BART DETERMINATION ANALYSIS
FOR
CF INDUSTRIES
PLANT CITY PHOSPHATE COMPLEX

Prepared For:
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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
CFI	CF Industries
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
lb/hr	pounds per hour

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lb/MMBtu	pounds per million British thermal units
LEA	less excess air
LNB	low-NO_x burner
LVHC	low volume high concentration
m	meter
MACT	Maximum Achievable Control Technology
MMBtu/hr	million British thermal units per hour
MMBtu/yr	million British thermal units per year
$MMft^3$	million cubic feet
MMscf/yr	million standard cubic feet per year
N_2	nitrogen
NAAQS	National Ambient Air Quality Standards
NCG	non-condensable gas
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NSPS	New Source Performance Standards
NSR	new source review
NWA	National Wilderness Area
O_2	oxygen
OAQPS	Office of Air Quality Planning and Standards
OFA	overfire air
PCP	pollution control project
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter equal to or less than 10 micrometers
ppmv	parts per million by volume
PSD	prevention of significant deterioration
RBLC	RACT, BACT, LAER Clearinghouse
SAM	sulfuric acid mist
scf/hr	standard cubic foot per hour
SCR	selective catalytic reduction

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LIST OF ACRONYMS AND ABBREVIATIONS (cont'd)

SIL	significant impact level
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 (CAA), 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 CF Industries (CFI) Plant City 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 CF Industries Plant City Facility", commonly known as the "BART Protocol". A copy of this document has been included for reference in Appendix A. The facility information section of the FFDEP application form is included in Appendix B.

2.0 DESCRIPTION OF BART-ELIGIBLE EMISSIONS UNITS

CFI Plant City facility operates four sulfuric acid plants (SAPs), two phosphoric acid plants (PAPs), four diammonium phosphate/monoammonium phosphate (DAP/MAP) plants, molten sulfur storage and handling operations, product storage and shipping operations, and ancillary equipment, in order to produce phosphate fertilizers. The CFI Plant City facility is located south of Zephyrhills and north of Plant City in northeastern Hillsborough County, Florida. The CFI Plant City facility is currently operating under the Title V Permit No. 0570005-017-AV, most recently issued on October 13, 2005.

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 SO_2, NO_x, or PM_{10} are as follows:

- EU002 "A" SAP
- EU003 "B" SAP
- EU007 "C" SAP
- EU008 "D" SAP
- EU010 "A" DAP/MAP Plant
- EU011 "Z" DAP/MAP Plant
- EU012 "X" DAP/MAP Plant
- EU013 "Y" DAP/MAP Plant
- EU015 "A" Shipping Baghouse
- EU018 "B" Shipping Baghouse

SAP → Sulfuric acid
DAP/MAP → Phosphate
Phosphoric Acid

A description of each of these emissions units is presented in the following sections.

2.1 Sulfuric Acid Plants "A" (EU002) and "B" (EU003)

CFI operates two Dorr-Oliver single-absorption sulfuric acid plants [(SAPs) A and B] that have a maximum permitted production rate of 1,300 tons per day (TPD) of 100-percent sulfuric acid (H_2SO_4). 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) in a 4-bed converter tower. SO_3 is then absorbed in an approximately 98-percent H_2SO_4 stream to form a more concentrated acid in a single stage absorption tower (final stage of production). Heat generated by the chemical reactions in the sulfur furnace and the 4-bed converter tower is recovered

Table 1. CF Industries, Plant City – Existing Visibility Impacts at CNWA. Contribution of Visibility Impairing Particle Species Types

	Percent Contribution to 8th Highest Visibility Impacts (dv)											
	2001				2002				2003			
	Visibility	Contribution of [a]			Visibility	Contribution of [a]			Visibility	Contribution of [a]		
Emission Unit	Impact (dv)	SO_4 (%)	NO_3 (%)	PM_{10} (%)	Impact (dv)	SO_4 (%)	NO_3 (%)	PM_{10} (%)	Impact (dv)	SO_4 (%)	NO_3 (%)	PM_{10} (%)
A SAP	0.145	99.0	1.0	0.0	0.112	99.6	0.4	0.0	0.128	99.1	0.9	0.0
B SAP	0.174	98.7	1.3	0.0	0.120	99.7	0.3	0.0	0.149	99.7	0.3	0.0
C SAP	0.202	99.6	0.4	0.0	0.180	99.2	0.8	0.0	0.237	99.3	0.7	0.0
D SAP	0.199	99.6	0.4	0.0	0.174	98.6	1.4	0.0	0.232	99.3	0.7	0.0
A DAP/MAP	0.016	2.4	5.2	92.4	0.014	0.0	11.9	88.1	0.016	2.3	5.0	92.7
X DAP/MAP	0.012	3.2	10.4	86.4	0.011	3.5	23.1	73.4	0.013	12.4	6.7	80.9
Y DAP/MAP	0.015	2.5	8.1	89.4	0.014	5.4	5.9	88.7	0.016	9.9	5.4	84.7
Z DAP/MAP	0.013	12.5	3.4	84.1	0.012	3.3	21.6	75.0	0.014	2.7	11.9	85.4
A Ship Baghouse	0.004	0.0	0.0	100.0	0.003	0.0	0.0	100.0	0.004	0.0	0.0	100.0
B Ship Baghouse	0.004	0.0	0.0	100.0	0.003	0.0	0.0	100.0	0.004	0.0	0.0	100.0

The SAP contribute to visibility impairment primarily by emitting sulfate particles; therefore, the applicant provided a BART analysis for the SAP regarding SO_2 only. Emission rates used in the BART modeling analysis were from recently permitted 24-hr emission limits for SAP A and B and continuous emissions monitoring system (CEMS) data for SAP C and D, which reflect the maximum actual concentrations during normal operation.

As shown above, based on the 24-hour visibility impairment values for 2001 to 2003, the 8^{th} highest (98^{th} percentile) were determined. The maximum pre-control predicted impacts are 0.145, 0.174, 0.237 and 0.232 for SAP A, B, C and D respectively.

The results of the post-BART visibility analysis are detailed in subsequent sections.

to operate two boilers, and an economizer. The process results in emissions of SO_2 and sulfuric acid mist (SAM), as well as a small amount of NO_x.

SO_2 and SAM emissions at each plant are controlled by a two-stage ammonia scrubber and a high-efficiency mist eliminator (Brink's demister) and exhausted through a 110-foot stack. The ammonium sulfate solution generated in the scrubber is consumed in the DAP/MAP plants on-site.

A Prevention of Significant Deterioration (PSD) construction permit application has recently been submitted with FDEP to increase production capacity of the "B" SAP to 1,600 TPD of 100-percent H_2SO_4. The proposed Best Available Control Technology (BACT) for SO_2, SAM and NO_x emissions from the "B" SAP are the continued use of the existing control technology with 24-hour average emission limits of 3.5 pounds per ton (lb/ton), 0.075 lb/ton, and 0.12 lb/ton of 100-percent H_2SO_4, respectively, equivalent to 233.3 pounds per hour (lb/hr), 5.0 lb/hr, and 8.0 lb/hr, respectively.

CFI has also proposed a 24-hour average SO_2 emission limit of 250 lb/hr for the "A" SAP. The current SAM emission limit for the "A" SAP is 0.15 lb/ton of 100-percent H_2SO_4 and 1.43 lb/hr. There is currently no NO_x emission limit for the "A" SAP.

used Actual or Proposed new emissions

2.2 Sulfuric Acid Plants "C" (EU007) and "D" (EU008)

CFI operates two Monsanto double absorption sulfuric acid plants (C and D SAPs) with a maximum production capacity of 2,750 TPD of 100-percent H_2SO_4. At the C and D SAPs, dry air and molten sulfur are ignited in a sulfur burner. The combustion gases, primarily SO_2 are passed through a 3-stage catalytic converter where SO_2 is converted to SO_3. The gases, now primarily SO_3, enter the interpass tower where the SO_3 is absorbed into a sulfuric acid solution. The remaining gases (a mixture of SO_2, SO_3 and other products) exit the interpass tower through a high-efficiency mist eliminator. The gas then enters the 4th stage of the catalytic converter where additional SO_2 is converted to SO_3. This gas enters the final tower where SO_3 is again absorbed into a sulfuric acid solution. The remaining gases exit through a high-efficiency mist eliminator to the atmosphere with the limits established by the BACT. 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 hourly SO_2 emission limits for the C and D SAPs are 3.5 lb/ton of 100-percent H_2SO_4, equivalent to 401 lb/hr. The current SAM emission limits are 0.10 lb/ton of 100-percent H_2SO_4, equivalent to 11 lb/hr. The current NO_x emission limits for the C and D SAPs are 0.12 lb/ton of 100-percent H_2SO_4, equivalent to 14 lb/hr.

2.3 "A" DAP/MAP Plant (EU010)

The operation of the A-train phosphate manufacturing plant to produce DAP or MAP consists of a reactor, granulator, dryer, product cooler, mills and screens. The dryer is fired with natural gas, or No. 5 or better grade fuel oil, i.e., No. 2, 3 or 4 fuel oil (back-up); at a maximum heat input rate of 28.5 million British thermal units per hour (MMBtu/hr).

Emissions from the reactor and granulator are controlled by the following pollution control equipment:

- Stage I - Ducon Envir. Tech. Series 435X-RL 9' O.D. 27' long scrubber with phosphoric acid as the scrubbing liquid.
- Stage II - Fume Downcomer which consists of duct work with fresh water sprays. The water is from the abatement scrubber.
- Abatement Scrubber - Ducon Envir. Tech. Size 15'x28' scrubber with fresh water as the scrubbing liquid.

Emissions from the dryer and granulator are controlled by the following pollution control equipment:

- Dust Cyclones – Fly Ash Arrestor Corp. (4) 59 3/8" diameter each.
- Stage I - Ducon Envir. Tech. 11' O.D. x 30' scrubber with phosphoric acid as the scrubbing liquid.
- Stage II - Fume Downcomer which consists of duct work with fresh water sprays. The water is from the abatement scrubber.
- Abatement Scrubber - Ducon Envir. Tech. Size 15'x28' scrubber with fresh water as the scrubbing liquid.

Emissions from the mills and screens are controlled by the following pollution control equipment:

- Dust Cyclones – Fly Ash Arrestor Corp. (2) 59 3/8" diameter each.
- Dryer Scrubber - Ducon Envir. Tech. 11' O.D. x 30' scrubber with phosphoric acid as the scrubbing liquid.
- Abatement Scrubber - Ducon Envir. Tech. Size 15'x28' scrubber with fresh water as the scrubbing liquid.

Emissions from the product cooler are controlled by the following pollution control equipment:

- Dust Cyclones – Fly Ash Arrestor Corp. (2) 65" diameter each.
- Cooler Scrubber - Fume Downcomer which consists of duct work with fresh water sprays. The water is from the abatement scrubber.
- Abatement Scrubber - Ducon Envir. Tech. Size 15'x28' scrubber with fresh water as the scrubbing liquid.

The maximum permitted phosphorous pentoxide (P_2O_5) input rates for the A DAP/MAP plant are 29.53 tons/hr (TPH) of DAP and 33.30 TPH of MAP. These rates are based on a 12-hour average.

CFI has recently proposed a particulate matter (PM) emission limit of 13.0 lbs/hr and 56.9 tons per year (TPY) for the "A" DAP/MAP plant. The maximum total fluoride (F) emissions from the "A" DAP/MAP plant are limited to 0.06 lb/ton of P_2O_5 input, equivalent to 1.38 lb/hr.

2.4 "Z" DAP/MAP Plant (EU011), "X" DAP/MAP Plant (EU012), and "Y" DAP/MAP Plant (EU013)

The "X", "Y", and "Z" phosphate fertilizer plants operate to produce DAP or MAP, and each consists of a reactor, granulator, aging belt, product cooler, mills and screens. The dryers are fired with natural gas (primary fuel) or No. 2 fuel oil (back-up) at a maximum heat input rate of 49.7 MMBtu/hr for "X" DAP/MAP, 49.5 MMBtu/hr for the "Y" DAP/MAP, and 42.75 MMBtu/hr for the "Z" DAP/MAP.

Emissions from the reactor, granulator, and aging belt are controlled by the following pollution control equipment:

- Stage I - Ducon Envir. Tech. Series 550, 9'-9" O.D., 36'-10 1/2" high scrubber with phosphoric acid as the scrubbing liquid.
- Stage II - Ducon Envir. Tech. Series 550, 9'-9" O.D., 35'-4 1/2" high scrubber with pond water as the scrubbing liquid.
- Abatement Scrubber - Ducon Envir. Tech. Size 15'x35' scrubber with fresh water as the scrubbing liquid.

Emissions from the dryer are controlled by the following pollution control equipment:

- Dust Cyclones – Ducon Envir. Tech. 810/175 Type VM.
- Stage I - Ducon Envir. Tech. Series 555, 10'-2" O.D., 38'-4 1/2" high scrubber with phosphoric acid as the scrubbing liquid.

- Stage II - Ducon Envir. Tech. Series 555, 10'-2" O.D., 36'-10 1/2" high scrubber with pond water as the scrubbing liquid.
- Abatement Scrubber - Ducon Envir. Tech. Size 15'x28' scrubber with fresh water as the scrubbing liquid.

Emissions from the mills and screens are controlled by the following pollution control equipment:

- Dust Cyclones – Ducon Envir. Tech. 810/175 Type VM.
- Dust Scrubber - Ducon Envir. Tech. Series 535, 8'-8" O.D., overall height 34'-3 with phosphoric acid as the scrubbing liquid.
- Abatement Scrubber - Ducon Envir. Tech. Size 15'x28' scrubber with fresh water as the scrubbing liquid.

Emissions from the product cooler are controlled by the following pollution control equipment, respectively:

- Dust Cyclones – Ducon Envir. Tech. 810/175 Type VM Size 4-355 cyclone.
- Cooler Scrubber - Ducon Envir. Tech. Series 550, 9'-9" O.D., 35'-- 4 1/2" high scrubber with pond water as the scrubbing liquid.
- Abatement Scrubber - Ducon Envir. Tech. Size 15'x28' scrubber with fresh water as the scrubbing liquid.

The maximum permitted P_2O_5 input rates for each of the "X", "Y", and "Z" DAP/MAP plants are 48.7 TPH for DAP and 55.0 TPH for MAP production.

The hourly maximum allowable total F emissions rates for the "X", "Y", and "Z" plants are 1.70 lbs/hr, 2.20 lbs/hr and 1.44 lbs/hr, respectively. The hourly maximum allowable PM emission rates for the "X" and "Y" plants are 13.75 lbs/hr and 15.3 lbs/hr, respectively. CFI has recently proposed a PM emission limit of 15.0 lbs/hr and 65.7 TPY for the "Z" DAP/MAP plant.

The primary fuel for the "X", "Y", and "Z" granulation plant dryers is natural gas, with No. 2 fuel oil used as a back-up fuel. The maximum heat input rates for the X Train, Y Train and Z Train are 49.7 MMBtu/hr, 49.5 MMBtu/hr, and 42.75 MMBtu/hr, respectively.

2.5 "A" Shipping Baghouse (EU015) and "B" Shipping Baghouse (EU018)

The operations of the "A" and "B" Shipping units consist of sizing, screening, and conveying systems for transferring DAP/MAP from storage buildings "A" and "B" to the truck and railcar loading operations associated with these buildings.

