: Initial Construction Date	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 Emissions [b] SO_2 (TPY)	Potential Emissions [b] NO_x (TPY)	Potential Emissions [b] PM_{10} (TPY)	Comments
003	Sulfuric Acid Plant (Double Contact/Absorption) #3	13	--	--	--	--	--	--	--	--	--	--	Shut down [c]
004	Sulfuric Acid Plant (Double Contact/Absorption) #4	13	--	<8/7/77	Yes	Yes	Yes	Yes	Yes	1,533.0	--	--	
005	Sulfuric Acid Plant (Double Contact/Absorption) #5	13	--	2/4/1991	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
007	South AP Fertilizer Plant	13	Oct-65	<8/7/77	Yes	Yes	Yes	Yes	Yes	--	--	35.5	
009	Green Superphosphoric Acid Plant (GSPA)	13	--	--	--	--	--	--	--	--	--	--	Shut down [c]
013	Phosphoric Acid Plant #2 with Scrubber	13	11/1/1976	--	Yes	Yes	Yes	No	Yes	--	--	--	Not a SO_2, NO_x, or PM source
014	Two 54% Phos Acid Storage Tanks at PAD 1 with Scrubber R-R	13	11/13/1975	--	Yes	Yes	Yes	No	Yes	--	--	--	Not a SO_2, NO_x, or PM source
015	Two 54% Phos Acid Storage Tanks at PAD 2 with Scrubber N-N	13	11/13/1975	--	Yes	Yes	Yes	No	Yes				Not a SO_2, NO_x, or PM source
016	Phosphoric Acid Plant No 1 North Train With Wet Scrubber	13	11/10/1976	--	Yes	Yes	Yes	No	Yes	--	--	--	Not a SO_2, NO_x, or PM source
017	Phosphoric Acid Plant No. 1 (South Train)	13	10/10/1975	--	Yes	Yes	Yes	No	Yes				Not a SO_2, NO_x, or PM source
020	Storage and Shipping Buildings for MAP.DAP	13	--	--	Yes	Yes	Yes	Yes	Yes				Fugitive emissions only
026	Auxiliary Process Steam Boiler	13	--	--	--	--	--	--	--	--	--	--	Shut down [c]
028	Superphosphoric Acid Therminol Heater	13	--	--	--	--	--	--	--	--	--	--	Shut down [c]
029	North MAP/DAP Fertilizer Plant	13	--	<8/7/77	Yes	Yes	Yes	Yes	Yes	--	--	139.3	
030	Molten Sulfur Storage Tank 1 - 6000 Short Tons, 9 Vents	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
031	Molten Sulfur Storage Tank 2 (East)-2500 Short Tons, 10 Vent	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
032	Molten Sulfur Storage Tank 3 (West)-2500 Short Tons, 10 Vent	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
033	Molten Sulfur Truck Pit - 72 Short Tons, 1 Vent	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
034	Molten Sulfur Rail (And Back-Up Truck) Pit - 91 Short Tons	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
035	Molten Sulfur No. 5 Supply Pit - 31 Short Tons,	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
036	Molten Sulfur Supply Pit #3 & #4 - 28 Short Tons, One Vent	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
037	Four Phosphoric Acid Blend Tanks	13	3/25/1995	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
038	2750 Tpd No. 6 Sulfuric Acid Plant	13	4/10/1999	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
039	Molten Sulfur Storage Tank No. 4 with 1 Vent	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
040	Phosphogypsum Stack I	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
041	Molten Sulfur No. 6 Supply Pit	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
042	Facility-wide fugitive and unregulated emissions	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
043	Lime Storage Silo	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
044	Phosphogypsum Stack II	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
									Total TPY =	1,533.0	0.0	174.8	

[a] BART Category 13 is "Phosphate Rock Processing Plants."

[b] Permit No. 1050053-037-AV

[c] Source has been permanently shutdown per Permit No. 1050053-037-AV.

TABLE 2-4
BART ELIGIBILITY ANALYSIS FOR MOSAIC - SOUTH PIERCE
FACILITY ID 1050055

EU ID	Emission Unit	BART Category [a]	Dates: Start-Up Date	Dates: Initial Construction Date	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 Emissions [b]: SO_2 (TPY)	Potential Emissions [b]: NO_x (TPY)	Potential Emissions [b]: PM_{10} (TPY)	Comments
001	Auxiliary Boiler	N/A	1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	--	<250 MMBtu/hr and not integral to process [d]
004	Sulfuric Acid Plant No. 10	13	1965	1964	Yes	Yes	Yes	Yes	Yes	2190.0	65.7	--	
005	Sulfuric Acid Plant No. 11	13	1965	1964	Yes	Yes	Yes	Yes	Yes	2190.0	65.7	--	
008	Phosphoric Acid Plant - A Train	13	1965	1964	Yes	Yes	Yes	No	Yes	--	--	--	Not a SO_2, NO_x, or PM source
009	Phosphoric Acid Plant - B Train	13	1965	1964	Yes	Yes	Yes	No	Yes	--	--	--	Not a SO_2, NO_x, or PM source
022	No. 2 Ball Mill Grinding System	13	1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	139.2	
023	GTSP Production Plant	13	1965	1964	Yes	Yes	Yes	Yes	Yes	745.0 [c]	104.4 [c]	153.0	
024	GTSP East Storage Building - North Scrubber	13	1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	175.6	
025	GTSP East Storage Building - South Scrubber	13	1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	175.6	
026	GTSP Rock Hopper Bin	13	1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	98.6	
030	Molten Sulfur Storage - (East) Tank 1 - Vent 1	13	1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	--	Fugitive emissions only
031	Molten Sulfur Storage - (East) Tank 1 - Vent 2	13	1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	--	Fugitive emissions only
032	Molten Sulfur Storage - (East) Tank 1 - Vent 3	13	1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	--	Fugitive emissions only
033	Molten Sulfur Storage - (East) Tank 1 - Vent 4	13	1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	--	Fugitive emissions only
034	Molten Sulfur Storage - (East) Tank 1 - Vent 5	13	--	--	--	--	--	--	--	--	--	--	Removed [e]
035	Molten Sulfur Storage - (West) Tank 2 - Vent 1	13	1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	--	Fugitive emissions only
036	Molten Sulfur Storage - (West) Tank 2 - Vent 2	13	1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	--	Fugitive emissions only
037	Molten Sulfur Storage - (West) Tank 2 - Vent 3	13	1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	--	Fugitive emissions only
038	Molten Sulfur Storage - (West) Tank 2 - Vent 4	13	1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	--	Fugitive emissions only
039	Molten Sulfur Storage - (West) Tank 2 - Vent 5	13	1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	--	Fugitive emissions only
040	Molten Sulfur Truck Pit, East Vent, with fan	13	1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	--	Fugitive emissions only
041	Molten Sulfur Truck Pit, East Vent, without fan	13	1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	--	Fugitive emissions only
042	Molten Sulfur Truck Pit, West Vent, with fan	13	1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	--	Fugitive emissions only
043	Molten Sulfur Truck Pit, West Vent, without fan	13	1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	--	Fugitive emissions only
044	Molten Sulfur Rail Pit, North Vent	13	--	--	--	--	--	--	--	--	--	--	Removed [e]
045	Molten Sulfur Rail Pit, South Vent	13	--	--	--	--	--	--	--	--	--	--	Removed [e]
048	PHOSPHOGYPSUM STACK	13	1965	1964	Yes	Yes	Yes	No	Yes	--	--	--	Not a SO_2, NO_x, or PM source
049	FUGITIVE EMISSIONS	13	1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	--	Fugitive emissions only
050	Molten Sulfur Transfer Pit with two vents	13	--	June,2003	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
									Total TPY=	5,125.0	235.8	742.0	

[a] BART Category 13 is "Phosphate Rock Processing Plants."
[b] Permit No. 1050055-014-AV.
[c] See Appendix A for Calculation.
[d] The Auxiliary Boiler (EU 001) has a heat input of less than 250 MMBtu/hr and only provides steam to the process, and is therefore exempt based on EPA guidelines.
[e] Source removed per Permit No. 1050055-014-AV.