PM emissions from the transfer points and emissions from the sizing and screening are controlled by two 100,000 acfm Mikro-Pulsaire Model 1F2-48 baghouse dust collectors, one on each unit. Emissions from the truck and railcar loading operations are minimized by the use of dust suppressant.

CFI has recently proposed hourly PM_{10} emissions rates for "A" and "B" Shipping baghouses of 1.71 lb/hr each, based on manufacturer specification on dust loading and exhaust flow rates. These emissions sources are currently permitted to emit 5.0 lb/hr of PM_{10} each, based on Title V Permit 0570005-017-AV.

3.0 BART EXEMPTION ANALYSIS AND RESULTS

A BART modeling protocol for the CFI Plant City facility 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 below.

3.1 Emission Rates

Emission rates used in the CFI BART analysis are presented in the BART protocol presented in Appendix A.

3.2 Modeling Methodology

The CALPUFF model, Version 5.756, was used to predict the maximum visibility impairment at the four PSD Class I areas located within 300 km of the CFI Plant City 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 CFI 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 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 PM component concentrations, which provides a better correspondence between measured visibility and that calculated from PM component concentrations. A detailed description of the new IMPROVE algorithm and its implementation is presented in Section 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 CFI 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 maximum visibility impairment values for the CFI 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 three 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 8th highest visibility impairment values predicted for each year at three of the four 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 those 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 0.88 dv in 2003 and the 22nd highest visibility impairment value predicted over the 3-year period is 0.63 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, the highest, 8th highest visibility impairment value at the Chassahowitzka NWA is predicted to be 0.68 dv in 2003 and the 22nd highest visibility impairment value predicted over the 3-year period is 0.66 dv.

Based on these results, the CFI Plant City 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 due to each BART-eligible unit were determined 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 8th highest visibility impact is presented in Table 3-6.

TABLE 3-1
SUMMARY OF BART EXEMPTION MODELING RESULTS, CFI PLANT CITY
1999 IMPROVE ALGORITHM

Class I Area	Distance (km) of Source to Nearest Class I Area Boundary	Number of Days and Receptors with Visibility Impact >0.5 dv									22nd Highest Impact (dv) Over 3-Yr Period
		2001			2002			2003			
		No. of Days	No. of Receptors	8th Highest Impact (dv)	No. of Days	No. of Receptors	8th Highest Impact (dv)	No. of Days	No. of Receptors	8th Highest Impact (dv)	
Chassahowitzka NWA	70	26	113	0.86	29	113	0.75	28	113	0.88	0.63
Everglades NP	261	0	0	0.16	3	412	0.32	0	0	0.17	0.15
Okefenokee NWA	263	0	0	0.16	0	0	0.19	0	0	0.17	0.13
Saint Marks NWA	273	3	69	0.37	1	43	0.31	2	95	0.33	0.27

TABLE 3-2
BART EXEMPTION ANALYSIS RESULTS FOR CFI PLANT CITY
VISIBILITY IMPACT RANKINGS AT CLASS I AREAS
1999 IMPROVE ALGORITHM

Class I Area	Rank	Predicted Visibility Impacts (dv) 2001	2002	2003
Chassahowitzka NWA	1	1.495	1.690	1.895
	2	1.461	1.013	1.700
	3	1.379	0.948	1.331
	4	1.224	0.905	1.168
	5	1.085	0.838	1.068
	6	0.916	0.814	0.947
	7	0.888	0.771	0.887
	8	0.864	0.747	0.879
Everglades NP	1	0.297	0.661	0.347
	2	0.217	0.611	0.321
	3	0.194	0.518	0.247
	4	0.181	0.456	0.238
	5	0.173	0.443	0.218
	6	0.173	0.407	0.198
	7	0.163	0.317	0.175
	8	0.155	0.316	0.174
Okefenokee NWA	1	0.308	0.308	0.444
	2	0.221	0.280	0.269
	3	0.210	0.273	0.217
	4	0.182	0.217	0.211
	5	0.181	0.206	0.201
	6	0.169	0.197	0.197
	7	0.161	0.194	0.170
	8	0.160	0.192	0.168
St. Marks NWA	1	0.735	0.542	0.570
	2	0.604	0.475	0.543
	3	0.543	0.442	0.393
	4	0.422	0.438	0.382
	5	0.412	0.400	0.351
	6	0.386	0.385	0.341
	7	0.370	0.341	0.331
	8	0.369	0.306	0.327

TABLE 3-3
SUMMARY OF BART EXEMPTION MODELING RESULTS, CFI PLANT CITY
NEW IMPROVE ALGORITHM

Class I Area	Distance from Source to Nearest Class I Area Boundary (km)	Number of Days and Nreceptors with Visibility Impact >0.5 dv									22nd Highest Impact (dv) Over 3-Yr Period
		2001			2002			2003			
		No. of Days	No. of Receptors	8th Highest Impact (dv)	No. of Days	No. of Receptors	8th Highest Impact (dv)	No. of Days	No. of Receptors	8th Highest Impact (dv)	
Chassahowitzka NWA	70	13	NA	0.666	13	NA	0.574	16	NA	0.677	0.656

TABLE 3-4
BART EXEMPTION ANALYSIS RESULTS FOR CFI PLANT CITY
VISIBILITY IMPACT RANKINGS AT CLASS I AREAS
NEW IMPROVE ALGORITHM

Class I Area	Predicted Visibility Impacts (dv)			
	Rank	2001	2002	2003
Chassahowitzka NWA	1	1.163	1.318	1.542
	2	1.136	0.772	1.381
	3	1.114	0.731	1.034
	4	0.947	0.727	0.941
	5	0.838	0.652	0.860
	6	0.736	0.645	0.731
	7	0.686	0.593	0.712
	8	0.666	0.574	0.677

TABLE 3-5
BART ANALYSIS FOR CFI PLANT CITY - CHANGE IN HAZE INDEX AT CNWA
8th HIGHEST IMPACT OF EACH INDIVIDUAL BART-ELIGIBLE UNIT

Emission Unit	Unit ID	Visibility Impacts in Delta-Deciview (8th Highest)		
		2001	2002	2003
"A" SAP	SAPA	0.145	0.112	0.128
"B" SAP	SAPB	0.174	0.120	0.149
"C" SAP	SAPC	0.202	0.180	0.237
"D" SAP	SAPD	0.199	0.174	0.232
"A" DAP/MAP	ADMP	0.016	0.014	0.016
"X" DAP/MAP	XDMP	0.012	0.011	0.013
"Y" DAP/MAP	YDMP	0.015	0.014	0.016
"Z" DAP/MAP	ZDMP	0.013	0.012	0.014
"A" SHIPPING BAGHOUSE	ASBAG	0.004	0.003	0.004
"B" SHIPPING BAGHOUSE	BSBAG	0.004	0.003	0.004

.032

.4

.016 / .2 / .75

10 times more

25 times more

TABLE 3-6
BART ANALYSIS FOR CFI PLANT CITY - CHANGE IN HAZE INDEX AT CNWA
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} (%)
"A" SAP	SAPA	0.145	99.0	1.0	0.0	0.112	99.6	0.4	0.0	0.128	99.1	0.9	0.0
"B" SAP	SAPB	0.174	98.7	1.3	0.0	0.120	99.7	0.3	0.0	0.149	99.7	0.3	0.0
"C" SAP	SAPC	0.202	99.6	0.4	0.0	0.180	99.2	0.8	0.0	0.237	99.3	0.7	0.0
"D" SAP	SAPD	0.199	99.6	0.4	0.0	0.174	98.6	1.4	0.0	0.232	99.3	0.7	0.0
"A" DAP/MAP	ADMP	0.016	2.4	5.2	92.4	0.014	0.0	11.9	88.1	0.016	2.3	5.0	92.7
"X" DAP/MAP	XDMP	0.012	3.2	10.4	86.4	0.011	3.5	23.1	73.4	0.013	12.4	6.7	80.9
"Y" DAP/MAP	YDMP	0.015	2.5	8.1	89.4	0.014	5.4	5.9	88.7	0.016	9.9	5.4	84.7
"Z" DAP/MAP	ZDMP	0.013	12.5	3.4	84.1	0.012	3.3	21.6	75.0	0.014	2.7	11.9	85.4
"A" SHIPPING BAGHOUSE	ASBAG	0.004	0.0	0.0	100.0	0.003	0.0	0.0	100.0	0.004	0.0	0.0	100.0
"B" SHIPPING BAGHOUSE	BSBAG	0.004	0.0	0.0	100.0	0.003	0.0	0.0	100.0	0.004	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.

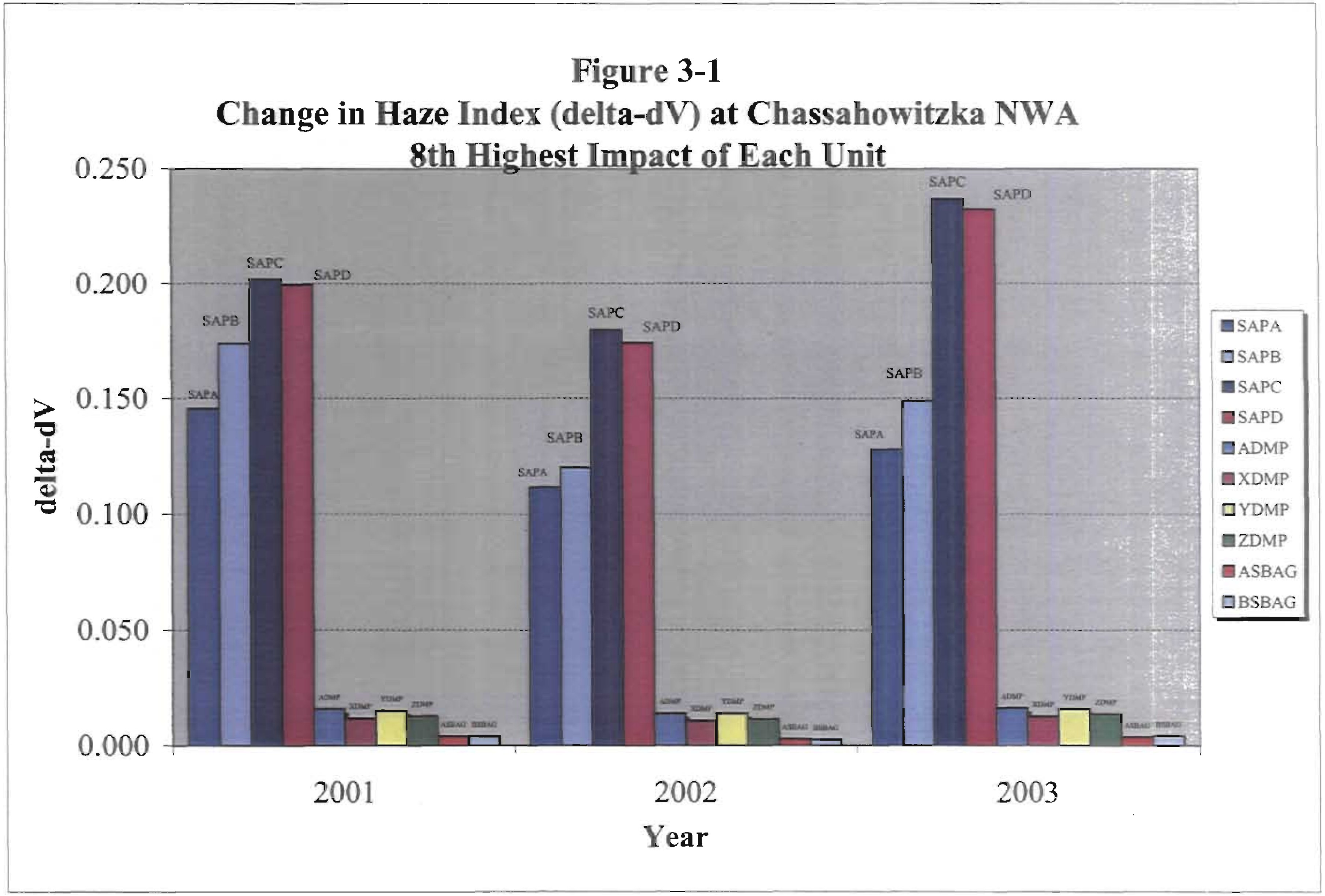
Figure 3-1
Change in Haze Index (delta-dV) at Chassahowitzka NWA
8th Highest Impact of Each Unit
delta-dV
0.250
0.200
0.150
0.100
0.050
0.000
SAPA
SAPB
SAPC
SAPD
2001
2002
2003
Year
SAPA
SAPB
SAPC
SAPD
ADMP
XDMP
YDMP
ZDMP
ASBAG
BSBAG

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 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 the 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 (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-NOX 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.

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. Giving 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, that in analyzing the technology one take 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 identify clearly the emission units 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 in the analysis documentation of the assumptions regarding design parameters. 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, then 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, Fifth 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 ($/yr) and emission rates are calculated in TPY, the result is an average cost-effectiveness number in (annualized) dollars per ton ($/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 which 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 source's "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.

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 (TPY, lb/hr);
2. Emissions performance level (*e.g.*, percent pollutant removed, emissions per unit product, lb/MMBtu, ppm);
3. Expected emissions reductions (TPY);
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 you should evaluate control options for BART. 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 you to choose that 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 "A" SAP

As shown in Table 3-5, the highest, 8th highest visibility impact due to the "A" SAP alone is 0.145 dv, which is about 20 percent of the total BART-eligible source impact. Individual visibility impairing particle species contributions are shown in Table 3-6, which shows that more than 99-percent of the "A" SAP's visibility impact is due to the sulfate particles. Since sulfate particles are formed due to SO_2 and SAM emissions, it can be clearly seen that control of SO_2 emissions from the "A" SAP may be the best strategy to reduce visibility impacts due to the unit. However, the SO_2 emissions from the single-absorption "A" SAP is currently controlled by a tail-gas ammonia scrubber and converting the plant to a double absorption plant was recently found to be not cost-effective in the BACT analysis for the "B" SAP, which is an identical unit as the "A" SAP.

The BART control analysis, which is similar to the BACT analysis in nature, is conducted in the following sections for SO_2 emissions from the "A" SAP. The analysis includes consideration of the available retrofit control technologies, analyzing the feasibility of these technologies, evaluating control effectiveness of the feasible control technologies, evaluating the impacts from cost of compliance, energy, non air-quality environmental, remaining useful life, and finally evaluating the improvement in visibility that may result from the control technology.

5.1.1 Available Retrofit Control Technologies

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.

5.1.2 Control Technology Feasibility

The available SO_2 controls for the "A" SAP are identified in Table 5-2. As shown, there are four types of available SO_2 abatement methods. Each abatement method is described below.

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.

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 convert 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.

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 (such as at CFI's "A" and "B" SAPs).

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 2-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. Ammonia scrubbing is the type of SO_2 control that is employed at CFI's "A" SAP.

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.

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, for example. 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 Mosaic 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.

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), which 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.