TABLE 2-5
BART ELIGIBILITY ANALYSIS FOR MOSAIC - NEW WALES
FACILITY ID 1050059

EU ID	Emission Unit	BART Category [a]	Dates: Start-Up Date	Dates: Initial Construction Date	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 Emissions [b] SO_2 (TPY)	Potential Emissions [b] NO_x (TPY)	Potential Emissions [b] PM_{10} (TPY)	Comments
002	Sulfuric Acid Plant No. 1	13	1975	1973	Yes	Yes	Yes	Yes	Yes	2172.0	63.5	--	
003	Sulfuric Acid Plant No. 2	13	1975	1973	Yes	Yes	Yes	Yes	Yes	2172.0	63.5	--	
004	Sulfuric Acid Plant No. 3	13	1975	1973	Yes	Yes	Yes	Yes	Yes	2172.0	63.5	--	
005	Ground Phosphate Rock Railcar Unloading	13	--	--	--	--	--	--	--	--	--	--	Shut down [c]
006	Ground Phosphate Rock Silo	13	--	--	--	--	--	--	--	--	--	--	Shut down [c]
008	Phosphoric Acid Plant (East)	13	1975	1973	Yes	Yes	Yes	No	Yes	--	--	--	Only fluoride emissions
009	DAP Plant No. 1	13	1975	1973	Yes	Yes	Yes	Yes	Yes	127.0 [c]	44.5 [c]	125.3	
010	GTSP Plant	13	--	--	--	--	--	--	--	--	--	--	Shut down [c]
011	MAP Plant	13	1975	1973	Yes	Yes	Yes	Yes	Yes	--	--	65.7	
012	GTSP Storage Building	13	--	--	--	--	--	--	--	--	--	--	Shut down [c]
013	Auxiliary Boiler	13	--	--	--	--	--	--	--	--	--	--	Shut down [c]
015	Animal Feed Ingredients (AFI) Shipping/Truck Loading	13	1978	1976	Yes	Yes	Yes	Yes	Yes	--	--	15.8	
017	Phosphoric Acid Plant (West)	13	1975	1973	Yes	Yes	Yes	No	Yes	--	--	--	Only fluoride emissions
021	Ground Phosphate Rock Bin	13	--	--	--	--	--	--	--	--	--	--	Shut down [c]
023	AFI Storage Silos (3) - "A" Side	13	1978	1976	Yes	Yes	Yes	Yes	Yes	--	--	20.8	
024	AFI Shipping Rail Car Loading	13	1978	1976	Yes	Yes	Yes	Yes	Yes	--	--	15.8	
025	AFI Limestone Storage Silos (2)	13	1978	1976	Yes	Yes	Yes	Yes	Yes	--	--	15.8	
026	AFI Silica Unloading and Storage	13	1978	1976	Yes	Yes	Yes	Yes	Yes	--	--	7.0	
027	AFI Plant	13	1978	1976	Yes	Yes	Yes	Yes	Yes	618.9 [c]	185.3 [c]	161.2	
028	AFI Storage Silos (3) - "B" Side	13	1978	1976	Yes	Yes	Yes	Yes	Yes	--	--	20.8	
029	Fertilizer Truck/Rail Loadout No. 1	13	1975	1973	Yes	Yes	Yes	Yes	Yes	--	--	20.5	
030	Multifos Soda Ash Unloading System	13	1979	6/3/1977	Yes	Yes	Yes	Yes	Yes	--	--	0.44 [d]	
031	Multifos Soda Ash Conveying System	13	1979	6/3/1977	Yes	Yes	Yes	Yes	Yes	--	--	0.26 [d]	
032	Multifos "A" Kiln Cooler	13	1979	6/3/1977	Yes	Yes	Yes	Yes	Yes	--	--	5.69 [d]	
033	Multifos "B" Kiln Cooler	13	1979	6/3/1977	Yes	Yes	Yes	Yes	Yes	--	--	8.32 [d]	
034	Multifos A & B Kilns Milling & Sizing - West Bag	13	1979	6/3/1977	Yes	Yes	Yes	Yes	Yes	--	--	1.75 [d]	
035	Multifos A & B Kilns Milling & Sizing - East Bag	13	1979	6/3/1977	Yes	Yes	Yes	Yes	Yes	--	--	1.75 [d]	
036	Multifos A and B Kilns, Dryer and Blending Operation	13	1979	6/3/1977	Yes	Yes	Yes	Yes	Yes	1426.9 [c]	200.0 [c]	130.7	
037	Fertilizer Truck Loadout No. 2	13		1980	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
038	Multifos A&B Kilns Milling&Sizing - Surge Bin	13	1979	6/3/1977	Yes	Yes	Yes	Yes	Yes	--	--	3.9 [d]	
039	Phosphoric Acid Plant No. 3	13		1979	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
041	Fertilizer Truck Loadout No. 3	13		1980	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
042	Sulfuric Acid Plant #4	13	1982	1980	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
043	Fertilizer Rail Loadout No. 2	13		1980	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
044	Sulfuric Acid Plant #5	13	1982	1980	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
045	DAP Plant #2--East Train	13		1980	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
046	DAP Plant #2--West Train	13		1980	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
047	DAP Plant #2 West Product Cooler	13		1980	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
048	Uranium Recovery Operations -- Acid Clean Up	13	1980	1978	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
049	Uranium Recovery Operations -- Solvent Extraction	13	--	--	--	--	--	--	--	--	--	--	Shut down [c]
050	Uranium Recovery Operations -- Uranium Refining	13	--	--	--	--	--	--	--	--	--	--	Shut down [c]
051	Uranium Recovery Operations -- Clay Storage	13	--	--	--	--	--	--	--	--	--	--	Shut down [c]
052	AFI Limestone Feed Bin	13	1978	1976	Yes	Yes	Yes	Yes	Yes	--	--	15.8	

TABLE 2-5
BART ELIGIBILITY ANALYSIS FOR MOSAIC - NEW WALES
FACILITY ID 1050059

EU ID	Emission Unit	BART Category [a]	Dates: Start-Up Date	Dates: Initial Construction Date	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 Emissions [b]: SO_2 (TPY)	Potential Emissions [b]: NO_x (TPY)	Potential Emissions [b]: PM_{10} (TPY)	Comments
053	Phosphoric Acid Clarification and Storage Area	13	1975	1973	Yes	Yes	Yes	No	Yes	--	--	--	Only fluoride emissions
054	DAP Plant No. 1 Cooler	13	--	--	--	--	--	--	--	--	--	--	Removed[f]
055	MAP Plant Cooler	13	1975	1973	Yes	Yes	Yes	Yes	Yes	--	--	17.5	
056	DAP Plant #2 East Product Cooler	13	1991	1990	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
059	Fertilizer Rail Loadout No. 3	13		1980	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
060	7500 Ton Rail Molten Storage Tank	13	1998	1997	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
061	Molten Sulfur - 2000 Ton Tank No 2, south (removed)	13	--	--	--	--	--	--	--	--	--	--	Shutdown[f]
062	5000 Ton Molten Storage Tank	13	1982	1980	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
063	1500 Ton Truck Unloading Sulfur Pit	13	1975	1973	Yes	Yes	Yes	Yes	Yes	1.2	--	0.8	
064	350 Ton Truck Unloading Sulfur Pit	13	1982	1980	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
065	Railcar Unloading Pit	13	1982	1980	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
066	200 Ton Molten Sulfur Transfer Pit	13	1975	1973	Yes	Yes	Yes	Yes	Yes	0.4	--	0.4	
067	1500 Ton Truck Unloading Sulfur Pit, Front Vent	13	1975	1973	Yes	Yes	Yes	Yes	Yes	1.2	--	0.8	
068	1500 Ton Truck Unloading Sulfur Pit, Rear Vent	13	1975	1973	Yes	Yes	Yes	Yes	Yes	1.2	--	0.8	
069	350 Ton Truck Unloading Sulfur Pit, Vent	13	1982	1980	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
070	Limestone Storage Silo/Rock Grinding	13		1996	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
071	Phosphogypsum stack	13	1975	1973	Yes	Yes	Yes	No	Yes	---	--	--	Only fluoride emissions
072	Facility-Wide Fugitive Emissions	13	1975	1973	Yes	Yes	Yes	Yes	Yes	--	--	--	Fugitive emissions only
074	Multifos C Kiln	13	10/26/99		No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
075	Multifos Kiln C Cooler Baghouse	13	10/26/99		No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
076	Multifos Kiln C Milling & Sizing Baghouse	13	10/26/99		No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
078	GRANULAR MAP PLANT	13	1/18/2001		No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
079	Molten sulfur pit - 200 ton (not constructed)	13	--	na	--	--	--	--	--	--	--	--	Source does not exist
080	Molten Sulfur Truck Loading (1 of 2 constructed)	13		2002	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
081	89.5 MMBTU/hr. boiler (non-NSPS) - rental boiler	13	--	--	--	--	--	--	--	--	--	--	Source eliminated [e]
									Total TPY =	8,692.8	620.3	657.6	

[a] BART Category 13 is "Phosphate Rock Processing Plants."

[b] Permit No. 1050059-014-AV

[c] See Appendix A for Calculation.

[d] Based on stack test data and 8760 hr/yr operation.

[e] Permit No. 1050059-045-AV.

[f] Source does not exist in Permit No. 1050059-045-AV.

TABLE 2-6
BART ELIGIBILITY ANALYSIS FOR MOSAIC BARTOW
FACILITY ID 1050046

EU ID	Emission Unit	BART Category[a]	Dates: Start-Up Date	Dates: Initial Construction Date	Dates: In Existence on 8/7/1977 ? (Yes/No)	Dates: 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 Emissions[b] SO_2 (TPY)	Potential Emissions[b] NO_x (TPY)	Potential Emissions[b] PM_{10} (TPY)	Comments
	Bartow Plant												
001	NO. 3 FERTILIZER PLANT	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
002	No. 4 Fertilizer Shipping Plant	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
004	No. 3 Fertilizer Shipping Plant	13	<8/7/62	<8/7/77	No	No	No	--	NO	--	--	--	Began operation before 8/7/62
010	Phosphoric Acid Plant (No. 4 -- V-Train, and No. 5 -- U-Train)	13	--	--	Yes	Yes	Yes	No	Yes	--	--	--	Only fluoride emissions
012	No. 4 Sulfuric Acid Plant	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
021	NO. 4 FERTILIZER PLANT	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
032	No. 6 Sulfuric Acid Plant	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
033	No. 5 Sulfuric Acid Plant	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
034	No. 5 Phosphoric Acid Plant	13	--	7/22/1975	Yes	Yes	Yes	No	Yes	--	--	--	Only fluoride emissions
045	Molten Sulfur System -- Stack 45 from West 200 ton molten sulfur pit	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
046	Molten Sulfur System -- Vent 44 and 44A from 6,000 ton tank	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
047	Molten Sulfur System -- Vent 43, 43A, 43B, 43C and 43D from 3,000 ton tank	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
050	Molten Sulfur System -- Stack 47 from East 300 ton molten sulfur pit	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
051	Cleaver Brooks Package Watertube Boiler	13	--	>8/7/77	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
052	Bartow Phosphogypsum Stack	13	--	--	Yes	Yes	Yes	--	Yes	--	--	--	Only fluoride emissions
	Mulberry Plant												
054	No. 3 Sulfuric Acid Plant	13	12/26/74	--	Yes	Yes	Yes	Yes	Yes	1240.8	--	--	
055	Auxiliary Process Steam Boiler	13	<8/7/62	--	Yes	No	No	--	NO	--	--	--	Began operation before 8/7/62
056	Molten Sulfur Storage/Handling--Truck Delivery Pit	13	4/3/90	--	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
057	Molten Sulfur Storage/Handling--Storage Tank, North Vent	13	4/3/90	--	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
058	Molten Sulfur Storage/Handling--Storage Tank, Southeast Vent	13	4/3/90	--	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
059	Molten Sulfur Storage/Handling--Storage Tank, Southwest Vent	13	4/3/90	--	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
060	Molten Sulfur Storage/Handling--Storage Tank, Middle Vent	13	4/3/90	--	No	Yes	No	--	NO	--	--	--	Did not exist on 8/7/1977
									Total TPY=	1,240.8	0.0	0.0	

[a] BART Category 13 is "Phosphate Rock Processing Plants."
[b] Permit No. 1050046-018-AV

TABLE 2-7
SUMMARY OF STACK AND OPERATING PARAMETERS AND LOCATIONS FOR THE BART-ELIGIBLE EMISSIONS UNITS
MOSAIC RIVERVIEW

EU ID	Emission Unit	Model ID	Stack Parameters[a]				Operating Parameters[a]				
			Height		Diameter		Flow Rate	Exit Temperature		Velocity	
			ft	m	ft	m	(acfm)	°F	K	ft/s	m/s
004	No. 7 Sulfuric Acid Plant	NO7SAP	150	45.72	7.5	2.29	122,000	170	349.8	46.0	14.03
005	No. 8 Sulfuric Acid Plant	NO8SAP	150	45.72	8.0	2.44	105,000	150	338.7	34.8	10.61
006	No. 9 Sulfuric Acid Plant	NO9SAP	150	45.72	9.0	2.74	149,000	152	339.8	39.0	11.90
22,23,24	Nos. 3 and 4 MAP Plants and South Cooler	MAPNO34	133	40.54	7.0	2.13	165,000	142	334.3	71.5	21.78
063	Molten Sulfur Storage Tank Nos. 1, 2, and 3	MSSKTL	33	10.06	0.83	0.25	665	110	316.5	20.5	6.24
66,67,68	Molten Sulfur Storage and Handling -- Pits 7, 8, 9[b]	MSPITS	6	1.83	0.58	0.18	--	70	294.3	0.3	0.1

[a] Stack and operating parameters from PSD Permit Application for facility expansion, May 2001.

Note: All emissions units will be collocated for the purpose of modeling. The facility coordinates are as follows:

UTM Coordinates: Zone 17, 362.9 km East, 3,082.5 km North.

Lat/Long: 27° 51' 28" North, 82° 23' 15" West.

Lambert Conformal Conic (LCC) coordinate, VISTAS Domain: 1,448.7 km, -1,233.5 km.

[b] Modeled as volume sources. Dimensions are based on methods presented in accordance with AERMOD User's Manual, and are as follows:

Physical Dimensions (ft)		Model Dimensions (ft)		
Height (H)	Width (W)	Height (H or H/2)	Sigma Y (W/4.3)	Sigma Z (H/2.15)
8.0	210.0	8.0	48.8	3.72

TABLE 2-8
SUMMARY OF STACK AND OPERATING PARAMETERS AND LOCATIONS FOR THE BART-ELIGIBLE EMISSIONS UNITS
MOSAIC GREEN BAY

			Stack Parameters[a]				Operating Parameters[a]				
			Height		Diameter		Flow Rate	Exit Temperature		Velocity	
EU ID	Emission Unit	Model ID	ft	m	ft	m	(acfm)	°F	K	ft/s	m/s
004	#4 Sulfuric Acid Plant	MOSGB4	100	30.48	7.5	2.29	151,100	180.0	355.4	57.0	17.37
007	South AP Fertilizer Plant	MOSGB7A	130	39.62	5.0	1.52	24,400	151.0	339.3	20.7	6.31
007	South AP Fertilizer Plant	MOSGB7B	129.5	39.47	7.5	2.29	139,500	108.0	315.4	52.6	16.04
029	North MAP/DAP Fertilizer Plant	MOSGB29A	129.5	39.47	7.5	2.29	180,800	105.0	313.7	68.2	20.79
029	North MAP/DAP Fertilizer Plant	MOSGB29B	117	35.66	5.5	1.68	56,100	204.0	368.7	39.4	12.00

[a] Stack and operating parameters from PSD Permit Application for Ammoniated Phosphates Plants dated August, 2005.

Note: All emissions units will be collocated for the purpose of modeling. The facility coordinates are as follows:

UTM Coordinates: Zone 17, 409.5 km East, 3,080.1 km North.

Lat/Long: 27° 50' 21" North, 81° 54' 41" West.

Lambert Conformal Conic (LCC) coordinate, VISTAS Domain: 1,492.85 km, -1,227.83 km.

TABLE 2-9
SUMMARY OF STACK AND OPERATING PARAMETERS AND LOCATIONS FOR THE BART-ELIGIBLE EMISSIONS UNITS
MOSAIC SOUTH PIERCE

			Stack Parameters[a]				Operating Parameters[a]				
			Height		Diameter		Flow Rate	Exit Temperature		Velocity	
EU ID	Emission Unit	Model ID	ft	m	ft	m	(acfm)	°F	K	ft/s	m/s
004	Sulfuric Acid Plant No. 10	SPIER4	150	45.72	9.0	2.74	125,162	169.7	349.7	32.8	9.99
005	Sulfuric Acid Plant No. 11	SPIER5	150	45.72	9.0	2.74	118,163	159.9	344.2	31.0	9.44
022	No. 2 Ball Mill Grinding System	SPIER22	110	33.53	1.8	0.55	4,513	145.5	336.2	29.6	9.01
023	GTSP Production Plant	SPIER23	140	42.67	9.0	2.74	138,527	113.3	318.3	36.3	11.06
024	GTSP East Storage Building - North Scrubber	SPIER24	70	21.34	11.0	3.35	134,892	88.9	304.7	23.7	7.21
025	GTSP East Storage Building - South Scrubber	SPIER25	70	21.34	11.0	3.35	140,830	92.0	306.5	24.7	7.53
026	GTSP Rock Hopper Bin	SPIER26	60	18.29	11.7	3.57	1,325	123.5	324.0	0.03	0.01 [b]
030	Molten Sulfur Storage - (East) Tank 1 - Vent 1[c]	SPIER30	30	9.14	14.0	4.27	--	70.0	294.3	0.03	0.01 [b]
031	Molten Sulfur Storage - (East) Tank 1 - Vent 2[c]	SPIER31	30	9.14	14.0	4.27	--	70.0	294.3	0.03	0.01 [b]
032	Molten Sulfur Storage - (East) Tank 1 - Vent 3[c]	SPIER32	30	9.14	14.0	4.27	--	70.0	294.3	0.03	0.01 [b]
033	Molten Sulfur Storage - (East) Tank 1 - Vent 4[c]	SPIER33	30	9.14	14.0	4.27	--	70.0	294.3	0.03	0.01 [b]
035	Molten Sulfur Storage - (West) Tank 2 - Vent 1[c]	SPIER35	30	9.14	14.0	4.27	--	70.0	294.3	0.03	0.01 [b]
036	Molten Sulfur Storage - (West) Tank 2 - Vent 2[c]	SPIER36	30	9.14	14.0	4.27	--	70.0	294.3	0.03	0.01 [b]
037	Molten Sulfur Storage - (West) Tank 2 - Vent 3[c]	SPIER37	30	9.14	14.0	4.27	--	70.0	294.3	0.03	0.01 [b]
038	Molten Sulfur Storage - (West) Tank 2 - Vent 4[c]	SPIER38	30	9.14	14.0	4.27	--	70.0	294.3	0.03	0.01 [b]
039	Molten Sulfur Storage - (West) Tank 2 - Vent 5[c]	SPIER39	30	9.14	14.0	4.27	--	70.0	294.3	0.03	0.01 [b]
040	Molten Sulfur Truck Pit, East Vent, with fan[d]	SPIER40	10	3.05	12.0	3.66	--	70.0	294.3	0.03	0.01 [b]
041	Molten Sulfur Truck Pit, East Vent, without fan[d]	SPIER41	10	3.05	12.0	3.66	--	70.0	294.3	0.03	0.01 [b]
042	Molten Sulfur Truck Pit, West Vent, with fan[d]	SPIER42	10	3.05	12.0	3.66	--	70.0	294.3	0.03	0.01 [b]
043	Molten Sulfur Truck Pit, West Vent, without fan[d]	SPIER43	10	3.05	12.0	3.66	--	70.0	294.3	0.03	0.01 [b]

[a] Mosaic data.

[b] Horizontal or downward discharge. EUs 40, 41, 42, and 43 have raincap. Exit temperature assumed as ambient.

[c] Emission units 30 to 39 are modeled as one emission unit.

[d] Emission units 40 to 43 are modeled as one emission unit.

Note: All emissions units will be collocated for the purpose of modeling. The facility coordinates are as follows:

UTM Coordinates: Zone 17, 408.2 km East, 3,073.2 km North.

Lat/Long: 27° 46' 56" North, 81° 55' 55" West.

Lambert Conformal Conic (LCC) coordinate, VISTAS Domain: 1,494.852 km, -1,234.567 km.

TABLE 2-10
SUMMARY OF STACK AND OPERATING PARAMETERS AND LOCATIONS FOR THE BART-ELIGIBLE EMISSIONS UNITS
MOSAIC NEW WALES

			Stack Parameters[a]				Operating Parameters[a]				
			Height		Diameter		Flow Rate	Exit Temperature		Velocity	
EU ID	Emission Unit	Model ID	ft	m	ft	m	(acfm)	°F	K	ft/s	m/s
002	Sulfuric Acid Plant No. 1	WALES2	200	60.96	8.5	2.59	139,680	157.2	342.7	41.0	12.50
003	Sulfuric Acid Plant No. 2	WALES3	200	60.96	8.5	2.59	131,990	152.1	339.8	38.8	11.82
004	Sulfuric Acid Plant No. 3	WALES4	200	60.96	8.5	2.59	143,948	162.5	345.6	42.3	12.89
009	DAP Plant No. 1	WALES9	133	40.54	7.0	2.13	168,647	158.5	343.4	73.0	22.26
011	MAP Plant	WALES11	120	36.58	4.0	1.22	43,246	173.8	351.9	57.4	17.48
015	Animal Feed Ingredients (AFI) Shipping/Truck Loading[c]	WALES15	66	20.12	2.5	0.76	5,685	83.9	302.0	0.03	0.01 [b]
023	AFI Storage Silos (3) - "A" Side[c]	WALES23	114	34.75	0.8	0.23	1,812	93.4	307.3	0.03	0.01 [b]
024	AFI Shipping Rail Car Loading[c]	WALES24	103	31.39	2.5	0.76	2,538	90.6	305.7	0.03	0.01 [b]
025	AFI Limestone Storage Silos (2)[c]	WALES25	119	36.27	1.2	0.37	9,727	102.7	312.4	0.03	0.01 [b]
026	AFI Silica Unloading and Storage[c]	WALES26	18	5.49	0.7	0.21	1,522	154.8	341.4	0.03	0.01 [b]
027	AFI Plant	WALES27	172	52.43	8.0	2.44	221,554	153.1	340.5	73.5	22.39
028	AFI Storage Silos (3) - "B" Side[c]	WALES28	114	34.75	0.8	0.23	716	84	302.0	0.03	0.01 [b]
029	Fertilizer Truck/Rail Loadout No. 1[c]	WALES29	132	40.23	3.0	0.91	16,843	97.5	309.5	39.7	12.10
030	Multifos Soda Ash Unloading System[c]	WALES30	5	1.52	0.5	0.15	538	131	328.2	45.7	13.92
031	Multifos Soda Ash Conveying System[c]	WALES31	105	32.00	0.8	0.23	1,354	105	313.7	0.03	0.01 [b]
032	Multifos "A" Kiln Cooler[c]	WALES32	86	26.21	1.5	0.46	30,376	212	373.2	286.5	87.32
033	Multifos "B" Kiln Cooler[c]	WALES33	86	26.21	1.5	0.46	22,665	260	399.8	213.8	65.15
034	Multifos A & B Kilns Milling & Sizing - West Bag Collector[c]	WALES34	71	21.64	2.5	0.76	10,035	136	330.9	0.03	0.01 [b]
035	Multifos A & B Kilns Milling & Sizing - East Bag Collector[c]	WALES35	65	19.81	1.1	0.34	4,525	89.3	305.0	0.03	0.01 [b]
036	Multifos A and B Kilns, Dryer and Blending Operation	WALES36	172	52.43	4.5	1.37	51,469	102.4	312.3	53.9	16.44
038	Multifos A&B Kilns Milling&Sizing - Surge Bin Bag Collector[c]	WALES38	71	21.64	2.5	0.76	4,525	89.3	305.0	0.03	0.01 [b]
052	AFI Limestone Feed Bin[c]	WALES52	116	35.36	0.9	0.27	1,178	99.8	310.8	0.03	0.01 [b]
055	MAP Plant Cooler[c]	WALES55	51	15.54	4.3	1.31	19,188	131.2	328.3	0.03	0.01 [b]
063	1500 Ton Truck Unloading Sulfur Pit[c]	WALES63	40	12.19	2.0	0.61	80	240	388.7	0.42	0.13
066	200 Ton Molten Sulfur Transfer Pit[c]	WALES66	12	3.66	1.0	0.30	--	240	388.7	0.03	0.01 [b]
067	1500 Ton Truck Unloading Sulfur Pit, Front Vent[c]	WALES67	10	3.05	1.0	0.30	--	90	305.4	0.03	0.01 [b]
068	1500 Ton Truck Unloading Sulfur Pit, Rear Vent[c]	WALES68	10	3.05	1.0	0.30	--	90	305.4	0.03	0.01 [b]

[a] Mosaic data.