Summary of Technically Feasible Options

The available SO_2 controls for the "A" SAP (EU 002) 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 Section 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

Cost of Compliance

To achieve SO_2 emissions below what is achieved by the "A" SAP single-absorption system, conversion from a single-absorption plant to a double-absorption plant or a different type of tail-gas scrubbing would be required. Even though double-absorption has been generally accepted as the best available control technology for new plants, according to the Air Pollution Engineering Manual, converting an existing plant to double-absorption is rarely justified economically. To convert a single-absorption plant to a double-absorption plant, another converter and absorbing tower will have to be added on the tail end of the single absorption plant, which would add considerable capital and operating costs to the present system. The tail-gas scrubbing systems can all achieve the same level of SO_2 control efficiency, and ammonia scrubbing is already employed at CFI's "A" SAP.

To evaluate the cost-effectiveness of converting a single-absorption plant to a double-absorption plant, cost estimates for a converter and absorbing tower were developed. The complete system includes a converter, absorption tower, ancillary equipment, and all installation costs. A capital cost quote by Monsanto for two double-absorption plants at Plant City for the price of $16.2 million was used in the analysis. Based on economies of scale, the capital cost to construct only one double-absorption plant on the "A" or the "B" SAP was estimated at $10 million. The cost quote was given in 1996, which was converted to 2006 dollars using the U.S. Department of Labor Bureau of Labor Statistics Producer Price Index for Chemical Manufacturing Industry. The cost quote resulted in a direct capital cost of $14.4 million. The cost analysis is presented in Table 5-3.

Indirect capital costs were determined from estimates of engineering, construction and field expenses, contractor fees, startup, performance test fees, and retrofit costs, which were developed based on factors from the QAQPS Cost manual. Retrofit cost was assumed to be 15% of the purchased equipment cost and the indirect capital cost was estimated to be $3.3 million.

Total annualized costs were developed considering the annualized capital recovery cost and other direct and indirect operating costs, which are based on standard cost factors and engineering estimates. Capital recovery costs are based on an interest rate of 7 percent and a 20-year equipment life. The total annualized cost was determined to be $2.85 million per year.

The current baseline annual SO_2 emission from the "A" SAP is 611 TPY, based on the average operation of 2003 and 2004. If the plant is converted to double-absorption, the existing ammonia scrubbing system would further reduce this emission to 61.1 TPY, assuming 90% control efficiency of the scrubbing system, which is a reduction of 550 TPY. Based on the annualized cost of $2.85 million, this emissions reduction is achieved for a cost effectiveness of more than $5,000, which is considered high for a BACT determination.

Also, based on 1 million TPY of DAP/MAP production, the annualized cost of $2.85 million to add ammonia scrubbing to just one SAP would increase the cost to produce the DAP/MAP by almost $3/ton, which is unacceptable in today's marketplace.

Energy Impacts

Annual energy consumption by the new converter, absorbing tower and ancillary equipment was estimated to be 1,000 MW-hr and the operating cost was estimated using a cost factor of $0.06 per kilowatt-hr (kW-hr) of electricity. This energy cost was included in developing the direct operating cost in Section 5.1.4.1.

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

EU No.	Description	Existing PM limit (lb/hr)	Existing PM limit (equivalent lb/tonP_2O_5)	BART PM limit lb/tonP_2O_5	Existing NOx and SO_2 technology	BART NOX and SO_2 technology
013 Plant "Z"	DAP	15	0.31	0.10	Good Combustion Practices	Good Combustion Practices
	MAP	15	0.27	0.10	Good Combustion	Good Combustion
EU No.	**Description**	**Existing PM limit (lb/hr)**	**Existing PM limit Opacity**	**BART PM limit lb/tonP_2O_5**	**Existing NOx and SO_2 technology**	**BART NOX and SO_2 technology**
015	Shipping Baghouse "A"	1.71	5	5 % Opacity 1.71 lb/hr	N/A	N/A
018	Shipping Baghouse "B"	1.71	5	5 % Opacity 1.71 lb/hr	N/A	N/A

Al: The limits were changed in PSD 355 (july 2007) for the A and Z plants. The P2O5 input capacity is different for the MAP and DAP; but the lb/hr is equal.

Modeling Analysis with BART Reduced Emission Rates

The applicant assumed converting the current single-absorption with ammonia scrubber configuration to a double absorption configuration as a possible BART control technology for the A and B SAPs. The reduced emission rates from the configuration change provided visibility impacts of 0.02 and 0.056 dv for the A and B SAPs respectively. The applicant assumed adding ammonia scrubbing as a possible BART control technology to C and D SAPs. The reduced emission rates from the ammonia scrubbing provided visibility impacts of 0.045 and 0.042 dv for the C and D SAPs respectively. Therefore, according to the applicant, possible BART control technologies would decrease visibility impacts by approximately 0.125 and 0.12 for the A and B SAPs respectively and 0.2 dv or less for each of the C and D SAPs.

5. PRELIMINARY DETERMINATION

The Department makes a preliminary determination that the proposed project will comply with all applicable state and federal air pollution regulations regarding BART as conditioned by the draft permit. This determination is based on a technical review of the complete application, all available information, reasonable assurances provided by the applicant, and the conditions specified in the draft permit.

Deborah Nelson is the project meteorologist responsible for reviewing the modeling analysis for visibility. She may be contacted at deborah.nelson@dep.state.fl.us and 850-921-9537. Teresa Heron is responsible for reviewing the application, and preparing the draft permit package. She may be contacted at teresa.heron@dep.state.fl.us and 850-921-9529. Alvaro Linero is the ~~project~~ chief engineer responsible for approving the draft BART determination and sealing the permit. He may be contacted at alvaro.linero@dep.state.fl.us and 850-921-9523.

Preliminary PM BART Determination for Finish Mills 1 and 2

The Department accepts the CEMEX BART proposal for Finish Mills 1 and 2 of 9 lb/hr per finish mill by EPA Method 5 and a VE limitation of 5% opacity by EPA Method 9. The VE standard is less than the specified limit of 10% opacity given in Subpart LLL. Subpart LLL includes a requirement for O&M plans for all baghouses. This will further insure compliance with the PM and VE standards.

7. EMISSIONS UNITS 002, 006, 008, 009 and 011 – SILOS AND FEED SYSTEMS

All of the raw material and product silos and feed systems are adequately controlled by baghouses. Except for the cement plant storage silos dust unit (EU 009), the same lb/hr limit will continue to apply at each emissions unit in the future as presently applies.

EU 009 has a limit of 36.05 lb PM/hr. The company generally reports the results of visible emissions testing to comply with a 5% opacity value in lieu of PM testing. Reported stack test results indicate actual emissions less than 1 lb/hr.

In the case of EU 009, the Department will require an initial PM stack test and a simultaneous opacity test to demonstrate compliance with the revised PM/PM_{10} emission limits of 5 lb/hr. After demonstrating compliance by the stack test, the applicant may thereafter request to satisfy the test requirement by meeting a 5% opacity limit as provided by Department rules 62-297.620(4) together with 62-310(7)(c) F.A. C. Until such a demonstration is made, the Department will require PM stack tests on an annual basis.

Table 7. PM BART Determination for CEMEX Brooksville Silos and Feed Systems

EU No.	Description	Existing limit lb/hr	BART limit lb/hr (3-hr)	BART Opacity
002	No.1 Kiln Feed System (Baghouse D-31) Pyroprocessing / Raw Mill System	1.02	1.02	5%
006	Clinker Storage Silo Nos. 1 & 2 (Baghouse F-31) Clinker Handling System	1.45	1.45	5%
008	Kiln No 1. Blending Silos [Baghouse No. (E-36)(silo 2)] Cement Products	1.02	1.02	5%
009	Cement Plant Storage Silos Dust Unit [Baghouse No. (H-3)(silos 1-5)] – Cement Products	36.05	5.0	5%
011	Raw Material Storage Silos (Baghouse C-11) – Raw Material Handling	1.29	1.29	5%
	Transfer Belt (Baghouse C-11A) – Raw Material Handling	0.86	0.86	5%

8. MODELING ANALYSIS WITH BART REDUCED EMISSION RATES

With regards to PM/PM_{10}, BART is a reduction of the finish mills emissions by 9 lb/hr. The Post-Control/BART visibility impacts include the particulate matter reductions along with reductions of NO_x due to SNCR and Indirect Firing permitted in 2006. The results of these lower emissions provide a maximum total visibility impact of 0.933dv. The modeling results show a reduction of the number of days above the visibility threshold in the CNWR by approximately 45%.

The applicant proposed that the current BART-eligible sources "represent the most stringent available technologies" and therefore the current controls represent BART. The basis was primarily the 1997 BACT determinations on Kiln 1 and Cooler 1 as well as use of baghouses on the other BART-eligible sources. Additionally, the applicant took credit for the visibility reductions from the December 2006 SNCR permit that further reduced NO_X emissions and from the pending permit that will reduce PM emissions from Finish Mills 1 and 2.

The results of the post-BART visibility analysis are detailed in subsequent sections.

3. BART-ELIGIBLE UNIT DESCRIPTION

This section provides the control technology review and BART determination for the emissions units identified by the applicant and shown in Table 1 (repeated below). In the case of EU 008, only one emission point requires a BART determination.

EU No.	Emission Unit Description
002	No.1 Kiln Feed System (Baghouse D-31) – Pyroprocessing/Raw Mill System
003	Cement Kiln No. 1 (Baghouse E-55) – Pyroprocessing/Raw Mill System
004	Cement Plant Clinker Cooler No. 1 (Baghouse F-18) – Clinker Handling System
005	Finish Mills No. 1 and No. 2 with two dust collectors (Baghouse G-23) – Finish Mill System
006	Clinker Storage Silo Nos. 1 & 2 (Baghouse F-31) – Clinker Handling System
008	Baghouse No. F-17 of Kiln No.1 Blending Silo No. 1 – Cement Products is not BART-eligible
	Baghouse No. E-36 of Kiln No 1. Blending Silo No. 2 – Cement Products is BART-eligible
009	Cement Plant STG Silos Dust Unit (Baghouse H-3) – Cement Products
011	Raw Material Storage Silos & Feed System (Baghouses C-11, C-11A)

The Department previously identified all BART-eligible sources through a series of notifications, workshops, and rule making efforts. The list for CEMEX Line 1 included the following emissions units or emissions points within an EU as listed in Table 3 that are not actually subject to BART and will not be considered.

A review by the applicant (confirmed by the Department) of the permitting history revealed that one emissions point of EU 008 as well as all of EU 024 and EU 025 were permitted for physical construction after August 7, 1977. They were included within the permitting of Line 2 (the non-BART line) or were constructed after Line 2 to further support both lines. The original rationale for inclusion in the BART review was that they support Line 1 and it was assumed they were permitted and constructed with the first line.

Table 3. Emission Units/Emissions Points related to Line 1 and Excluded from BART

EU No.	Emission Unit Description
008	Emission Point: Baghouse No. F-17 of Kiln No. 1 Blending Silo No. 1 – Cement Products
024	Raw Materials Pre-Mix Bin with Baghouse (M-2280)
025	Additive Material Storage Bin with Baghouse (M-1171)

4. EMISSIONS UNIT 003 – CEMENT KILN NO. 1 – PYROPROCESSING/RAW MILL SYSTEM

In conducting the BART determination, it will be useful to refer to Table 4 that is a compilation of relevant rule and permit based limitations on NO_X, SO_2 and PM in lb/ton of clinker. PM values include kiln plus cooler emissions. Values in parentheses denote lb/ton of $kiln_{ph}$ feed and are also included for CEMEX Line 1 (and several other installations) because the permit limits are actually specified in those terms.

Table 8. CEMEX Brooksville Visibility Impact to CNWR from all BART-Eligible Units Combined

Percent Contribution to 8th Highest Visibility Impacts (dv)				
Year	Visibility Impact with BART	Days Above Visibility Threshold	Total Reduction of Days Above Visibility Threshold	Total Visibility Reduction
2001	0.933	52	41	0.524
2002	0.841	60	63	0.500
2003	0.848	57	39	0.506

9. PRELIMINARY DETERMINATION

The Department makes a preliminary determination that the proposed project will comply with the applicable state and federal air pollution regulations regarding BART as conditioned by the draft permit.

A .145 .02
B .174 .056
C .237 .045
D .232 .042

.02 A
.056 B

the source. Note that if the most stringent BART control option available is selected, it is not necessary to conduct an air quality modeling analysis for the purpose of determining its visibility impacts.

BART Determination: In making a final BART determination, the following will be considered: (1) technically feasible options; (2) the average and incremental costs of each option; (3) the energy and non-air quality environmental impacts of each option; (4) the remaining useful life; and (5) the modeled visibility impacts. A justification for selecting a technology as the "best" level of control must be provided and include an explanation of these factors that led to the BART determination. When a BART determination is made for two regulated pollutants on the same source, if the result is two different BART technologies that do not work well together, it may be reasonable to substitute a different technology or combination of technologies.

Summary of Applicant's Initial Modeling Analysis

The CEMEX Brooksville BART modeling analysis methodology followed the VISTAS (Visibility Improvement State and Tribal Association of the Southeast) common air modeling protocol, Version 3.2. The BART-eligible emission units for CEMEX are subject to a visibility impairment analysis as dictated by the modeling protocol. The analysis includes visibility impairment at all PSD Class I areas within 300 km of the CEMEX Brooksville facility. These Class I areas are the Chassahowitzka National Wildlife Refuge (CNWR), the Okefenokee National Wildlife Refuge (ONWR) and the St. Marks National Wildlife Refuge (SNWR). These Class I areas are 10, 245 and 230 kilometers (km) away from CEMEX respectively.

The CALPUFF modeling system (CALPUFF Version 5.756) was used to predict the maximum visibility impairment. The Department provided the applicant with 4-km "CALPUFF-ready" CALMET meteorological data for the period 2001-2003. Class I receptor locations were obtained from the National Park Service (NPS) and a Lambert Conformal Conic (LCC) coordinate system was used. Modeling results are based on the 8th highest 24-hour average impairment value in one year, for 3 years.

The applicant performed initial modeling to determine whether the CEMEX Brooksville facility contributes to visibility impairment. Modeled concentrations were then compared to the visibility impairment threshold of 0.5 deciviews (dv), based on the final BART rule 70 FR 39118. A dv is a standard visibility index. The Interagency Monitoring of Protected Visual Environments (IMPROVE) states that the dv scale is linear to humanly-perceived changes in visual air quality. A dv near zero is considered a "pristine" atmosphere and a dv increase with visibility impairment. This initial analysis concluded that the CEMEX Brooksville facility contributes to visibility impairment at the CNWR only and therefore, all BART-eligible sources are subject to a BART determination analysis for the CNWR.

The BART-eligible sources for the CEMEX Brooksville facility are listed in Table 2 below. The existing BART-eligible sources modeled emission rates for PM/PM_{10}, SO_2, and sulfuric acid mist (H_2SO_4) were determined from either stack test data or permit limits to reflect the maximum 24-hour average normal operation for the most recent 3 to 5 years. NO_X emission rates were determined by the maximum 24-hour concentrations for the most recent 3 to 5 years, not taking into account a recently permitted limit of 1.21 lb/ton of $kiln_{ph}$ feed. The maximum visibility impact of the existing BART-eligible sources, prior to any proposed BART control technologies, is 1.457dv. The total number days above the visibility impairment threshold for the nearby CNWR are shown in Table 2 below.