[b] Horizontal discharge. EUs 66, 67, and 68 have raincap.

[c] Emissions units 15 to 26, 28 to 35, and 38 to 68 are modeled as one emission unit using the stack parameters of EU 68.

Note: All emissions units will be collocated for the purpose of modeling. The facility coordinates are as follows:

UTM Coordinates: Zone 17, 396.6 km East, 3,078.9 km North.

Lat/Long: 27° 49' 56" North, 82° 03' 00" West.

Lambert Conformal Conic (LCC) coordinate, VISTAS Domain: 1,482.32 km, -1,230.95 km.

TABLE 2-11
SUMMARY OF STACK AND OPERATING PARAMETERS AND LOCATIONS FOR THE BART-ELIGIBLE EMISSIONS UNITS
MOSAIC BARTOW

			Stack Parameters[a]				Operating Parameters[a]				
			Height		Diameter		Flow Rate	Exit Temperature		Velocity	
EU ID	Emission Unit	Model ID	ft	m	ft	m	(acfm)	°F	K	ft/s	m/s
054	No. 3 Sulfuric Acid Plant	BARTOW54	200	60.96	7.0	2.13	77,550	153.0	340.4	33.6	10.24

[a] Stack and operating parameters from Title V renewal application dated May, 2004.

Note: All emissions units will be collocated for the purpose of modeling. The facility coordinates are as follows:

UTM Coordinates: Zone 17, 409.8 km East, 3,086.6 km North.

Lat/Long: 27° 54' 10" North, 81° 54' 59" West.

Lambert Conformal Conic (LCC) coordinate, VISTAS Domain: 1,494.137 km, -1,220.920 km.

TABLE 2-12
SUMMARY OF MAXIMUM 24-HOUR AVERAGE EMISSION RATES FOR THE BART-ELIGIBLE EMISSIONS UNITS
MOSAIC RIVERVIEW

Source	EU ID	Model ID	PM_{10} lb/hr	NO_x lb/hr	SO_2 lb/hr	H_2SO_4 [h] lb/hr
No. 7 Sulfuric Acid Plant	004	NO7SAP	--	16.0 [b]	467.0 [a]	16.0 [a]
No. 8 Sulfuric Acid Plant	005	NO8SAP	--	13.5 [b]	393.8 [c]	11.3 [c]
No. 9 Sulfuric Acid Plant	006	NO9SAP	--	17.0 [b]	495.8 [c]	14.2 [c]
Nos. 3 and 4 MAP Plants and South Cooler	22,23,24	MAPNO34	22 [a]	0.47 [b]	0.003 [b]	--
Molten Sulfur Storage Tank Nos. 1, 2, and 3	063	MSTKTL	0.28 [b]	--	3.34 [b]	--
Molten Sulfur Storage and Handling -- Pits 7, 8, 9	66,67,68	MSPITS	1.31 [b]	--	0.13 [b]	--

[a] Based on permit limit in permit No. 0570008-045-AV

[b] Based on PSD permit application for facility expansion dated May, 2001.

[c] Based on permit limit in permit No. 0570008-036-AC/PSD-FL-315

TABLE 2-13
SUMMARY OF MAXIMUM 24-HOUR AVERAGE EMISSION RATES FOR THE BART-ELIGIBLE EMISSIONS UNITS
MOSAIC GREEN BAY

Source	EU ID	Model ID	PM_{10} lb/hr	NO_x lb/hr	SO_2 lb/hr	H_2SO_4 lb/hr
#4 Sulfuric Acid Plant	004	MOSGB4	--	10.5 [a]	350.0 [b]	13.1 [b]
South AP Fertilizer Plant - Reactor/Granulator	007	MOSGB7	5.9 [b]	--	--	--
South AP Fertilizer Plant - Dryer	007	MOSGB7B	5.9 [b]	12.6 [c]	3.2 [c]	0.053 [c]
North MAP/DAP Fertilizer Plant - Main Stack (Dryer)	029	MOSGB29A	15.9 [b]	7.4 [c]	2.6 [c]	0.044 [c]
North MAP/DAP Fertilizer Plant - R/G Stack	029	MOSGB29B	15.9 [b]	--	--	--

[a] Calculated based on emission limit of No. 6 SAP (0.12 lb/ton H_2SO_4) and 2,100 TPD of production capacity.

[b] Permit allowable emission rates from Permit 1050053-037-AV.

[c] See Appendix A for calculation.

TABLE 2-14
SUMMARY OF MAXIMUM 24-HOUR AVERAGE EMISSION RATES FOR THE BART-ELIGIBLE EMISSIONS UNITS
MOSAIC SOUTH PIERCE

Source	EU ID	Model ID	PM_{10} lb/hr	NO_x lb/hr	SO_2 lb/hr	H_2SO_4 lb/hr
Sulfuric Acid Plant No. 10	004	MOSSP4	--	--	494.7 [b]	18.6 [b]
Sulfuric Acid Plant No. 11	005	MOSSP5	--	--	477.2 [b]	17.9 [b]
No. 2 Ball Mill Grinding System	022	MOSSP22	31.8 [c]	--	--	--
GTSP Production Plant	023	MOSSP23	35.0 [c]	23.8 [a]	170.1 [a]	2.2 [a]
GTSP East Storage Building - North Scrubber	024	MOSSP24	20.1 [c]	--	--	--
GTSP East Storage Building - South Scrubber	025	MOSSP25	20.1 [c]	--	--	--
GTSP Rock Hopper Bin	026	MOSSP26	22.5 [c]	--	--	--
Molten Sulfur Storage - (East) Tank 1 - Vent 1	030	MOSSP30	0.14 [c]	--	0.18 [c]	--
Molten Sulfur Storage - (East) Tank 1 - Vent 2	031	MOSSP31	0.14 [c]	--	0.18 [c]	--
Molten Sulfur Storage - (East) Tank 1 - Vent 3	032	MOSSP32	0.14 [c]	--	0.18 [c]	--
Molten Sulfur Storage - (East) Tank 1 - Vent 4	033	MOSSP33	0.14 [c]	--	0.18 [c]	--
Molten Sulfur Storage - (West) Tank 2 - Vent 1	035	MOSSP35	0.11 [c]	--	0.14 [c]	--
Molten Sulfur Storage - (West) Tank 2 - Vent 2	036	MOSSP36	0.11 [c]	--	0.14 [c]	--
Molten Sulfur Storage - (West) Tank 2 - Vent 3	037	MOSSP37	0.11 [c]	--	0.14 [c]	--
Molten Sulfur Storage - (West) Tank 2 - Vent 4	038	MOSSP38	0.11 [c]	--	0.14 [c]	--
Molten Sulfur Storage - (West) Tank 2 - Vent 5	039	MOSSP39	0.11 [c]	--	0.14 [c]	--
Molten Sulfur Truck Pit, East Vent, with fan [d]	040	MOSSP40	--	--	--	--
Molten Sulfur Truck Pit, East Vent, without fan	041	MOSSP41	0.51 [c]	--	0.66 [c]	--
Molten Sulfur Truck Pit, West Vent, with fan [e]	042	MOSSP42	--	--	--	--
Molten Sulfur Truck Pit, West Vent, without fan	043	MOSSP43	0.51 [c]	--	0.66 [c]	--

[a] See Appendix A for calculation.

[b] Based on maximum actual daily production rate during 2001-2003 and permit allowable emission limit in lb/ton H_2SO_4 production.

[c] Permit allowable emission rates from Permit 1050055-014-AV.

[d] Duplicate of EU 041.

[e] Duplicate of EU 043.

Notes:
Emission units 30 to 39 are modeled as one emisison unit.
Emission units 40 to 43 are modeled as one emisison unit.