Table 2. CEMEX Brooksville Visibility Impact to CNWR from all BART-Eligible Units Combined Prior to BART Controls

Percent Contribution to 8th Highest Visibility Impacts (dv)		
Year	Deciviews	Days Above Visibility Threshold
2001	1.457	93
2002	1.341	123
2003	1.354	96

an excess weak H_2SO_4 stream and requires additional water for flushing of the carbon bed for regeneration. The primary environmental concern of using the wet scrubbing system is the process wastewater or waste sludge which is generated. These waste streams require proper treatment and disposal.

In a single-absorption process SAP, there are no byproducts or waste scrubbing materials produced. Therefore, there is very little environmental impact. The "A" SAP has a tail-gas SO_2 control technology consisting of an ammonia scrubbing system, which produces an ammonium sulfate byproduct solution. The solution is used for the production of phosphate fertilizers and the liquid ammonium sulfate is sent to the MAP/DAP plants. However, the MAP/DAP plants cannot accommodate further increases in ammonium sulfate solution. As a result, any further increase in tail gas SO_2 scrubbing would negatively impact MAP/DAP product quality. Therefore, the excess would create a liquid ammonium sulfate stream, which must be disposed of.

Remaining Useful Life

CFI has no plan to shutdown the "A" SAP in the near future. An useful life of 20 years was used to develop the capital recovery cost in Section 5.1.4. The capital recovery cost was determined to be $1.67 million (see Table 5-3), which is part of the annualized operating cost of $2.85 million.

5.1.5 Visibility Impacts

As shown in Table 2-3 of the BART protocol, the baseline SO_2 emissions used in the determination of the visibility impact due to the "A" SAP is 250.0 lb/hr, which is the recently proposed 24-hour average emission limit for the unit and equivalent to 4.62 lb/ton of 100-percent H_2SO_4 production. This baseline emission rate can be achieved by the current single-absorption configuration and the ammonia scrubber control technology, and can also be achieved by a double-absorption plant without the ammonia scrubber. Assuming a SO_2 removal efficiency of 90-percent, the existing ammonia scrubber will further reduce the SO_2 emission rate to 25.0 lb/hr.

?? actual emissions?

As shown in Table 3-5, the highest, 8th highest visibility impact due to "A" SAP is 0.145 dv. Using this reduced SO_2 emission rate, the CALPUFF model was run for the "A" SAP and the 8th highest visibility impact was determined to be 0.02 dv, which is a reduction of only 0.125 dv from the baseline impact. Based on this reduction in the change in haze index and the annualized cost of $2.85 million per year determined in Section 5.1.4, the cost effectiveness of converting the "A" SAP to a double-absorption plant can be estimated as $22.8 million for every 1 dv reduction in haze index.

5.1.6 Selection of BART

Based on the high cost of reducing the visibility impact, it is considered economically infeasible to convert the existing "A" SAP to double absorption. An annual cost of $22.8 million results in only 1 dv reduction in the visibility impact. Therefore, CFI is proposing the current single-absorption system with the continuing use of the ammonia scrubber as BART for SO_2 emissions from the "A" SAP, with a proposed BART SO_2 emission limit of 250 lb/hr, 24-hour average.

5.2 BART For NO_x Emissions From the "A" SAP

The "A" SAP emits only a small amount of NO_x emissions, which is a result of the combustion process. As shown in Table 3-6, only about 1-percent or less of the total visibility impact due to the "A" SAP is due to nitrate particles, which are formed by NO_x emissions. It is clear that no amount of control for NO_x emissions can provide a meaningful reduction in the visibility impact due to the unit.

A BACT analysis was recently conducted for NO_X emissions from the "B" SAP, which is a similar single-absorption plant like the "A" SAP, and it was concluded that because of the low NO_X emissions from the unit and because there are no known add-on NO_X control techniques that have been applied to SAPs, BACT was no add-on control.

As a result, CFI proposes that BART for NO_X emissions from the "A" SAP is the existing combustion process and good combustion practices.

5.3 BART For SO_2 Emissions From "B" SAP

As shown in Table 3-5, the highest 8th highest visibility impact due to the "B" SAP alone is 0.174 dv, based on a recently proposed 24-hour average SO_2 BACT-established emission limit of 233.3 lb/hr. A PSD permit application has recently been submitted to the FDEP to increase the production capacity of the "B" SAP to 1,600 TPD of 100-percent H_2SO_4, and the BACT for SO_2 emissions from the unit has been established as the existing control technology consisting of a two-stage ammonia scrubber with an emission rate of 3.5 lb/ton H_2SO_4 (equivalent to 233.3 lb/hr).

Based on the individual visibility impairing particle species contributions presented in Table 3-6, 99-percent or more of the "B" SAP's visibility impact is due to sulfate particles. Since sulfate particles are formed due to SO_2 and SAM emissions, reduction of SO_2 emissions has the potential to reduce visibility impacts due to the unit.

The BACT analysis for the "B" SAP in the PSD permit application dated April, 2006 showed that additional control of SO_2 for the unit is not cost effective. The BART analysis conducted in this section, which is similar to the BACT analysis in nature, and develops a cost for every 1 dv reduction in visibility impact, also shows that additional control is not cost effective.

The "B" SAP is a single absorption plant similar to the "A" SAP with the same existing control technology. Therefore the available retrofit control technologies, control technology feasibility, and effectiveness of available control options for the SO_2 emissions from the "A" SAP discussed in Section 5.1 are also valid for the "B" SAP.

5.3.1 Impacts of Control Technology Options

Cost of Compliance

Similar to the "A" SAP, to achieve SO_2 emissions below what is achieved by the "B" SAP single-absorption system, conversion from a single-absorption plant to a double-absorption plant or a different type of tail-gas scrubbing would be required. Even though double-absorption has been generally accepted as the best available control technology for new plants, according to the Air Pollution Engineering Manual, converting an existing plant to double-absorption is rarely justified economically. To convert a single-absorption plant to a double-absorption plant, another converter and absorbing tower will have to be added on the tail end of the single absorption plant, which would add considerable capital and operating costs to the present system. The tail-gas scrubbing systems can all achieve the same level of SO_2 control efficiency, and ammonia scrubbing is already employed at CFI's "B" SAP.

The same capital cost quote by Monsanto used in the cost analysis for "A" SAP for two double-absorption plants at Plant City for the price of $16.2 million was used in the analysis. Based on economies of scale, the capital cost to construct only one double-absorption plant on the "A" or the "B" SAP was estimated at $10 million. The cost quote was given in 1996, which was converted to 2006 dollars using the U.S. Department of Labor Bureau of Labor Statistics Producer Price Index for Chemical Manufacturing Industry. Also, the cost quote, which was for 1,300 TPD of H2SO4 production, was escalated for a 1,600-TPD production capacity. These factors resulted in a direct capital cost of $17.7 million. The cost analysis is presented in Table 5-4.

Indirect capital costs were determined from estimates of engineering, construction and field expenses, contractor fees, startup, performance test fees, and retrofit costs, which were developed based on factors from the QAQPS Cost manual. Retrofit cost was assumed to be 15% of the purchased equipment cost and the indirect capital cost was estimated to be $4.1 million.

Annual operating costs were developed considering the annualized capital recovery cost and other direct and indirect operating costs, which are based on standard cost factors and engineering estimates. Capital recovery costs are based on an interest rate of 7 percent and a 20-year equipment life. The total annualized cost was determined to be $3.48 million per year.

The current baseline annual SO_2 emission from the "B" SAP is 661 TPY based on the average operation of 2003 and 2004. If the plant is converted to double-absorption, the existing ammonia scrubbing system would further reduce this emission to 66.1 TPY, assuming 90 percent control efficiency of the scrubbing system, which is a reduction of 595 TPY. Based on the annualized cost of $3.48 million, this emissions reduction is achieved for a cost effectiveness of more than $5,800, which is considered high for a BACT determination.

Also, based on 1 million TPY of DAP/MAP production, the annualized cost of $3.48 million to add ammonia scrubbing to just one SAP would increase the cost to produce the DAP/MAP by almost $3.5/ton, which is not acceptable in today's marketplace.

Remaining Useful Life

CFI has no plan to shutdown the "B" SAP in the near future. An useful life of 20 years was used to develop the capital recovery cost in Table 5-4. The capital recovery cost was determined to be $2.06 million, which is part of the total annualized cost of $3.48 million per year.

5.3.2 Visibility Impacts

As shown in Table 2-3, the baseline SO_2 emissions used in the determination of the visibility impact due to the "B" SAP is 233.3 lb/hr, which is the recently proposed 24-hour average emission limit for the unit. A PSD permit application has been submitted to the FDEP for the production increase of the "B" SAP and the 233.3 lb/hr is proposed BACT SO_2 emission rate, equivalent to 3.5 lb/ton of 100-percent H_2SO_4. As mentioned in the BACT analysis for the "B" SAP, this baseline emission rate can be achieved by the current single-absorption configuration and the ammonia scrubber control technology. If the plant is converted to a double-absorption plant, the existing ammonia scrubber will further reduce the SO_2 emission rate to 23.33 lb/hr, assuming a SO_2 removal efficiency of 90 percent.

As shown in Table 3-5, the highest, 8th highest visibility impact due to "B" SAP alone is 0.174 dv. Using the 23.33 lb/hr of SO_2 emissions from the "B" SAP, the CALPUFF model was re-run for the "B" SAP and a revised visibility impact was determined to be 0.056 dv, which is a reduction of only 0.12 dv from the baseline visibility impact. Based on this reduction in the change in haze index and the total annualized cost of $3.48 million determined in Section 5.3.1, the cost effectiveness of converting the "B" SAP to a double-absorption plant can be estimated as $29.0 million for every 1 dv reduction in visibility impact.

5.3.3 Selection of BART

Based on the high cost of reducing the visibility impact, it is considered economically infeasible to convert the existing "B" SAP to double absorption. An annual cost of $29.0 million results in only 1 dv reduction in the visibility impact. Therefore, CFI is proposing the current single-absorption system with the continuing use of the ammonia scrubber as BART for SO_2 emissions from the "B" SAP, with a proposed BART SO_2 emission limit of 233.3 lb/hr, 24-hour average.

5.4 BART for NO_x Emissions From the "B" SAP

The "B" SAP emits only a small amount of NO_X emissions, which is a result of the combustion process. As shown in Table 3-6, only about 1 percent of the total visibility impact due to the "B" SAP is due to nitrate particles, which are formed by NO_x emissions. Therefore, as explained in Section 5.2, controlling NO_x emissions will not result in any significant reduction of visibility impacts due to the "B" SAP.

As a requirement of the PSD permit application to increase production capacity of the "B" SAP submitted to the FDEP in April, 2006, a BACT analysis was conducted for NO_x emissions from the unit and it was concluded that because of low NO_x emissions from the unit, and because there are no known add-on NO_x control techniques that have been applied to SAPs, BACT for NO_x was no add-on control.

As a result, CFI proposes that BART for NO_x emissions from the "B" SAP is the existing combustion process and good combustion practice.

5.5 BART for SO_2 Emissions From "C" and "D" SAPs

The "C" and "D" SAPs each are Monsanto design, double-absorption plants, with a maximum production capacity of 2,750 TPD of 100-percent H_2SO_4. The production capacity of the plants was recently increased through a PSD permit, which included a BACT determination for SO_2 emissions.

The current SO_2 emission limit of 3.5 lb/hr, 24-hour average, from each of the plants is established by the BACT determination.

As shown in Table 3-5, the highest 8th highest visibility impacts due to the "C" and "D" SAPs are 0.237 dv and 0.232 dv, respectively. Individual visibility impairing particle species contributions presented in Table 3-6, show that more than 99 percent of each of the "C" and "D" 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 emission limit and the existing double absorption technology with a 4-stage converter with cesium catalyst in the fourth stage is considered to be the BACT for SAPs in the phosphate fertilizer industry. A BART analysis is conducted in the following sections to demonstrate that the existing controls at the "C" and "D" SAPs are BART.

5.5.1 Available Retrofit Technologies

In the C and D 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 mentioned in Section 5.1.1, BART determinations issued during the last 10 years (see Table 5-1) show that SO_2 BACT determinations for SAPs 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.

The C and D SAPs at CFI 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 C and D SAPs. The C and D SAPs also have upgraded by incorporating cesium catalyst into the 4th pass of the converter (beds 4a and 4b). 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 "C" and "D" SAPs were subject to a BACT determination when the production capacity of the units were increased to 2,750 TPD and the continued use of double-absorption technology with the addition of cesium catalyst into the 4[th] pass of the converter (beds 4a and 4b) was determined to be BACT for SO_2 emissions. The "C" and "D" SAPs are subject to a BACT SO_2 emission limit of 3.5 lb/ton 100-percent H_2SO_4 as a 24-hour average.

5.5.2 Control Technology Feasibility

The available SO_2 controls for the "C" and "D" SAPs are identified in Table 5-2. As shown, there are four types of available SO_2 abatement methods, with various techniques within each method. These abatement methods have been described in Section 5.1.2.

5.5.3 Control Effectiveness of Options

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

5.5.4 Impacts of Control Technology Options

Cost of Compliance

To achieve SO_2 emissions below those achieved by the C and D sulfuric acid double-absorption plants, add-on control equipment such as tail-gas scrubbers would be required. This would add considerable capital and operating costs to the present system. CFI has estimated the cost of installing and operating an ammonia scrubbing system on the C and "D" SAPs, which is presented in Table 5-5. The ammonia scrubbing systems would be similar to those already employed on the "A" and "B" SAPs. 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 ammonia scrubber on one of the "C" and "D" SAPs is $8 million, which includes installation but does not include blower and mist eliminators and certain other items. Converting cost quote to 2006 dollars, the estimated total capital cost of the ammonia scrubbing system on either "C" or "D" SAP is almost $19 million. Using a standard capital recovery factor of 0.0944 (20 years at 7 percent 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 annualized cost is $3.0 million per year as shown in Table 5-5.

This cost does not include any cost for handling or disposal of the liquid ammonium sulfate stream generated by the scrubbing process. At present, the liquid ammonium sulfate stream from the "A" and "B" SAPs ammonia scrubbing system is sent to the on site granular fertilizer plants. However, no additional volume can be accommodated within these plants without diluting the phosphate content of the ammonium phosphate product to below market specifications.

As a result, the only 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. 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 "C" and "D" SAPs, the cost of these systems would be economically infeasible. Assuming 90-percent control efficiency, the ammonia scrubbing system would further reduce the current baseline annual emission rates of "C" and "D" SAPs from 1,447 TPY and 1,400 TPY, respectively, to 144.7 TPY and 140 TPY, a reduction of 1,302 TPY and 1,260 TPY, respectively. These baseline annual SO_2 emissions are based on the average operation of 2003 and 2004. Based on the annualized cost of $3 million, either of these emissions reductions is achieved for a cost effectiveness of $2,300 or more, which is considered high for a BACT determination.

Also, based on 1 million TPY of DAP/MAP production, the annualized cost of $3 million to add ammonia scrubbing to just one SAP would increase the cost to produce the DAP/MAP by almost $3/ton, which is unacceptable in today's marketplace.

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

Energy Impacts

Annual energy consumption by the ammonia scrubber, new blower, mist eliminator, and auxiliary equipment are estimated to be 700 kW and the operating cost was estimated using a cost factor of $0.06 per kW-hr of electricity. This energy cost was included in developing the direct operating cost in Section 5.5.4.

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 and 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 since this process does not create any by-products or waste scrubbing materials.

Remaining Useful Life

CFI has no plan to shutdown either of the "C" and "D" SAP in the near future. A useful life of 20 years was used to calculate the annualized capital recovery cost.

5.5.5 Visibility Impacts

As shown in Table 3-5, the highest, 8th highest visibility impact due to the "C" and "D" SAP are 0.24 dv and 0.23 dv, respectively. Adding ammonia scrubber would further reduce the current baseline emission rates of "C" and "D" SAPs from 373 lb/hr and 384 lb/hr, respectively, to 37.3 lb/hr and 38.4 lb/hr, respectively. Using these reduced SO_2 emission rates, the CALPUFF model was run for each of the "C" and "D" SAPs and the highest, 8th highest visibility impact was determined to be 0.045 dv and 0.042 dv, respectively, which is a reduction of about 0.2 dv or less from the baseline visibility impacts of each of the "C" and "D" SAPs. Based on these reductions in the change in haze index and the annualized operating cost of $3 million determined in Section 5.5.4, the cost effectiveness of adding an ammonia scrubber to each of the "C" and "D" SAPs can be estimated as $15.0 million or more for every 1 dv reduction in the visibility impact.

5.5.6 Selection of BART

Based on the high cost of reducing the visibility impact, it is considered economically infeasible to add tail-gas scrubbing to the existing "C" and "D" SAPs. An annual cost of $15 million results in only 1 dv reduction in the visibility impact. Also, no other double absorption SAP located at a phosphate fertilizer plant has been required to employ add-on FGD equipment. Requiring ammonia scrubbing on the "C" and "D" SAPs would put CFI 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.

As a result, CFI is proposing the current double-absorption system with cesium catalyst converter as the BART for SO_2 emissions from the "C" and "D" SAPs, with a proposed BART SO_2 emission limit of 3.5 lb/ton, 24-hour average.

5.6 BART For NO_x Emissions From the "C" and "D" SAPs

Similar to the "A" and "B" SAPs, the nitrate particles, which are formed by NO_X emissions, contribute only about 1-percent of the total visibility impact due to each of the "C" and "D" SAP (see Table 3-6). Since the double-absorption process results in a small amount of NO_x emissions, the NO_x emissions from the "C" and "D" SAPs are very low. The "C" and "D" SAPs are currently limited to a NO_x emission limit of 0.14 lb/ton of H_2SO_4.

A BACT analysis was conducted for NO_x emissions from the "C" and "D" SAPs in 2004, which concluded that because of the low NO_x emissions from each of the units, and because there are no known add-on NO_x control techniques that have been applied to SAPs, the BACT was no add-on control.

As a result, CFI proposes that BART for NO_x emissions from each of the "C" and "D" SAPs, is the existing combustion process and good combustion practices.

5.7 BART for the "A" DAP/MAP Plant

As shown in Table 3-5, the highest 8th highest visibility impact due to the "A" DAP/MAP plant is only 0.016 dv. Considering that the highest 8th highest visibility impact due to the BART-eligible source is 0.68 dv, a complete shutdown of the "A" DAP/MAP plant will only theoretically reduce the total impact by about 2 percent. This is a conservative assumption, because it is important to note that visibility impacts due to individual units cannot be simply summed to get the cumulative impact. In other words, a 0.016 dv reduction from "A" DAP/MAP plant does not necessarily reduce the cumulative impact by the same amount.

As shown in Table 3-6, approximately 90-percent of the visibility impact due to the "A" DAP/MAP plant is due to non-hygroscopic PM particles. The "A" DAP/MAP plants visibility impact is also overly conservative because all PM emissions from the plant was assumed as organic carbon particles with very high light extinction efficiency. The PM emissions from the unit are currently controlled by medium and high-efficiency wet scrubbers and dust cyclones, which are considered to be BACT for the DAP/MAP plants in the fertilizer industry. Any further control of PM will be expensive and it will not achieve any meaningful reduction in visibility impacts.

Based on these facts, CFI proposes that the existing wet scrubbers and dust cyclones are the BART for PM emissions from the "A" DAP/MAP plant and the 24-hour average BART PM emissions limit is 13.0 lb/hr.

5.8 BART for the "X", "Y", & "Z" DAP/MAP Plants

Similar to the "A" DAP/MAP plant, the highest 8th highest visibility impact due to any of the "X", "Y", and "Z" DAP/MAP plant is only 0.016 dv (see Table 3-5). As explained for the "A" DAP/MAP plant, even the entire 0.016 dv reduction from any of the "X", "Y", and "Z"DAP/MAP plants will not be able to achieve a meaningful reduction of the BART-eligible source impact. The visibility impacts due to the "X", "Y", and "Z" DAP/MAP plants are also overly conservative because all PM emissions from these plants were assumed as organic carbon particles with very high light extinction efficiency.

As shown in Table 3-6, the non-hygroscopic PM particles account for 70 to 90-percent of the visibility impacts due to the "X", "Y", and "Z" DAP/MAP plants. PM emissions from these plants are currently controlled by several wet scrubbers (medium and high efficiency) and dust cyclones. Any further PM control would be a significant economic burden for CFI and it will not achieve any meaningful reduction in visibility impact.

As a result, CFI proposes the existing wet scrubbers and dust cyclones as BART for PM emissions from the "X", "Y", and "Z" DAP/MAP plants.

5.9 BART for the "A" and "B" Shipping Baghouses

Based on the visibility modeling results presented in Table 3-5, the highest 8th highest visibility impact due to either of the "A" and "B" shipping baghouse is only 0.004 dv, approximately 0.6 percent of the highest, 8th highest visibility impact for the entire BART-eligible source. The "A" and "B" shipping baghouses are sources of PM emissions only. Because of the very low impact, no amount of control can provide a meaningful reduction of visibility impacts due to these units.

The PM emissions from the "A" and "B" shipping units are each controlled by a Mikro-Pulsaire high-efficiency baghouse. Any further reduction of these emissions will not achieve any meaningful reduction in visibility impacts. CFI therefore, proposes that the existing baghouses are BART for PM emissions from the "A" and "B" shipping units.

5.10 Application for BART Determination

The FDEP's Air Permit Application Long Form is attached in Appendix B to support the BART Determination application.

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 "A" and "B" SAPs? (Y/N)	Employed by the "C" and "D" SAPs? (Y/N)
Sorbent Injection	Sorbent Furnace Injection	50%	N	--	N	N
	Sorbent Economiser Injection	50%	N	--	N	N
	Sorbent Duct Injection	80%	N	--	N	N
Process Modification	Double-Absorption System	>99.7%	Y	1	N	Y
Gas Absorption/Wet Scrubbers	Ammonia Scrubbing	>90%	Y	3	Y	N
	Hydrogen Peroxide Scrubbing	>90%	Y	3	N	N
	Molecular Sieves	>90%	N	--	N	N
Flue Gas Desulfurization	Sodium Sulfite-Bisulfite Scrubbing	>90%	Y	3	N	N
	Lime or Calcium Oxide Spray Dryers	80 - 90%	Y	4	N	N
	Wet Limestone FGD	50 - 98%	Y	2	N	N
Oxidation	SO_2 Oxidation with Activated Carbon	>90%	Y	3	N	N

TABLE 5-5
COST EFFECTIVENESS OF AMMONIA SCRUBBING, CF INDUSTRIES "C" OR "D" 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 "A" and "B" SAPs, $8 million for one unit in March 2004, adjusted for 2006 dollars..

TABLE 5-3
COST EFFECTIVENESS OF DOUBLE ABSORPTION SAP, CF INDUSTRIES "A" SAP

Cost Items	Cost Factors[a]	Cost ($)
DIRECT CAPITAL COSTS (DCC):		
Purchased Equipment Cost (PEC)		
Converter + Absorption Tower	Engineering Estimate	13,580,247
Instruments and Controls	Included	0
Freight	Included	0
Taxes	6% Sales Tax	814,815
Total PEC:		14,395,062
Direct Installation Costs		
Foundation and Structure Support	Included	0
Handling & Erection	Included	0
Electrical	Included	0
Piping	Included	0
Insulation for ductwork	Included	0
Painting	Included	0
Total Direct Installation Costs		0
Total DCC (PEC + Direct Installation):		14,395,062
INDIRECT CAPITAL COSTS (ICC):		
Engineering	2% of PEC (for excluded items)	287,901
Construction and field expenses	2% of PEC (for excluded items)	287,901
Contractor Fees	2% of PEC (for excluded items)	287,901
Startup	1% of PEC	143,951
Performance test +	1% of PEC	143,951
Contingencies (retrofit cost)	15% of PEC	2,159,259
Total ICC:		3,310,864
TOTAL CAPITAL INVESTMENT (TCI):	DCC + ICC	17,705,926
DIRECT OPERATING COSTS (DOC):		
(1) Operating Labor		
Operator	21 hours/week, $16/hr, 52 weeks/yr	17,472
Supervisor	15% of operator cost	2,621
(2) Maintenance	Engineering estimate, 1% PEC	143,951
(3) Replacement Parts	Engineering estimate, 1% PEC	143,951
(4) Electricity - Operating	$0.06/kWh, 8760 hr/yr	60,000
Total DOC:		367,994
INDIRECT OPERATING COSTS (IOC):		
Overhead	60% of oper. labor & maintenance	98,426
Property Taxes	1% of total capital investment	177,059
Insurance	1% of total capital investment	177,059
Administration	2% of total capital investment	354,119
Total IOC:		806,663
CAPITAL RECOVERY COSTS (CRC):	CRF of 0.0944 times TCI (20 yrs @ 7%)	1,671,439
ANNUALIZED COSTS (AC):	DOC + IOC + CRC	2,846,097

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

TABLE 5-4
COST EFFECTIVENESS OF DOUBLE ABSORPTION SAP, CF INDUSTRIES "B" SAP

Cost Items	Cost Factors[a]	Cost ($)
DIRECT CAPITAL COSTS (DCC):		
Purchased Equipment Cost (PEC)		
Converter + Absorption Tower	Engineering Estimate	16,714,150
Instruments and Controls	Included	0
Freight	Included	0
Taxes	6% Sales Tax	1,002,849
Total PEC:		17,716,999
Direct Installation Costs		
Foundation and Structure Support	Included	0
Handling & Erection	Included	0
Electrical	Included	0
Piping	Included	0
Insulation for ductwork	Included	0
Painting	Included	0
Total Direct Installation Costs		0
Total DCC (PEC + Direct Installation):		17,716,999
INDIRECT CAPITAL COSTS (ICC):		
Engineering	2% of PEC (for excluded items)	354,340
Construction and field expenses	2% of PEC (for excluded items)	354,340
Contractor Fees	2% of PEC (for excluded items)	354,340
Startup	1% of PEC	177,170
Performance test +	1% of PEC	177,170
Contingencies (retrofit cost)	15% of PEC	2,657,550
Total ICC:		4,074,910
TOTAL CAPITAL INVESTMENT (TCI):	DCC + ICC	21,791,909
DIRECT OPERATING COSTS (DOC):		
(1) Operating Labor		
Operator	21 hours/week, $16/hr, 52 weeks/yr	17,472
Supervisor	15% of operator cost	2,621
(2) Maintenance	Engineering estimate, 1% PEC	177,170
(3) Replacement Parts	Engineering estimate, 1% PEC	177,170
(4) Electricity - Operating	$0.06/kWh, 8760 hr/yr	60,000
Total DOC:		434,433
INDIRECT OPERATING COSTS (IOC):		
Overhead	60% of oper. labor & maintenance	118,358
Property Taxes	1% of total capital investment	217,919
Insurance	1% of total capital investment	217,919
Administration	2% of total capital investment	435,838
Total IOC:		990,034
CAPITAL RECOVERY COSTS (CRC):	CRF of 0.0944 times TCI (20 yrs @ 7%)	2,057,156
ANNUALIZED COSTS (AC):	DOC + IOC + CRC	3,481,623

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

APPENDIX A

REVISED
AIR MODELING PROTOCOL
TO EVALUATE
BEST AVAILABLE RETROFIT TECHNOLOGY (BART) OPTIONS
FOR CF INDUSTRIES

REVISED
BART MODELING PROTOCOL
CF INDUSTRIES
PLANT CITY, FLORIDA

Prepared For:
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Plant City, Florida

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January 2007

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1.0 INTRODUCTION

1.1 Objectives

Under the regional haze regulations, which are contained in Title 40, Part 51 of the Code of Federal Regulations (40 CFR 51), Subpart P – Protection of Visibility, the U.S. Environmental Protection Agency (EPA) has issued final 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 were put in place between August 7, 1962 and August 7, 1977;
- Contains emissions units that are one of the 26 listed source categories in the guidance; 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})].

CF Industries (CFI) Plant City facility has been identified as a BART-eligible source with multiple BART-eligible emissions units.

The Florida Department of Environmental Protection (FDEP) has proposed to adopt EPA's visibility protection rules and guidelines contained in 40 CFR 51, Subpart P. Final adoption of these rules is expected by 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 Class I areas while Georgia has two 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.

Step 5. Evaluate visibility impacts. Use CALPUFF or other appropriate dispersion model to determine the visibility improvement expected at a Class I area from the potential BART control technology applied to the source. Note that if the most stringent BART control option available is selected, it is not necessary to conduct an air quality modeling analysis for the purpose of determining its visibility impacts.

BART Determination: In making a final BART determination, the following will be considered: (1) technically feasible options; (2) the average and incremental costs of each option; (3) the energy and non-air quality environmental impacts of each option; (4) the remaining useful life; and (5) the modeled visibility impacts. A justification for selecting a technology as the "best" level of control must be provided and include an explanation of these factors that led to the BART determination. When a BART determination is made for two regulated pollutants on the same source, if the result is two different BART technologies that do not work well together, it may be reasonable to substitute a different technology or combination of technologies.

Summary of Applicant's Initial Modeling Analysis

The CF Industries Plant City BART analysis methodology was based on an air modeling protocol, revised January 2007. The modeling protocol was reviewed by the Department and is based on guidance from the VISTAS (Visibility Improvement State and Tribal Association of the Southeast) common modeling protocol, Version 3.2. Further, the Department determined the protocol to be the basis for the modeling methodologies used for this BART analysis.

The BART-eligible emissions units for the CF facility are subject to the visibility impairment analysis as dictated by the modeling protocol. The analysis includes visibility impairment at all PSD Class I areas within 300 km of the Plant City facility. These Class I areas are the Chassahowitzka National Wildlife Refuge (CNWR), the Everglades National Park (ENP), the Okefenokee National Wildlife Refuge (ONWR) and the St. Marks National Wildlife Refuge (SNWR). These Class I areas are 70, 261, 263 and 273 kilometers (km) away from CF Industries Plant City respectively.

The CALPUFF model (Version 5.756) was used to predict the maximum visibility impairment. The Department provided the applicant with 4-km "CALPUFF-ready" CALMET meteorological data for the period 2001-2003. Class I receptor locations were obtained from the National Park Service (NPS) and a Lambert Conformal Conic (LCC) coordinate system was used. Modeling results are based on the 8th highest 24-hour average impairment value in one year, for 3 years.