TABLE 2-15
SUMMARY OF MAXIMUM 24-HOUR AVERAGE EMISSION RATES FOR THE BART-ELIGIBLE EMISSIONS UNITS
MOSAIC NEW WALES

Source	EU ID	Model ID	PM_{10} lb/hr	NO_x lb/hr	SO_2 lb/hr	H_2SO_4 [h] lb/hr
Sulfuric Acid Plant No. 1	002	WALES2		14.5 [a]	422.9 [b]	12.1 [b]
Sulfuric Acid Plant No. 2	003	WALES3		14.5 [a]	422.9 [b]	12.4 [b]
Sulfuric Acid Plant No. 3	004	WALES4		14.5 [a]	438.1 [b]	12.5 [b]
DAP Plant No. 1	009	WALES9	26.8 [a]	10.2 [c]	29.0 [c]	0.37 [c]
MAP Plant	011	WALES11	15.0 [a]	--		--
Animal Feed Ingredients (AFI) Shipping/Truck Loading[e]	015	WALES15	3.6 [a]	--	--	--
AFI Storage Silos (3) - "A" Side[e]	023	WALES23	4.8 [a]	--	--	--
AFI Shipping Rail Car Loading[e]	024	WALES24	3.6 [a]	--	--	--
AFI Limestone Storage Silos (2)[e]	025	WALES25	3.6 [a]	--	--	--
AFI Silica Unloading and Storage[e]	026	WALES26	1.6 [a]	--	--	--
AFI Plant	027	WALES27	36.8 [a]	42.3 [c]	141.3 [c]	1.8 [c]
AFI Storage Silos (3) - "B" Side[e]	028	WALES28	4.8 [a]	--	--	--
Fertilizer Truck/Rail Loadout No. 1[e]	029	WALES29	4.7 [a]	--	--	--
Multifos Soda Ash Unloading System[e]	030	WALES30	0.1 [d]	--	--	--
Multifos Soda Ash Conveying System[e]	031	WALES31	0.1 [d]	--	--	--
Multifos "A" Kiln Cooler[e]	032	WALES32	1.3 [d]	--	--	--
Multifos "B" Kiln Cooler[e]	033	WALES33	1.9 [d]	--	--	--
Multifos A & B Kilns Milling & Sizing - West Bag Collector[e]	034	WALES34	0.4 [d]	--	--	--
Multifos A & B Kilns Milling & Sizing - East Bag Collector[e]	035	WALES35	0.4 [d]	--	--	--
Multifos A and B Kilns, Dryer and Blending Operation	036	WALES36	29.83 [a]	45.7 [c]	316.0 [d]	4.2 [c]
Multifos A&B Kilns Milling&Sizing - Surge Bin Bag Collector[e]	038	WALES38	0.9 [d]	--	--	--
AFI Limestone Feed Bin[e]	052	WALES52	3.6 [a]	--	--	--
MAP Plant Cooler[e]	055	WALES55	4.0 [a]	--	--	--
1500 Ton Truck Unloading Sulfur Pit[e]	063	WALES63	0.2 [a]		0.30 [a]	--
200 Ton Molten Sulfur Transfer Pit[e]	066	WALES66	0.1 [a]		0.10 [a]	--
1500 Ton Truck Unloading Sulfur Pit, Front Vent[e]	067	WALES67	0.2 [a]		0.30 [a]	--
1500 Ton Truck Unloading Sulfur Pit, Rear Vent[e]	068	WALES68	0.2 [a]		0.30 [a]	--

[a] Permit allowable emission rates from Permit 1050059-045-AV.

[b] Based on maximum actual daily production rate during 2001-2003 and permit allowable emission limit in lb/ton H_2SO_4 production.

[c] See Appendix A for calculation.

[d] Stack test data from 2001-2003.

[e] Emissions units 15 to 26, 28 to 35, and 38 to 68 are modeled as one emission unit using the stack parameters of EU 68.

TABLE 2-16
SUMMARY OF MAXIMUM 24-HOUR AVERAGE EMISSION RATES FOR THE BART-ELIGIBLE EMISSIONS UNITS
MOSAIC BARTOW

Source	EU ID	Model ID	PM_{10} lb/hr	NO_x lb/hr	SO_2 lb/hr	H_2SO_4 lb/hr
No. 3 Sulfuric Acid Plant	054	BARTOW54	--	--	283.3 [a]	10.6 [a]

[a] Permit allowable emission rates from Permit 1050046-018-AV.

3.0 GEOPHYSICAL AND METEOROLOGICAL DATA

3.1 Modeling Domain and Terrain

CALMET data sets have been developed by EarthTech, Inc. 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 FDEP. As indicated in Section 1.3 of this protocol, the exemption modeling will be based on the finer grid modeling since the Mosaic facilities are large sources that are likely to exceed the initial screening thresholds. Therefore, for the Mosaic BART analyses, 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 domains to be used in the exemption modeling have been supplied by VISTAS. The CALMET data sets contain meteorological data and land use parameters for the three-dimensional modeling domain.

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 Mosaic facilities are as follows:

Month	Chassahowitzka NWA	Everglades NP	Saint Marks NWA	Okefenokee NWA
January	3.8	2.7	3.7	3.5
February	3.5	2.6	3.4	3.2
March	3.4	2.6	3.4	3.1
April	3.2	2.4	3.4	3.0
May	3.3	2.4	3.5	3.6
June	3.9	2.7	4.0	3.7
July	3.9	2.6	4.1	3.7
August	4.2	2.9	4.4	4.1
September	4.1	3.0	4.2	4.0
October	3.9	2.8	3.8	3.8
November	3.7	2.6	3.7	3.5
December	3.9	2.7	3.8	3.6

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 (HI) based on these values.

According to FDEP recommendations, the natural background light extinction may be based on 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 Mosaic's 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 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 document, the annual average background light extinction coefficient for each PSD Class I area and corresponding calculated BKSOIL concentrations are as follows:

- Chassahowitzka NWA – 21.45 Mm-1 (equivalent to 7.63 dv); 11.45 g/m3
- Everglades NP – 20.77 Mm-1 (equivalent to 7.31 dv); 10.77 g/m3
- Saint Marks NWA – 21.53 Mm-1 (equivalent to 7.67 dv); 11.53 g/m3
- Okefenokee NWA – 21.40 Mm-1 (equivalent to 7.61 dv); 11.40 g/m3

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 U.S. Environmental Protection Agency (EPA) and the Federal Land Managers (FLMs) 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.

Because one or more of the Class I areas within 300 km of the CFI's Plant City facility 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 Mosaic's BART-eligible units in addition to the visibility impacts determined using the old IMPROVE equation.

It is assumed that ambient NO_2 concentrations due to Mosaic's BART eligible units would be very small as to cause negligible light absorption, so light absorption by NO_2 gas, which is a new term added to the new IMPROVE algorithm, will not be considered for Mosaic's 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:

- Chassahowitzka NWA – 11 Mm^{-1} ; 0.08 $\mu g/m^3$
- Everglades NP – 11 Mm^{-1} ; 0.31 $\mu g/m^3$
- Saint Marks NWA – 11 Mm^{-1} ; 0.03 $\mu g/m^3$
- Okefenokee NWA – 11 Mm^{-1} ; 0.09 $\mu g/m^3$

4.0 AIR QUALITY MODELING METHODOLOGY

For predicting maximum visibility impairment at the Class I Area, 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 the Mosaic BART modeling has been provided by FDEP. The major features used in preparing these CALMET data have been described in Section 4.0 of the VISTAS BART 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 receptor locations provided by the FLMs. The receptors to be used for each of the PSD Class I areas are presented in Figures 4-1 through 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 default modeling options and modeling options to be used for Mosaic's BART analysis 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 guidance, will be used to compute change in light extinction.

4.6 Quality Assurance and Quality Control (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 will be independently confirmed by an independent modeler not involved in the initial setup of the modeling files. The 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 program.

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 Mosaic. 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:

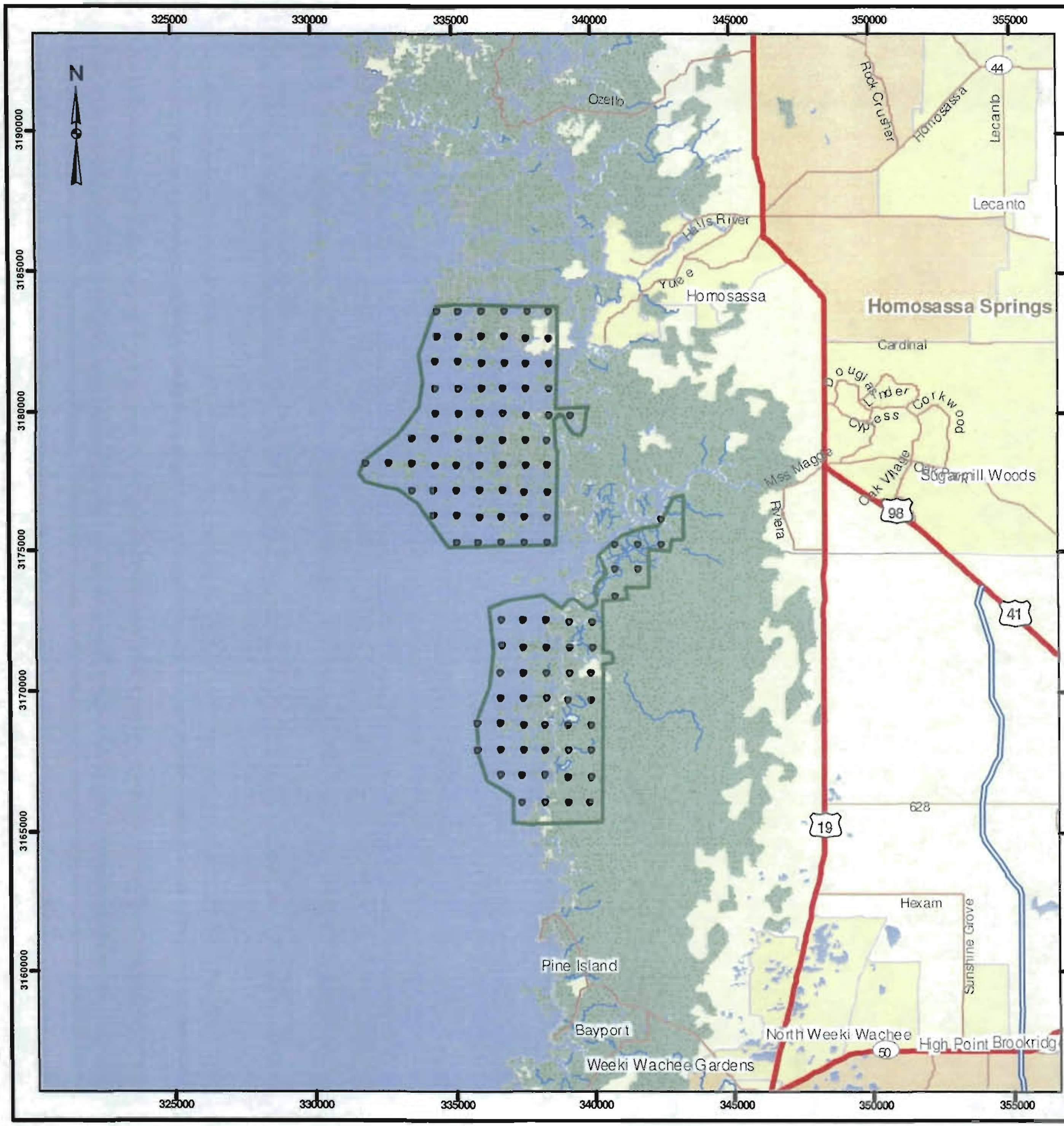
- Appropriate CALPUFF concentrations files are used in the POSTUTIL run;
- The PM species categories are computed using the appropriate fractions;
- Background light extinction computation method selected as Method 6;
- Correct monthly relative humidity adjustment factors used for the appropriate Class 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, which would include the following:
  - 8th highest impact each year;
  - number of days and number of receptors with visibility impacts more than 0.5 dv for each year; and
  - 22nd highest impact over a period of three years.
- 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.

The predicted visibility impairment results for the base emission case and all evaluated BART emission scenarios 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 regulation.