The applicant performed initial modeling to determine if the Plant City facility contributes to visibility impairment. Modeled concentrations were then compared to the visibility impairment threshold of 0.5 deciviews (dv), based on the final BART federal regulation 70 FR 39118. A deciview is a standard visibility index. The Interagency Monitoring of Protected Visual Environments (IMPROVE) states that the deciview scale is linear to humanly-perceived changes in visual air quality. A dv near zero is considered a "pristine" atmosphere. Deciviews increase with visibility impairment. This initial analysis concluded that the Plant City facility contributes to visibility impairment at the CNWR only and therefore, all BART-eligible sources are subject to a BART determination analysis for the CNWR.

The BART- eligible sources (emissions units) for the Plant City facility are: SAP A, B, C and D; DAP/MAP Plants A, X, Y and Z; and the A and B Shipping Baghouses. As indicated by the applicant, the visibility impacts from the DAP/MAP plants and the shipping baghouses are only 0.016 dv and 0.004 dv respectively compared to a maximum impact of 0.237 dv from the C SAP, therefore a complete reduction of the impact from the MAP/DAPs and baghouses would not result in a significant improvement of visibility. Due to this conclusion by the applicant, the applicant suggested that current controls on the DAP/MAPs and the existing baghouses are BART, therefore no further modeling was completed with regards to these sources.

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 criterion, 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 Class I areas. A source-specific modeling protocol is required to be submitted by the affected sources to FDEP for review and approval. Protocols are due to FDEP no later than September 30, 2006. 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 CFI'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 6, 2006)]. The proposed modeling protocol for the CFI Plant City facility follows the general procedures recommended by VISTAS.

1.2 Location of Source

The CFI Plant City facility is located south of Zephyrhills and north of Plant City in northeastern Hillsborough County. An area map showing the facility location and Class I areas located within 300 km of the facility is presented in Figure 1-1. The Class I areas and their distances from CFI are as follows:

- Chassahowitzka National Wilderness Area (NWA) - 70 km
- Everglades National Park (NP) - 261 km
- Okefenokee NWA - 263 km, and
- Saint Marks NWA - 273 km.

The Universal Transverse Mercator (UTM) coordinates of the CFI facility are approximately 388.0 km East and 3,116.0 km North in UTM Zone 17.

1.3 Source Impact Evaluation Criteria

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

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

The common BART protocol identifies the first 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.

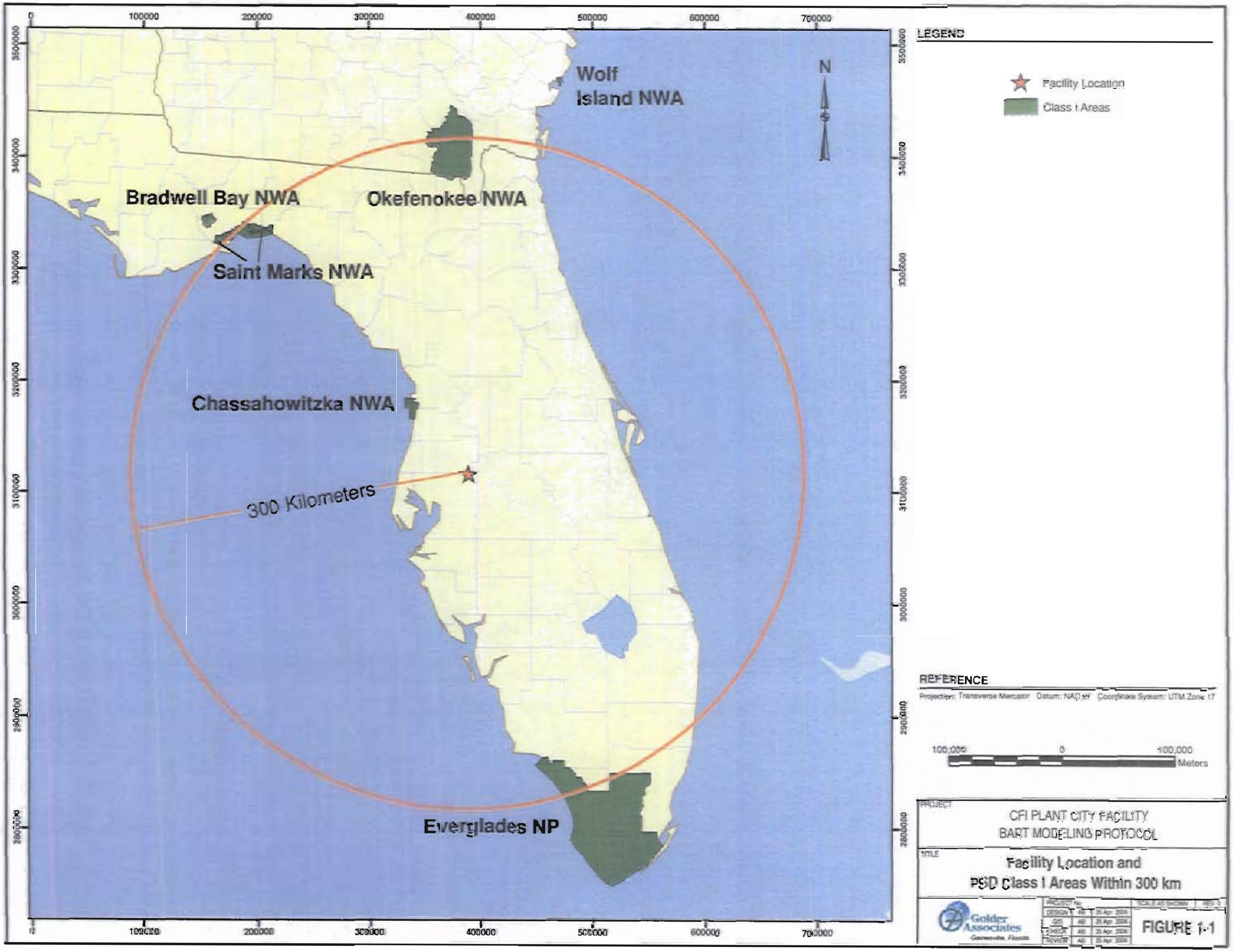
Based on VISTAS recommendations regarding BART exemption analysis, "initial screening" and "refined" analyses can be performed to determine whether a BART-eligible source is subject to or exempt from BART. The initial screening analysis, which is based on a coarse scale 12-km regional VISTAS domain,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



Facility Location and PSD Class I Areas Within 300 km

FIGURE 1-1

2.0 SOURCE DESCRIPTION

2.1 Source Applicability

CFI operates four sulfuric acid plants (SAP), two phosphoric acid plants (PAP), four diammonium phosphate/monoammonium phosphate (DAP/MAP) plants, molten sulfur storage and handling operations, product storage and shipping operations, and ancillary equipment at the Plant City facility in order to produce phosphate fertilizers. The FDEP has published a list of potential BART-eligible sources (updated January 10, 2006), which is based on a survey questionnaire sent by FDEP to selected facilities in Florida on November 4, 2002 and April 18, 2003. The FDEP's list contains a total of twenty potential BART-eligible emissions units located at the CFI Plant City facility. The CFI Plant City facility is on the FDEP list since it is one of the 26 major source categories identified in the BART regulation (phosphate rock processing plants) and has potential emissions of visibility impairment pollutants (i.e., SO_2, NO_x, and PM_{10}) from the BART-eligible emissions units that are greater than 250 TPY.

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

First, the facility is classified under the source category of "phosphate rock processing plants," which includes fertilizer production plants (the facility is also classified by FDEP as a "Chemical Process Plant").

Second, each emissions unit at the 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.

The results of this analysis are summarized in Table 2-1, which shows a total of twenty BART-eligible emission units at this facility. As shown in Table 2-1, 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 Class I area (i.e.: 50 km). The final list of BART-eligible, non-fugitive emissions units for CFI that emit SO_2, NO_x, or PM_{10} are as follows:

- EU002 "A" SAP
- EU003 "B" SAP
- EU007 "C" SAP
- EU008 "D" SAP
- EU010 "A" DAP/MAP Plant
- EU011 "Z" DAP/MAP Plant
- EU012 "X" DAP/MAP Plant
- EU013 "Y" DAP/MAP Plant
- EU015 "A" Shipping Baghouse
- EU018 "B" Shipping Baghouse

The Johnson Boiler (EU001) is excluded from the BART-eligible list as it has a maximum heat input rate less than 250 million British thermal units per hour (MMBtu/hr) and is not an integral part of any process in the BART source category of "phosphate rock processing plants" or "chemical process plants." EPA has ruled that any boiler that supplies only heat or steam to a process is not integral to that process.

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 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 emissions units at the Plant City facility are presented in Table 2-2. For the modeling analysis, all the emissions units will be collocated in the VISTAS domain Lambert Conformal Conic (LCC) coordinate system at (X, Y) = (1,467.3, -1,195.3) km.

2.3 Emission Rates for Visibility Impairment Analyses

The EPA BART guidelines indicate 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.

Among the BART-eligible emissions units at CFI, the SAPs (EUs 002, 003, 007, and 008) have CEM for SO_2 emissions. The SO_2 emission rates for the "C" and "D" SAPs will be obtained from the CEM data for the period 2001-2003. The "B" SAP is currently undergoing PSD review for a production rate increase; therefore, the proposed Best Available Control Technology (BACT) emission limit will be used in the modeling analysis. For the "A" SAP, a 24-hour average SO_2 emission limit of 250.0 pounds per hour (lb/hr) has recently been proposed, which will be used in the modeling analysis. NO_x emission rates for "C" and "D" SAPs are from the current Title V Permit No. 0570005-017-AV. NO_x emission rates for "A" and "B" SAPs are based on a proposed BACT limit for "B" SAP in the PSD permit application dated April 2006.

PM_{10} emission rates for the "A", "X", "Y", and "Z" DAP/MAP plants and the "A" and "B" shipping baghouses are obtained from Permit No. 0570005-017-AV and the recent PSD permit application dated April 2006. NO_x and SO_2 emission rates for the DAP/MAP plants are based on AP-42 emission factors for oil-firing since these emission rates are higher than for gas-firing.

The maximum 24-hour average emission rates for the BART-eligible units at CFI that will be used in the modeling are presented in Table 2-3.

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 Table 2-1, total PM_{10} emissions from the BART-eligible emissions units at CFI are approximately 400 TPY, compared to approximately 5,500 TPY of SO_2. Since PM_{10} emissions are much lower than SO_2 emissions and the PM speciation profile for the DAP/MAP plants is 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 SAPs will be considered as condensable inorganic PM and will be modeled as SO_4, with extinction efficiency of 3*f(RH).

2.5 Building Dimensions

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 Class I area is more than 50 km from the CFI Plant City facility.

TABLE 2-1
BART ELIGIBILITY ANALYSIS FOR CF INDUSTRIES - PLANT CITY FACILITY
(FACILITY ID 0570005)

EU ID	Emission Unit	BART Category [a]	Dates: Start-Up	Dates: Initial Construction	In Existence on 8/7/1977? (Yes/No)	Began Operation After 8/7/1962 ? (Yes/No)	Meets BART Date Criteria ? (Yes/No)	SO_2, NO_x, or PM Source ? (Yes/No)	BART Eligible ? (Yes/No)	Potential Emissions: SO_2 (TPY)	Potential Emissions: NO_x (TPY)	Potential Emissions: PM_{10} (TPY)	Comments
001	Johnston Scotch Marine Type Boiler	None	--	--	--	--	--	--	No	--	--	--	< 250 MMBtu/hr and not integral to process
002	"A" Sulfuric Acid Plant	13	12/1/1965	1964	Yes	Yes	Yes	Yes	Yes	1003	28.5	--	
003	"B" Sulfuric Acid Plant	13	12/1/1965	1964	Yes	Yes	Yes	Yes	Yes	1003	28.5	--	
004	"A" PAP [b]	13	12/1/1965	1964	Yes	Yes	Yes	No	Yes	--	--	--	Only fluoride emissions
007	"C" Sulfuric Acid Plant	13	1/8/1975	1974	Yes	Yes	Yes	Yes	Yes	1757	60.0	--	
008	"D" Sulfuric Acid Plant	13	1/8/1975	1974	Yes	Yes	Yes	Yes	Yes	1757	60.0	--	
009	"B" PAP [b]	13	1/8/1975	1974	Yes	Yes	Yes	No	Yes	--	--	--	Only fluoride emissions
010	"A" DAP/MAP Plant	13	12/1/1965	1964	Yes	Yes	Yes	Yes	Yes	6.3	17.8	143.1	
011	"Z" DAP/MAP Plant	13	1/8/1975	1974	Yes	Yes	Yes	Yes	Yes	9.5	26.7	99	
012	"X" DAP/MAP Plant	13	1/8/1975	1974	Yes	Yes	Yes	Yes	Yes	9.9	28	41.9	
013	"Y" DAP/MAP Plant	13	1/8/1975	1974	Yes	Yes	Yes	Yes	Yes	11	31	67	
014	"A" and "B" Storage Building [c]	13	1/8/1975	1974	Yes	Yes	Yes	Yes	Yes	--	--	--	Fugitive emissions only
015	"A" Shipping Baghouse	13	12/1/1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	21.9	
018	"B" Shipping Baghouse	13	1/8/1975	1974	Yes	Yes	Yes	Yes	Yes	--	--	21.9	
019	"B" Truck/Railcar Loading	13	1/8/1975	1974	Yes	Yes	Yes	Yes	Yes	--	--	--	Fugitive emissions only
020	"A" Railcar/Truck Loading	13	12/1/1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	--	Fugitive emissions only
032	Phosphoric Acid Cleanup System	13	5/1/1980	1979	No	Yes	No	--	No	--	--	--	Did not exist on 8/7/77
022	Molten Sulfur Handling --Storage Tank (022)	13	1/8/1975	1974	Yes	Yes	Yes	Yes	Yes	--	--	--	Fugitive emissions only
023	Molten Sulfur Handling --Truck Pit A	13	12/1/1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	--	Fugitive emissions only
024	Molten Sulfur Handling --Truck Pit B	13	12/1/1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	--	Fugitive emissions only
033	Molten Sulfur Handling --Storage Tank (033)	13	1/1/1992	1991	No	Yes	No	--	No	--	--	--	Did not exist on 8/7/77
099	Unregulated Units and Facility Fugitives	13	12/1/1965	1964	Yes	Yes	Yes	Yes	Yes	--	--	--	Fugitive emissions only
100	Phosphogypsum Stack [b]	13	12/1/1965	1964	Yes	Yes	Yes	No	Yes	--	--	--	Only fluoride emissions
									Total TPY =	5,556.7	280.4	394.8	

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

[b] Not a SO_2, NO_x, or PM_{10} source and therefore, will not be included in any modeling and a BART determination will not be required.

[c] A & B Storage building scrubber has been removed and this is a fugitive emissions source only.