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

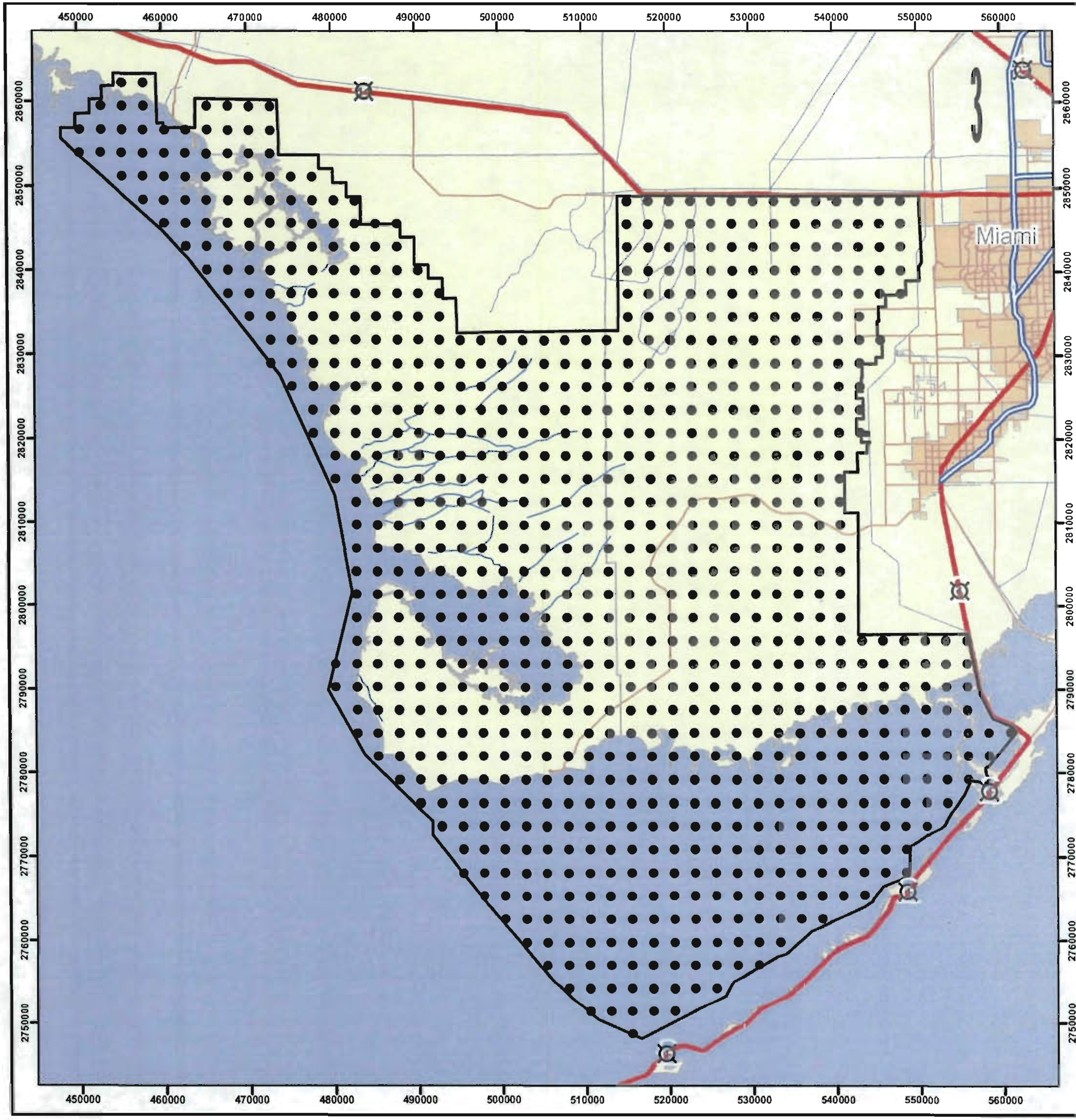
MOSAIC FERTILIZER, LLC
BART MODELING PROTOCOL

TITLE

Chassahowitzka NWA Receptor Grid

Golder Associates
Gainesville, Florida

FIGURE 4-1



LEGEND

Everglades NP

- ● 901 Receptor Grid
- ▭ Class 1 Boundary

REFERENCE

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

15,000 0 15,000 Meters

PROJECT

MOSAIC FERTILIZER, LLC
BART MODELING PROTOCOL

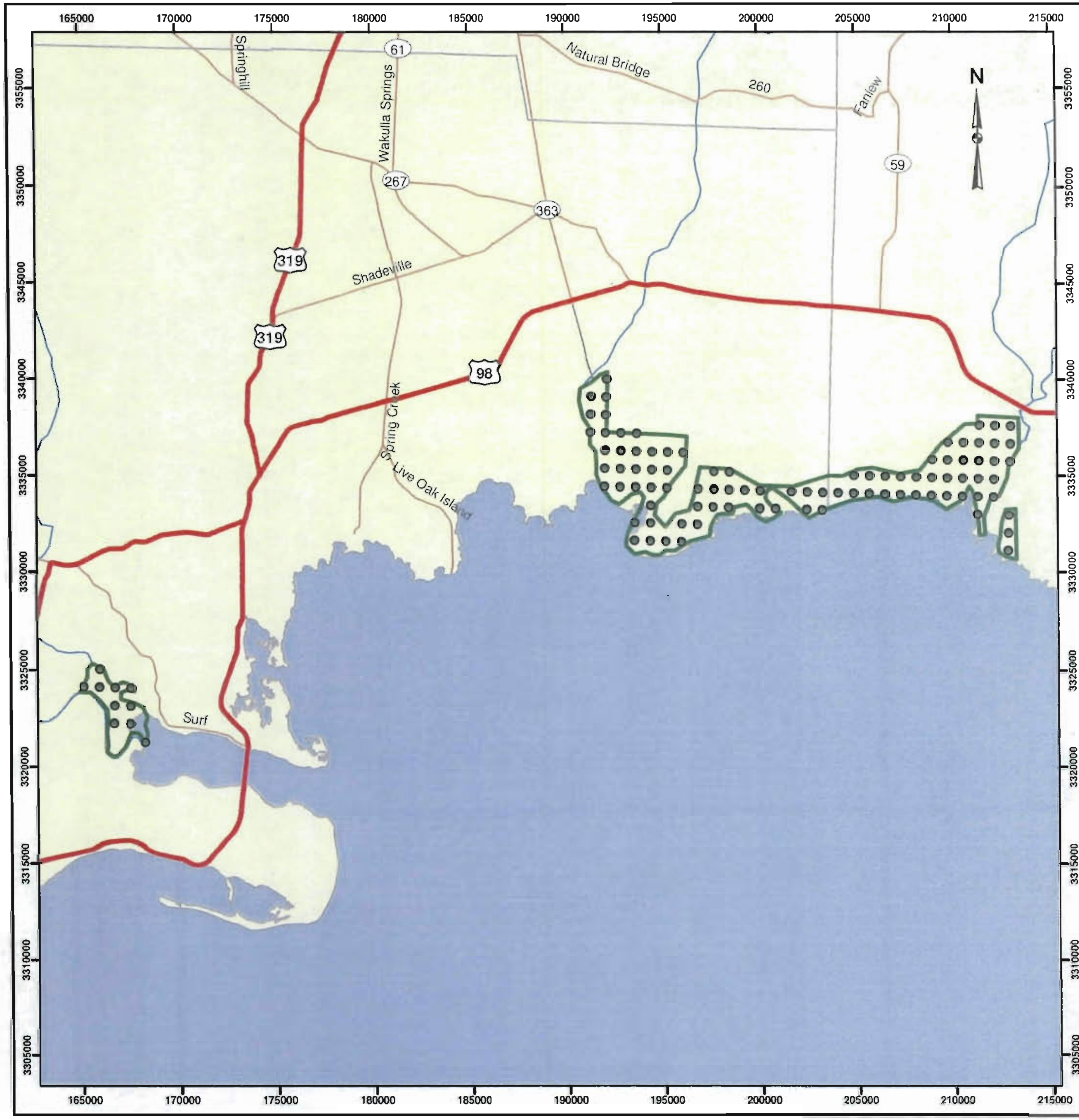
TITLE

Everglades NP Receptor Grid

Golder Associates
Gainesville, Florida

PROJECT No.			SCALE AS SHOWN	REV. 0
DESIGN	AB	25 Apr. 2006		
GIS	AB	25 Apr. 2006		

FIGURE 4-2



LEGEND

Saint Marks NWA

- 101 Receptor Grid
- Class I Boundary

REFERENCE

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

6,000 0 6,000 Meters

PROJECT

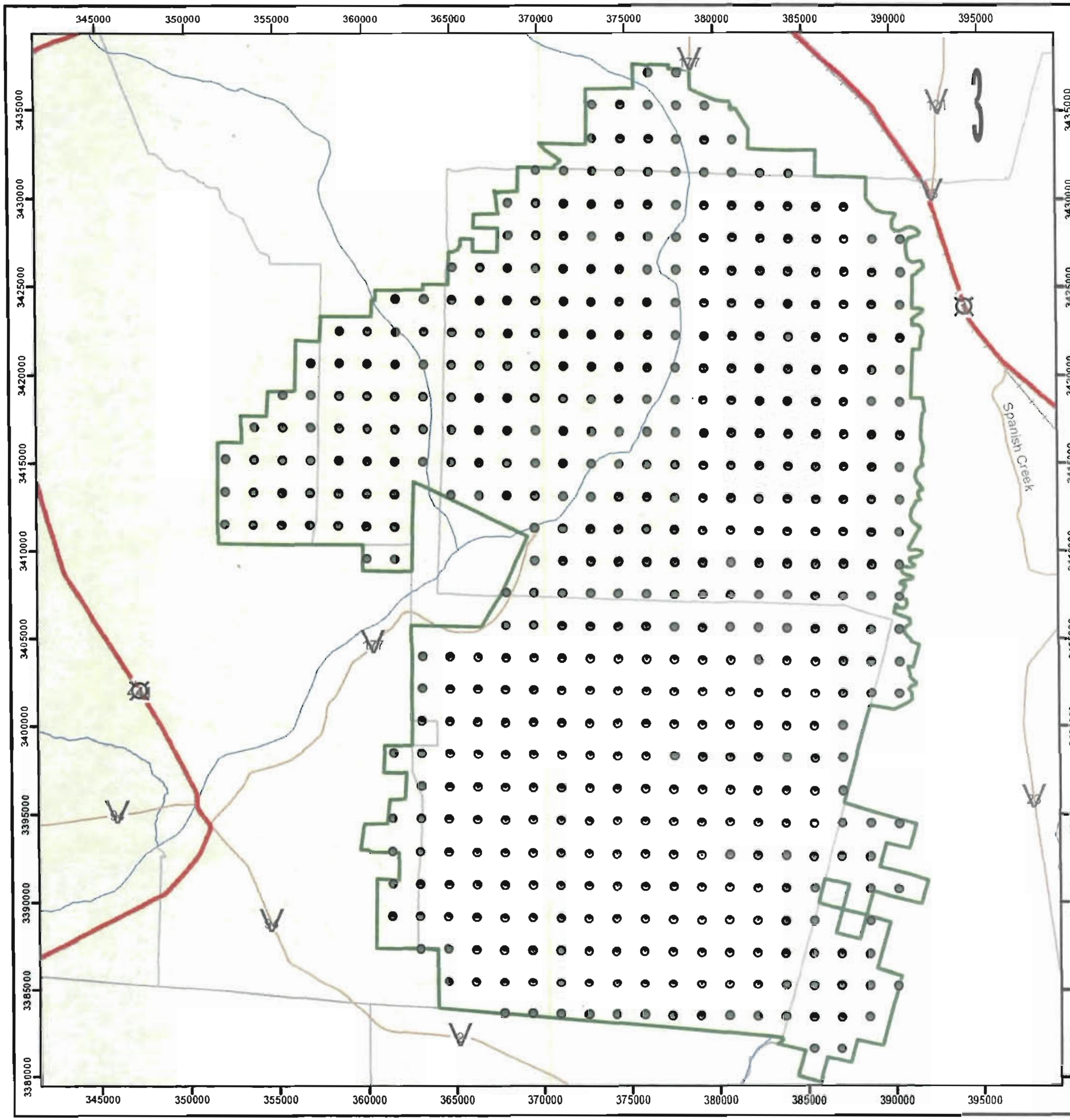
MOSAIC FERTILIZER, LLC
BART MODELING PROTOCOL