TABLE 2-2
SUMMARY OF STACK AND OPERATING PARAMETERS AND LOCATIONS FOR THE BART-ELIGIBLE EMISSIONS UNITS
CFI PLANT CITY FACILITY

		Stack Parameters				Operating Parameters				
		Height		Diameter		Flow Rate	Exit Temperature		Velocity	
Emission Unit	Model ID	ft	m	ft	m	(acfm)	^{o}F	K	ft/s	m/s
"A" SAP	SAPA	110	33.53	5.0	1.52	80,950	83	301.5	68.7	20.94
"B" SAP	SAPB	110	33.53	5.0	1.52	88,140	83	301.5	74.8	22.80
"C" SAP	SAPC	199	60.66	8.0	2.44	140,700	158	343.2	46.7	14.22
"D" SAP	SAPD	199	60.66	8.0	2.44	145,600	161	344.8	48.3	14.71
"A" DAP/MAP Plant	ADMP	99	30.18	10.0	3.05	173,300	137	331.5	36.8	11.21
"Z" DAP/MAP Plant	ZDMP	180	54.86	9.0	2.74	169,800	140	333.2	44.5	13.56
"X" DAP/MAP Plant	XDMP	180	54.86	9.0	2.74	193,700	134	329.8	50.7	15.47
"Y" DAP/MAP Plant	YDMP	180	54.86	9.0	2.74	203,400	135	330.4	53.3	16.24
"A" Shipping Baghouse	ASBAG	90	27.43	1.7	0.52	8,500	110	316.5	62.4	19.02
"B" Shipping Baghouse	BSBAG	35	10.67	2.0	0.61	10,000	120	322.0	53.1	16.17

Note: All emissions units will be collocated for the purpose of modeling. The facility coordinates are as follows:
UTM Zone 17: 388.0 km East, 3,116.0 km North.
Lambert Conformal Conic (LCC) coordinate, VISTAS Domain: 1,467.3 km, -1,195.3 km.

TABLE 2-3
SUMMARY OF MAXIMUM 24-HOUR AVERAGE EMISSION RATES FOR THE BART-ELIGIBLE EMISSIONS UNITS, CFI PLANT CITY FACILITY

Source	EU ID	Model ID	PM_{10} (lb/hr)	NO_x (lb/hr)	SO_2 (lb/hr)	H_2SO_4 [j] (lb/hr)
"A" SAP	002	SAPA	--	6.5 [a]	250.0 [b]	0.46 [c]
"B" SAP	003	SAPB	--	8.0 [d]	233.3 [d]	5.00 [d]
"C" SAP	007	SAPC	--	14.0 [e]	373.1 [f]	4.80 [c]
"D" SAP	008	SAPD	--	14.0 [e]	377.9 [g]	3.86 [c]
"A" DAP/MAP Plant	010	ADMP	7.87 [c]	4.1 [h]	1.45 [h]	<0.1
"Z" DAP/MAP Plant	011	ZDMP	6.75 [c]	6.1 [h]	2.17 [h]	<0.1
"X" DAP/MAP Plant	012	XDMP	6.23 [c]	7.1 [h]	2.52 [h]	<0.1
"Y" DAP/MAP Plant	013	YDMP	8.06 [c]	7.1 [h]	2.51 [h]	<0.1
"A" Shipping Baghouse	015	ASBAG	1.7 [i]	--	--	--
"B" Shipping Baghouse	018	BSBAG	1.7 [i]	--	--	--

[a] Based on proposed BACT limit of 0.12 lb/ton of 100% H_2SO_4 produced for the "B" SAP from PSD application dated April 2006 and permitted maximum production rate of 1,300 tons/day of 100% H_2SO_4.

[b] Based on the proposed 24-hour average emissions limit, January 2007.

[c] Based on the maximum of test data. See Appendix B.

[d] Proposed BACT limit, PSD permit application dated April 2006.

[e] Based on limit in Permit No. 0570005-017-AV. Actual ?

[f] Based on the maximum 24-hour average emissions from CEM data dated 3/02/05.

[g] Based on the maximum 24-hour average emissions from CEM data dated 1/31/05.

[h] Based on AP-42 emission factors. See Appendix A for calculations.

[i] Proposed emission limit, PSD permit application dated April 2006.

[j] Emission rates less than 0.1 lb/hr will not be included in modeling.

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, for this protocol, the exemption modeling will be based on the finer grid modeling since the CFI Plant City facility is a large source that is likely to exceed the initial screening thresholds.

3.2 Land Use and Meteorological Database

The CALMET 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 CFI facility are as follows:

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

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

According to FDEP recommendations, the natural background light extinction may be based on haze index (HI) values (in dv) for either the annual average or the 20-percent best visibility days provided by EPA in Appendix B of the Haze Guideline document (using the 10^{th} percentile HI value). For CFI'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, the annual average background light extinction coefficient for each Class I area and corresponding calculated BKSOIL concentrations are as follows:

- Chassahowitzka NWA – 21.45 Mm^{-1} (equivalent to 7.63 dv); 11.45 $\mu g/m^3$
- Everglades NP – 20.77 Mm^{-1} (equivalent to 7.31 dv); 10.77 $\mu g/m^3$
- Okefenokee NWA – 21.40 Mm^{-1} (equivalent to 7.61 dv); 11.40 $\mu g/m^3$
- Saint Marks NWA – 21.53 Mm^{-1} (equivalent to 7.67 dv); 11.53 $\mu g/m^3$

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

The new algorithm splits the total sulfate, nitrate, and organic carbon compound concentrations into two fractions, representing small and large size distributions of those compounds. New terms added to the algorithm are light absorption by NO_2 gas and light scattering due to fine sea salt accompanied by its own hygroscopic scattering enhancement factor and Class I area-specific Rayleigh scattering values rounded off to the nearest whole number. The 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 CFI'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 CFI'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 CFI'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 $\mu g/m^3$
- Okefenokee NWA – 11 Mm^{-1} ; 0.09 $\mu g/m^3$
- Saint Marks NWA – 11 Mm^{-1} ; 0.03 $\mu g/m^3$

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 FLMs' 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 of these domains cover 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 CFI's 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 Class I area using receptor locations provided by the FLMs. Because the Everglades NP and the Okefenokee NWA have such a large number of receptors, a smaller set of receptors consisting of the boundary and some intermediate points in each of these Class I areas will be modeled. The receptors to be used for each of the 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 CFI's BART analysis is presented in Appendix C.

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 CFI. 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:

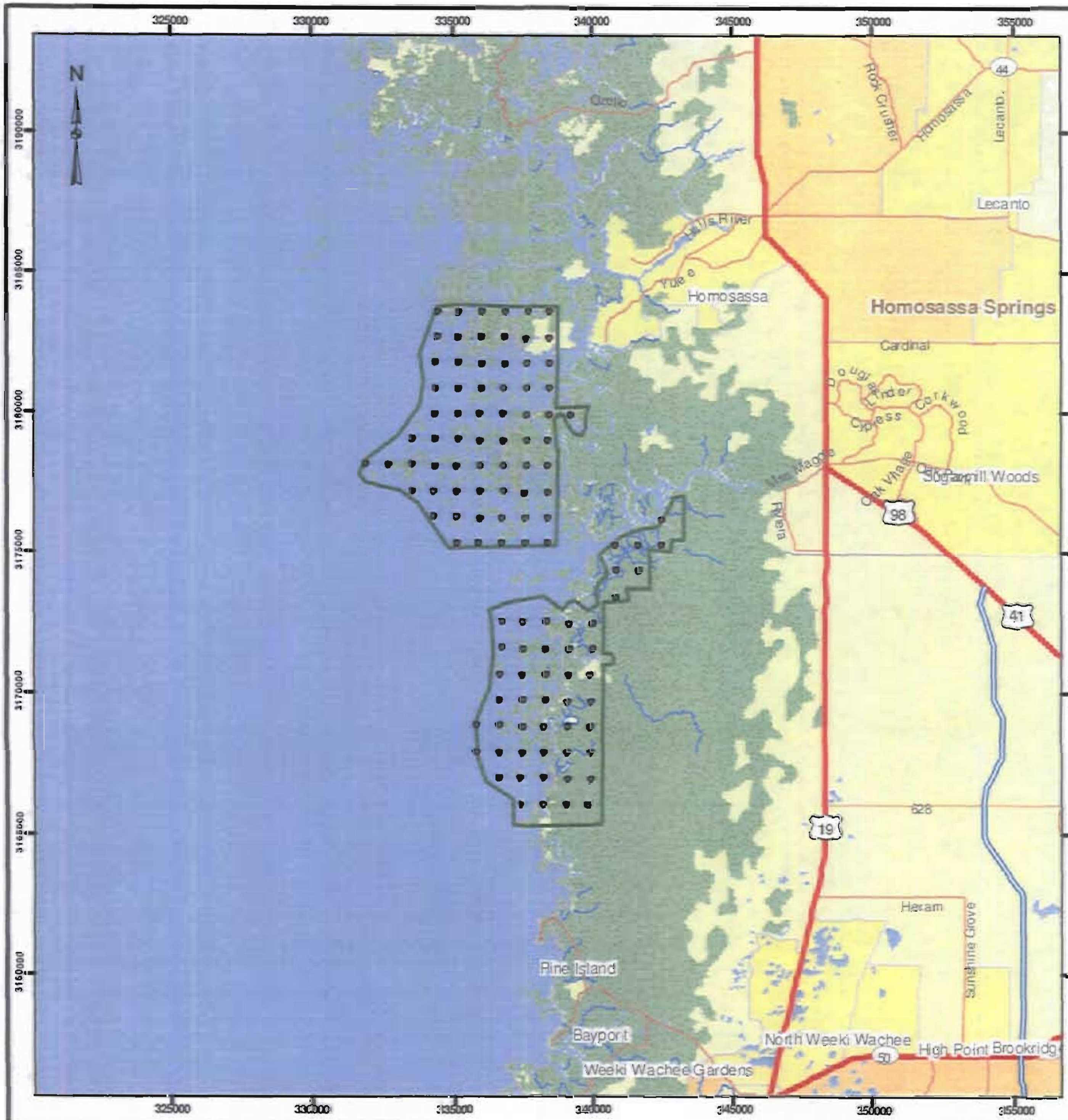
- Appropriate CALPUFF concentrations files are used in the POSTUTIL run;
- The PM species categories are computed using the appropriate fractions;
- Background light extinction computation method selected as Method 6;
- Correct monthly relative humidity adjustment factors used for the appropriate Class 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; and
- 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

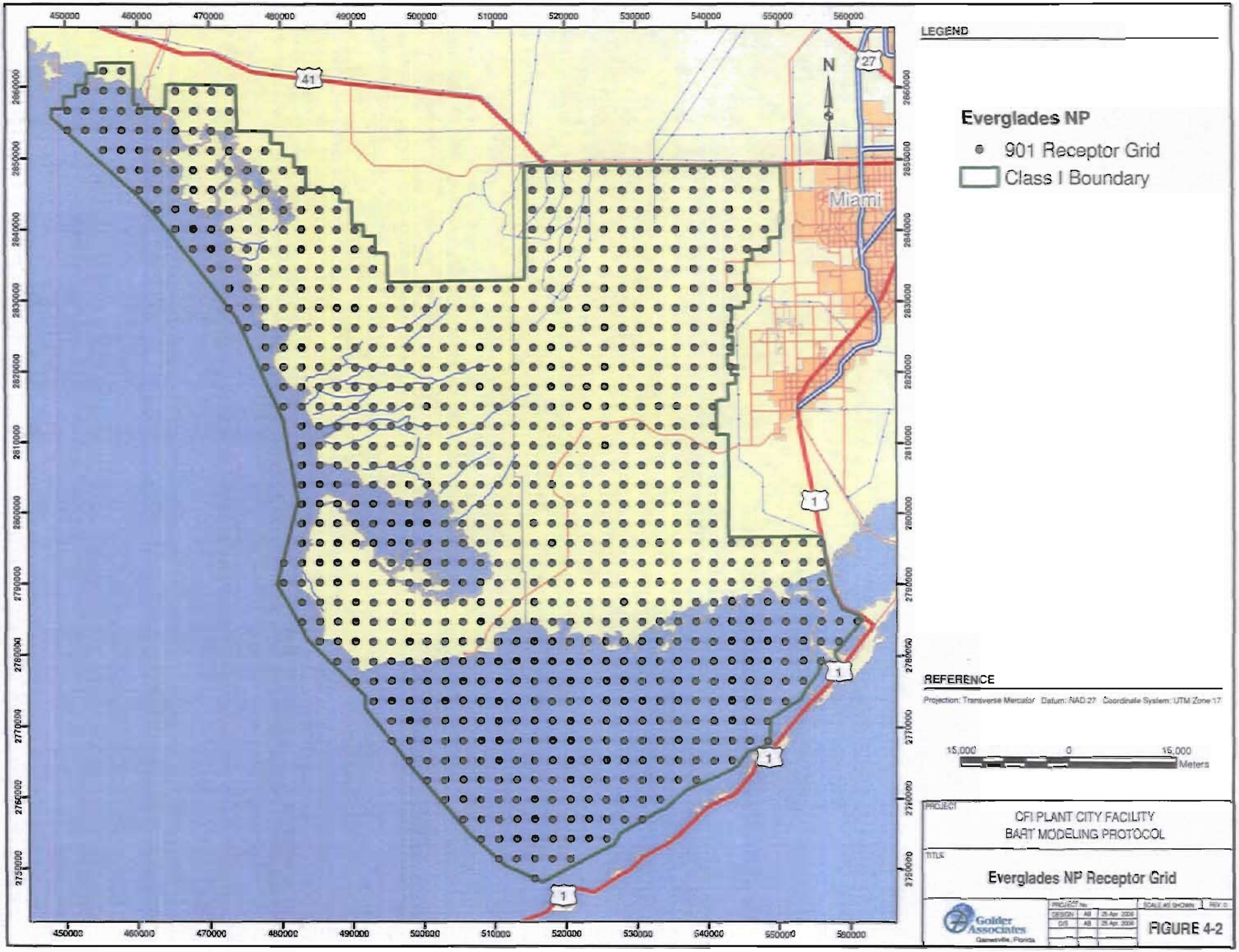
CF PLANT CITY FACILITY
BART MODELING PROTOCOL