TITLE

Saint Marks NWA Receptor Grid

Golder Associates
Gainesville, Florida

FIGURE 4-3



LEGEND

REFERENCE

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

6,000 0 6,000 Meters

PROJECT

BART MODELING PROTOCOL

TITLE

CALPUFF Modeling Receptors Okefenokee

Golder Associates Tampa, Florida

DESIGN AB 09 Nov 2006
GIS AB 09 Nov 2006
SCALE AS SHOWN REV 0

FIGURE 4-4

APPENDIX A

DETAILED EMISSION CALCULATIONS

TABLE A-1
MAXIMUM EMISSION RATES DUE TO FUEL COMBUSTION FOR THE DRYER AT THE SOUTH AP PLANT (EU 007)
MOSAIC GREEN BAY

Parameter	Units	No. 2 Fuel Oil	Natural Gas	LPG
Operating Data				
Annual Operating Hours	hr/yr	8760	8,760	8,760
Maximum Heat Input Rate	10^6Btu/hr	60	60	60
Hourly Fuel Oil Usage[a]	10^3gal/hr	0.44	N/A	N/A
Annual Fuel Oil Usage	10^3gal/yr	3,893	N/A	N/A
Maximum Sulfur Content	Weight %	0.05	N/A	N/A
Hourly Natural Gas Usage[b]	10^6scf/hr	N/A	0.060	N/A
Annual Natural Gas Usage	10^6scf/yr	N/A	525.6	N/A
Maximum Sulfur Content	*gr/100 ft^3*	*N/A*	*N/A*	*15*
Hourly LPG Usage[f]	10^3gal/hr	N/A	N/A	0.663
Annual LPG Usage	10^3gal/yr	N/A	N/A	5,808

Pollutant	AP-42 Emissions Factor[c]	No. 2 Fuel Oil Hourly Emisson Rate (lb/hr)	No. 2 Fuel Oil Annual Emission Rate (TPY)	Natural gas Hourly Emisson Rate (lb/hr)	Natural gas Annual Emission Rate (TPY)	LPG Hourly Emisson Rate (lb/hr)	LPG Annual Emission Rate (TPY)	Maximum Emission Rate Hourly Emisson Rate (lb/hr)	Maximum Emission Rate Annual Emission Rate (TPY)
Sulfur Dioxide									
Fuel oil	142 *(S) lb/10^3gal	3.16	13.82	--	--	--	--	--	--
Natural gas	0.6 lb/10^6ft^3	--	--	0.04	0.16	--	--	--	--
LPG	0.1 *(S)lb/10^3gal	--	--	--	--	0.994	4.36	--	--
Worse-Case Combination of Fuels		--	--	--	--	--	--	3.16	13.82
Sulfuric Acid Mist									
Fuel oil	2.4 *(S) lb/10^3gal	0.05	0.23	--	--	--	--	0.053	0.234
Nitrogen Oxides									
Fuel oil	20 lb/10^3gal	8.89	38.93	--	--	--	--	--	--
Natural gas	100 lb/10^6ft^3	--	--	6.00	26.28	--	--	--	--
LPG	19 lb/10^3gal	--	--	--	--	12.60	55.17	--	--
Worse-Case Combination of Fuels		--	--	--	--	--	--	12.60	55.17

Footnotes:
Particulate matter emissions rates through the common plant stack are included in Table 2-1.
[a] Based on the heat content of fuel oil of 135,000 Btu/gallon.
[b] Based on the heat content of natural gas of 1,000 Btu/scf.
[c] Emission factors for fuel oil are based on AP-42, Section 1.3, September 1998. Emission factors for natural gas are based on AP-42, Section 1.4, July 1998.
[d] S denotes the weight-percent of Sulfur in fuel oil; Maximum sulfur content = 0.05%.
[e] Sulfuric acid mist emission factor based on emission factor for SO_3 (AP-42, Section 1.3) converted to H_2SO_4 using molecular weight.
[f] Based on the heat content of propane of 90,500 Btu/gallon.
[g] S denotes the amount of sulfur in propane; maximum sulfur content = 15 grains/100 ft^3.

TABLE A-2
MAXIMUM EMISSION RATES DUE TO FUEL COMBUSTION FOR THE DRYER AT THE NORTH AP PLANT (EU 029)
MOSAIC GREEN BAY

Parameter	Units	No. 2 Fuel Oil	Natural Gas
Operating Data			
Annual Operating Hours	hr/yr	8,760	8,760
Maximum Heat Input Rate	10^6Btu/hr	50	50
Hourly Fuel Oil Usage [a]	10^3gal/hr	0.370	N/A
Annual Fuel Oil Usage	10^3gal/yr	3,244	N/A
Maximum Sulfur Content	Weight %	0.05	N/A
Hourly Natural Gas Usage [b]	10^6scf/hr	N/A	0.050
Annual Natural Gas Usage	10^6scf/yr	N/A	438
Hourly LPG Usage	10^3gal/hr	N/A	N/A
Annual LPG Usage	10^3gal/yr	N/A	N/A

		No. 2 Fuel Oil		Natural gas		Maximum Emission Rate	
Pollutant	AP-42 Emissions Factor[c]	Hourly Emisson Rate (lb/hr)	Annual Emission Rate (TPY)	Hourly Emisson Rate (lb/hr)	Annual Emission Rate (TPY)	Hourly Emisson Rate (lb/hr)	Annual Emission Rate (TPY)
Sulfur Dioxide							
Fuel oil	142 *(S) lb/10^3gal[d]	2.630	11.52	--	--	--	--
Natural gas	0.6 lb/10^6ft^3	--	--	0.030	0.131	--	--
Worse-Case Combination of Fuels		--	--	--	--	2.63	11.52
Sulfuric Acid Mist							
Fuel oil	2.4 *(S) lb/10^3gal[d,e]	0.044	0.195	--	--	0.044	0.195
Nitrogen Oxides							
Fuel oil	20 lb/10^3gal	7.407	32.44	--	--	--	--
Natural gas	100 lb/10^6ft^3	--	--	5.000	21.900	--	--
Worse-Case Combination of Fuels		--	--	--	--	7.41	32.44

Footnotes:
Particulate matter emissions rates through the common plant stack are included in Table 2-1.
[a] Based on the heat content of fuel oil of 135,000 Btu/gallon.
[b] Based on the heat content of natural gas of 1,000 Btu/scf.
[c] Emission factors for fuel oil are based on AP-42, Section 1.3, September 1998. Emission factors for natural gas are based on AP-42, Section 1.4, July 1998.
[d] S denotes the weight-percent of Sulfur in fuel oil; Maximum sulfur content = 0.05%.
[e] Sulfuric acid mist emission factor based on emission factor for SO_3 (AP-42, Section 1.3) converted to H_2SO_4 using molecular weight.

TABLE A-3
MAXIMUM EMISSION RATES DUE TO FUEL COMBUSTION FOR THE GTSP PRODUCTION PLANT (EU 023)
MOSAIC SOUTH PIERCE

Parameter	Units	No. 6 Fuel Oil	Natural Gas
Operating Data			
Annual Operating Hours	hr/yr	8,760	8,760
Maximum Heat Input Rate	10^6Btu/hr	65	113
Hourly Fuel Oil Usage[a]	10^3gal/hr	0.43	N/A
Annual Fuel Oil Usage	10^3gal/yr	3,796	N/A
Maximum Sulfur Content	Weight %	2.50	N/A
Hourly Natural Gas Usage[b]	10^6scf/hr	N/A	0.113
Annual Natural Gas Usage	10^6scf/yr	N/A	989.9
Maximum Sulfur Content	gr/100 ft^3	N/A	N/A

		No. 2 Fuel Oil		Natural gas		Maximum Emission Rate	
Pollutant	AP-42 Emissions Factor[c]	Hourly Emisson Rate (lb/hr)	Annual Emission Rate (TPY)	Hourly Emisson Rate (lb/hr)	Annual Emission Rate (TPY)	Hourly Emisson Rate (lb/hr)	Annual Emission Rate (TPY)
Sulfur Dioxide							
Fuel oil	157 *(S) lb/10^3gal[d]	170.08	744.97	--	--	--	--
Natural gas	0.6 lb/10^6ft^3	--	--	0.07	0.30	--	--
Worse-Case Combination of Fuels		--	--	--	--	170.08	744.97
Sulfuric Acid Mist							
Fuel oil	2 *(S) lb/10^3gal[d,e]	2.17	9.49	--	--	2.167	9.490
Nitrogen Oxides							
Fuel oil	55 lb/10^3gal	23.83	104.39	--	--	--	--
Natural gas	100 lb/10^6ft^3	--	--	11.30	49.49	--	--
Worse-Case Combination of Fuels		--	--	--	--	23.83	104.39

Footnotes:

[a] Based on the heat content of fuel oil of 150,000 Btu/gallon.

[b] Based on the heat content of natural gas of 1,000 Btu/scf.

[c] Emission factors for fuel oil are based on AP-42, Section 1.3, September 1998. Emission factors for natural gas are based on AP-42, Section 1.4, July 1998.

[d] S denotes the weight-percent of Sulfur in fuel oil; Maximum sulfur content = 2.5%.

[e] Sulfuric acid mist emission factor based on emission factor for SO_3 (AP-42, Section 1.3) converted to H_2SO_4 using molecular weight.

TABLE A-4
MAXIMUM EMISSION RATES DUE TO FUEL COMBUSTION FOR THE DAP PLANT NO. 1 DRYER (EU 009)
MOSAIC NEW WALES

Parameter	**Units**	**No. 6 Fuel Oil**	**Natural Gas**
Operating Data			
Annual Operating Hours	hr/yr	8,760	8,760
Maximum Heat Input Rate	10^6Btu/hr	27.7	27.7
Hourly Fuel Oil Usage[a]	10^3gal/hr	0.18	N/A
Annual Fuel Oil Usage	10^3gal/yr	1,618	N/A
Maximum Sulfur Content	Weight %	1.00	N/A
Hourly Natural Gas Usage[b]	10^6scf/hr	N/A	0.028
Annual Natural Gas Usage	10^6scf/yr	N/A	242.7
Maximum Sulfur Content	gr/100 ft^3	N/A	N/A

Pollutant	AP-42 Emissions Factor[c]	No. 6 Fuel Oil Hourly Emisson Rate (lb/hr)	No. 6 Fuel Oil Annual Emission Rate (TPY)	Natural gas Hourly Emisson Rate (lb/hr)	Natural gas Annual Emission Rate (TPY)	Maximum Emission Rate Hourly Emisson Rate (lb/hr)	Maximum Emission Rate Annual Emission Rate (TPY)
Sulfur Dioxide							
Fuel oil	157 *(S) lb/10^3gal[d]	28.99	126.99	--	--	--	--
Natural gas	0.6 lb/$10^6$$ft^3$	--	--	0.02	0.07	--	--
Worse-Case Combination of Fuels		--	--	--	--	28.99	126.99
Sulfuric Acid Mist							
Fuel oil	2 *(S) lb/10^3gal[d,e]	0.37	1.62	--	--	0.369	1.618
Nitrogen Oxides							
Fuel oil	55 lb/10^3gal	10.16	44.49	--	--	--	--
Natural gas	100 lb/$10^6$$ft^3$	--	--	2.77	12.13	--	--
Worse-Case Combination of Fuels		--	--	--	--	10.16	44.49

Footnotes:

[a] Based on the heat content of fuel oil of 150,000 Btu/gallon.

[b] Based on the heat content of natural gas of 1,000 Btu/scf.

[c] Emission factors for fuel oil are based on AP-42, Section 1.3, September 1998. Emission factors for natural gas are based on AP-42, Section 1.4, July 1998.

[d] S denotes the weight-percent of Sulfur in fuel oil; Maximum sulfur content of fuel oil used since 2001 = 1.0%.

[e] Sulfuric acid mist emission factor based on emission factor for SO_3 (AP-42, Section 1.3) converted to H_2SO_4 using molecular weight.

TABLE A-5
MAXIMUM EMISSION RATES DUE TO FUEL COMBUSTION FOR THE AFI PLANT DRYER (EU 027)
MOSAIC NEW WALES

Parameter	**Units**	**No. 2 Fuel Oil**	**Natural Gas**
Operating Data			
Annual Operating Hours	hr/yr	8,760	8,760
Maximum Heat Input Rate	10^6Btu/hr	135	135
Hourly Fuel Oil Usage[a]	10^3gal/hr	0.90	N/A
Annual Fuel Oil Usage	10^3gal/yr	7,884	N/A
Maximum Sulfur Content	Weight %	1.00	N/A
Hourly Natural Gas Usage[b]	10^6scf/hr	N/A	0.135
Annual Natural Gas Usage	10^6scf/yr	N/A	1182.6
Maximum Sulfur Content	gr/100 ft^3	N/A	N/A

Pollutant	AP-42 Emissions Factor[c]	No. 6 Fuel Oil Hourly Emisson Rate (lb/hr)	No. 6 Fuel Oil Annual Emission Rate (TPY)	Natural gas Hourly Emisson Rate (lb/hr)	Natural gas Annual Emission Rate (TPY)	Maximum Emission Rate Hourly Emisson Rate (lb/hr)	Maximum Emission Rate Annual Emission Rate (TPY)
Sulfur Dioxide							
Fuel oil	157 *(S) lb/10^3gal[d]	141.30	618.89	--	--	--	--
Natural gas	0.6 lb/$10^6$$ft^3$	--	--	0.08	0.35	--	--
Worse-Case Combination of Fuels		--	--	--	--	141.3	618.9
Sulfuric Acid Mist							
Fuel oil	2 *(S) lb/10^3gal[d,e]	1.80	7.88	--	--	1.80	7.88
Nitrogen Oxides							
Fuel oil	47 lb/10^3gal	42.30	185.27	--	--	--	--
Natural gas	100 lb/$10^6$$ft^3$	--	--	13.50	59.13	--	--
Worse-Case Combination of Fuels		--	--	--	--	42.3	185.3

Footnotes:

[a] Based on the heat content of fuel oil of 150,000 Btu/gallon.

[b] Based on the heat content of natural gas of 1,000 Btu/scf.

[c] Emission factors for fuel oil are based on AP-42, Section 1.3, September 1998. Emission factors for natural gas are based on AP-42, Section 1.4, July 1998.

[d] S denotes the weight-percent of Sulfur in fuel oil; Maximum sulfur content of fuel oil used since 2001 = 1.0%.

[e] Sulfuric acid mist emission factor based on emission factor for SO_3 (AP-42, Section 1.3) converted to H_2SO_4 using molecular weight.

TABLE A-6
MAXIMUM EMISSION RATES DUE TO FUEL COMBUSTION FOR THE MULTIFOS A AND B KILNS & DRYER (EU 036)
MOSAIC NEW WALES

Parameter	Units	No. 6 Fuel Oil	Natural Gas
Operating Data			
Annual Operating Hours	hr/yr	8,760	8,760
Maximum Heat Input Rate	10^6Btu/hr	124.5	124.5
Hourly Fuel Oil Usage[a]	10^3gal/hr	0.83	N/A
Annual Fuel Oil Usage	10^3gal/yr	7,271	N/A
Maximum Sulfur Content	Weight %	2.50	N/A
Hourly Natural Gas Usage[b]	10^6scf/hr	N/A	0.125
Annual Natural Gas Usage	10^6scf/yr	N/A	1090.6
Maximum Sulfur Content	gr/100 ft^3	N/A	N/A

Pollutant	AP-42 Emissions Factor[c]	No. 6 Fuel Oil Hourly Emisson Rate (lb/hr)	No. 6 Fuel Oil Annual Emission Rate (TPY)	Natural gas Hourly Emisson Rate (lb/hr)	Natural gas Annual Emission Rate (TPY)	Maximum Emission Rate Hourly Emisson Rate (lb/hr)	Maximum Emission Rate Annual Emission Rate (TPY)
Sulfur Dioxide							
Fuel oil	157 *(S) lb/10^3gal[d]	325.78	1426.89	--	--	--	--
Natural gas	0.6 lb/$10^6$$ft^3$	--	--	0.07	0.33	--	--
Worse-Case Combination of Fuels		--	--	--	--	325.8	1426.89
Sulfuric Acid Mist							
Fuel oil	2 *(S) lb/10^3gal[d,e]	4.15	18.18	--	--	4.15	18.177
Nitrogen Oxides							
Fuel oil	55 lb/10^3gal	45.65	199.95	--	--	--	--
Natural gas	100 lb/$10^6$$ft^3$	--	--	12.45	54.53	--	--
Worse-Case Combination of Fuels		--	--	--	--	45.65	199.95

Footnotes:

[a] Based on the heat content of fuel oil of 150,000 Btu/gallon.

[b] Based on the heat content of natural gas of 1,000 Btu/scf.

[c] Emission factors for fuel oil are based on AP-42, Section 1.3, September 1998.. Emission factors for natural gas are based on AP-42, Section 1.4, July 1998.

[d] S denotes the weight-percent of Sulfur in fuel oil; Maximum sulfur content = 2.5 %.

[e] Sulfuric acid mist emission factor based on emission factor for SO_3 (AP-42, Section 1.3) converted to H_2SO_4 using molecular weight.

APPENDIX B

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)
---------------
                                                            a
          VOLUME SOURCE: VARIABLE EMISSIONS DATA
          ----------------------------------------

     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)
---------------
                                                          a
           NON-GRIDDED (DISCRETE) RECEPTOR DATA
           ------------------------------------

                     X            Y          Ground        Height   b
Receptor         Coordinate   Coordinate    Elevation   Above Ground
  No.               (km)         (km)          (m)           (m)
--------         ----------   ----------    ---------   ------------
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.
```

APPENDIX B

APPLICATION FOR AIR PERMIT – LONG FORM

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: **Mosaic Fertilizer, LLC**	
2. Site Name: **Riverview Plant**	
3. Facility Identification Number: **0570008**	
4. Facility Location...: Street Address or Other Locator: **8813 U.S. Highway 41 South** City: **Riverview** County: **FL** Zip Code: **33569**	
5. Relocatable Facility? ☐ Yes ☒ No	6. Existing Title V Permitted Facility? ☒ Yes ☐ No

Application Contact

1. Application Contact Name: **Jeff Stewart, Environmental Superintendent**
2. Application Contact Mailing Address... Organization/Firm: **Mosaic Fertilizer, LLC** Street Address: **8813 U.S. Highway 41 South** City: **Riverview** State: **FL** Zip Code: **33569**
3. Application Contact Telephone Numbers... Telephone: (**813**) **671- 6369** ext. Fax: (**813**) **671- 6149**
4. Application Contact Email Address: **jeff.stewart@mosaicco.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):

FACILITY INFORMATION

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 units at the Mosaic Riverview facility.

FACILITY INFORMATION

Scope of Application

Emissions Unit ID Number	Description of Emissions Unit	Air Permit Type	Air Permit Proc. Fee
	BART-Eligible Emissions Units (see report)	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 :

   Jeff Stewart, Environmental Superintendent

2. Owner/Authorized Representative Mailing Address...

   Organization/Firm: **Mosaic Fertilizer, LLC.**

   Street Address: **8813 U.S. Highway 41 South**

   City: **Riverview** State: **FL** Zip Code: **33569**

3. Owner/Authorized Representative Telephone Numbers...

   Telephone: **(813) 671-6369** ext. Fax: **(813) 671-6149**

4. Owner/Authorized Representative Email Address: **Jeff.stewart@mosaicco.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] 01/31/07

   Signature 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: **David A. Buff** Registration Number:
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.**545** Fax: **(352) 336-6603**
4.	Professional Engineer Email Address: **dbuff@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.* David A. Buff (signature) 1/31/07 Signature Date (seal)

* Attach any exception to certification statement.

** **Board of Professional Engineers Certificate of Authorization #00001670**