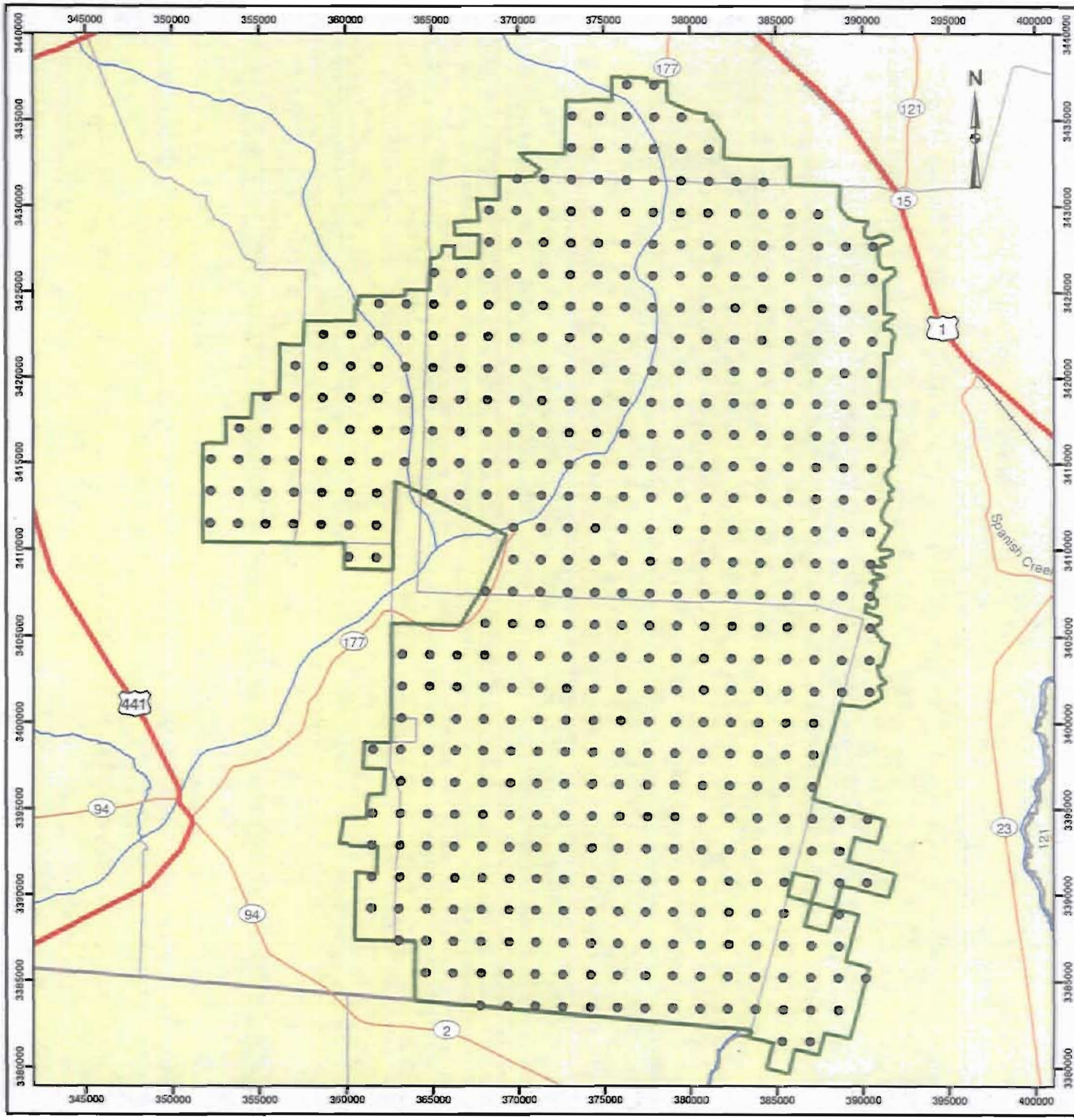
TITLE

Chassahowitzka NWA Receptor Grid

Golder Associates

FIGURE 4-1


LEGEND
Everglades NP
901 Receptor Grid
Class I Boundary
Miami
N
41
27
1
REFERENCE
Projection: Transverse Mercator Datum: NAD 27 Coordinate System: UTM Zone 17
15,000 0 15,000
Meters
PROJECT
CFI PLANT CITY FACILITY
BART MODELING PROTOCOL
TITLE
Everglades NP Receptor Grid
Golder Associates
Gainesville, Florida
FIGURE 4-2



LEGEND

Okefenokee NWA

- 500 Receptor Grid
- Class I Boundary

REFERENCE

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

8,000 0 8,000 Meters

PROJECT

CFI PLANT CITY FACILITY
BART MODELING PROTOCOL

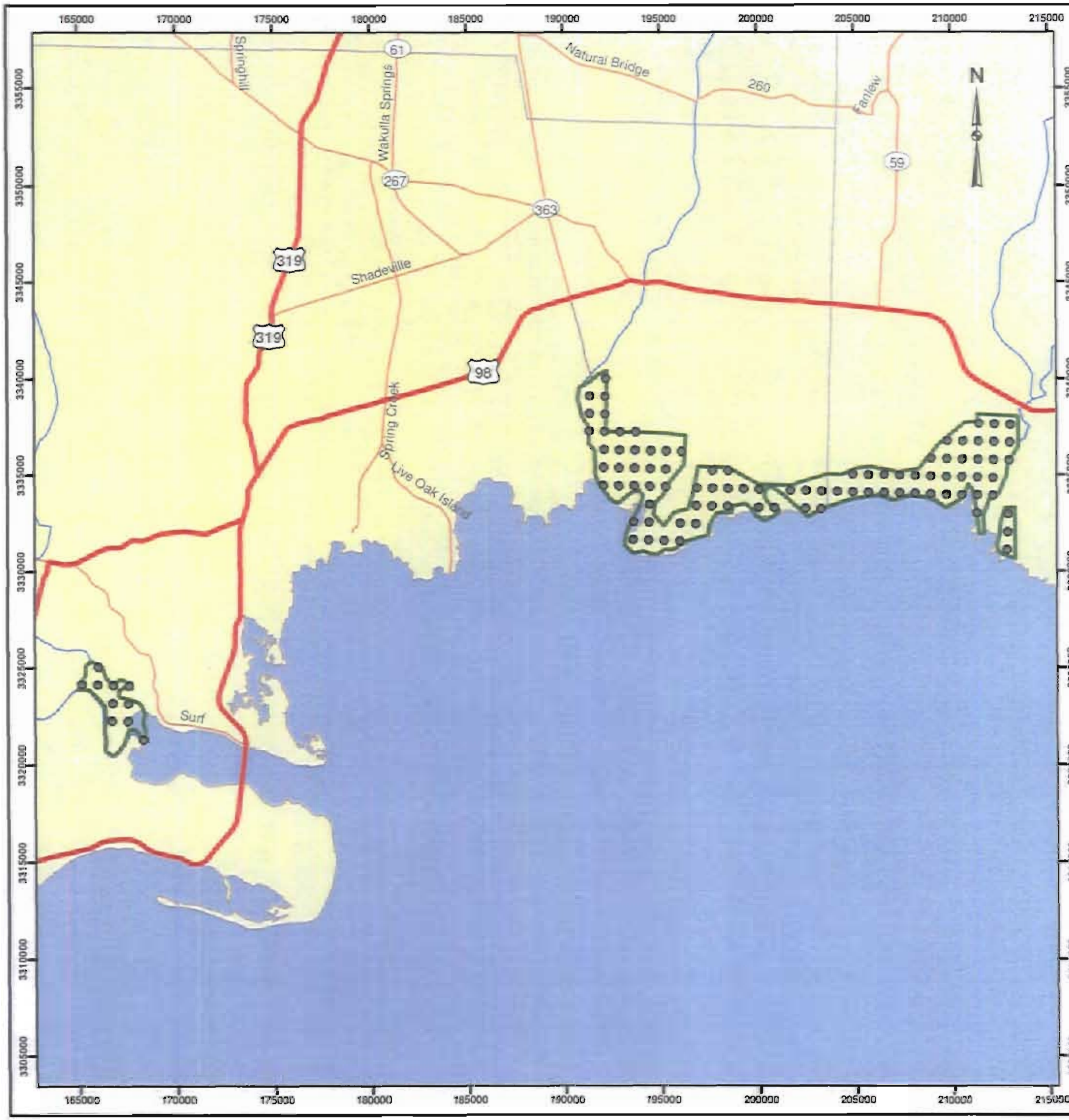
TITLE

Okefenokee NWA Receptor Grid

Golder Associates
Gainesville, Florida

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

FIGURE 4-3



LEGEND

Saint Marks NWA

- 100 Receptor Grid
- Class I Boundary

REFERENCE

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

6,000 0 6,000 Meters

PROJECT
CFI PLANT CITY FACILITY
BART MODELING PROTOCOL

TITLE
Saint Marks NWA Receptor Grid

Golder Associates
Gainesville, Florida

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

FIGURE 4-4

APPENDIX A

MAXIMUM EMISSION RATES

TABLE A-1
MAXIMUM EMISSION RATES DUE TO FUEL COMBUSTION FOR THE DRYER AT THE "A" DAP/MAP PLANT

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	28.5	28.5
Hourly Fuel Oil Usage[a]	10^3gal/hr	0.20	N/A
Annual Fuel Oil Usage	10^3gal/yr	1,783	N/A
Maximum Sulfur Content	Weight %	0.05	N/A
Hourly Natural Gas Usage[b]	10^6scf/hr	N/A	0.029
Annual Natural Gas Usage	10^6scf/yr	N/A	249.7
Maximum Sulfur Content	gr/100 ft^3	N/A	N/A

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)	Maximum Emission Rate Hourly Emisson Rate (lb/hr)	Maximum Emission Rate Annual Emission Rate (TPY)
Sulfur Dioxide							
Fuel oil	142 *(S) lb/10^3gal[d]	1.45	6.33	--	--	--	--
Natural gas	0.6 lb/10^6ft^3	--	--	0.02	0.07	--	--
Worse-Case Combination of Fuels		--	--	--	--	1.45	6.33
Sulfuric Acid Mist							
Fuel oil	2.4 *(S) lb/10^3gal[d,e]	0.02	0.11	--	--	0.024	0.107
Nitrogen Oxides							
Fuel oil	20 lb/10^3gal	4.07	17.83	--	--	--	--
Natural gas	100 lb/10^6ft^3	--	--	2.85	12.48	--	--
Worse-Case Combination of Fuels		--	--	--	--	4.07	17.83
Carbon Monoxide							
Fuel oil	5 lb/10^3gal	1.02	4.46	--	--	--	--
Natural gas	84 lb/10^6ft^3	--	--	2.39	10.49	--	--
Worse-Case Combination of Fuels		--	--	--	--	2.39	10.49
Volatile Organic Compounds							
Fuel oil	0.052 lb/10^3gal	0.01	0.05	--	--	--	--
Natural gas	5.5 lb/10^6ft^3	--	--	0.16	0.69	--	--
Worse-Case Combination of Fuels		--	--	--	--	0.16	0.69

Footnotes:

[a] Based on the heat content of fuel oil of 146,000 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-2

MAXIMUM EMISSION RATES DUE TO FUEL COMBUSTION FOR THE DRYER AT THE "Z" DAP/MAP PLANT

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	42.75	42.75
Hourly Fuel Oil Usage[a]	10^3gal/hr	0.31	N/A
Annual Fuel Oil Usage	10^3gal/yr	2,675	N/A
Maximum Sulfur Content	Weight %	0.05	N/A
Hourly Natural Gas Usage[b]	10^6scf/hr	N/A	0.043
Annual Natural Gas Usage	10^6scf/yr	N/A	374.5
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	142 *(S) lb/10^3gal[d]	2.17	9.50	--	--	--	--
Natural gas	0.6 lb/$10^6$$ft^3$	--	--	0.03	0.11	--	--
Worse-Case Combination of Fuels		--	--	--	--	2.17	9.50
Sulfuric Acid Mist							
Fuel oil	2.4 *(S) lb/10^3gal[d,e]	0.04	0.16	--	--	0.037	0.160
Nitrogen Oxides							
Fuel oil	20 lb/10^3gal	6.11	26.75	--	--	--	--
Natural gas	100 lb/$10^6$$ft^3$	--	--	4.28	18.72	--	--
Worse-Case Combination of Fuels		--	--	--	--	6.11	26.75
Carbon Monoxide							
Fuel oil	5 lb/10^3gal	1.53	6.69	--	--	--	--
Natural gas	84 lb/$10^6$$ft^3$	--	--	3.59	15.73	--	--
Worse-Case Combination of Fuels		--	--	--	--	3.59	15.73
Volatile Organic Compounds							
Fuel oil	0.052 lb/10^3gal	0.02	0.07	--	--	--	--
Natural gas	5.5 lb/$10^6$$ft^3$	--	--	0.24	1.03	--	--
Worse-Case Combination of Fuels		--	--	--	--	0.24	1.03

Footnotes:

[a] Based on the heat content of fuel oil of 140,000 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 DRYER AT THE "X" DAP/MAP PLANT

Parameter	Units	No. 2 Fuel Oil	Natural Gas
Operating Data			
Annual Operating Hours	hr/yr	7,884	7,884
Maximum Heat Input Rate	10^6Btu/hr	49.7	49.7
Hourly Fuel Oil Usage[a]	10^3gal/hr	0.36	N/A
Annual Fuel Oil Usage	10^3gal/yr	2,799	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	391.8
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	142 *(S) lb/10^3gal[d]	2.52	9.94	--	--	--	--
Natural gas	0.6 lb/$10^6$$ft^3$	--	--	0.03	0.12	--	--
Worse-Case Combination of Fuels		--	--	--	--	2.52	9.94
Sulfuric Acid Mist							
Fuel oil	2.4 *(S) lb/10^3gal[d,e]	0.04	0.17	--	--	0.043	0.168
Nitrogen Oxides							
Fuel oil	20 lb/10^3gal	7.10	27.99	--	--	--	--
Natural gas	100 lb/$10^6$$ft^3$	--	--	4.97	19.59	--	--
Worse-Case Combination of Fuels		--	--	--	--	7.10	27.99
Carbon Monoxide							
Fuel oil	5 lb/10^3gal	1.78	7.00	--	--	--	--
Natural gas	84 lb/$10^6$$ft^3$	--	--	4.17	16.46	--	--
Worse-Case Combination of Fuels		--	--	--	--	4.17	16.46
Volatile Organic Compounds							
Fuel oil	0.052 lb/10^3gal	0.02	0.07	--	--	--	--
Natural gas	5.5 lb/$10^6$$ft^3$	--	--	0.27	1.08	--	--
Worse-Case Combination of Fuels		--	--	--	--	0.27	1.08

Footnotes:

[a] Based on the heat content of fuel oil of 140,000 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-4
MAXIMUM EMISSION RATES DUE TO FUEL COMBUSTION FOR THE DRYER AT THE "Y" DAP/MAP PLANT

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	49.5	49.5
Hourly Fuel Oil Usage[a]	10^3gal/hr	0.35	N/A
Annual Fuel Oil Usage	10^3gal/yr	3,097	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	433.6
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	142 *(S) lb/10^3gal[d]	2.51	11.00	--	--	--	--
Natural gas	0.6 lb/10^6ft^3	--	--	0.03	0.13	--	--
Worse-Case Combination of Fuels		--	--	--	--	2.51	11.00
Sulfuric Acid Mist							
Fuel oil	2.4 *(S) lb/10^3gal[d,e]	0.04	0.19	--	--	0.042	0.186
Nitrogen Oxides							
Fuel oil	20 lb/10^3gal	7.07	30.97	--	--	--	--
Natural gas	100 lb/10^6ft^3	--	--	4.95	21.68	--	--
Worse-Case Combination of Fuels		--	--	--	--	7.07	30.97
Carbon Monoxide							
Fuel oil	5 lb/10^3gal	1.77	7.74	--	--	--	--
Natural gas	84 lb/10^6ft^3	--	--	4.16	18.21	--	--
Worse-Case Combination of Fuels		--	--	--	--	4.16	18.21
Volatile Organic Compounds							
Fuel oil	0.052 lb/10^3gal	0.02	0.08	--	--	--	--
Natural gas	5.5 lb/10^6ft^3	--	--	0.27	1.19	--	--
Worse-Case Combination of Fuels		--	--	--	--	0.27	1.19

Footnotes:

[a] Based on the heat content of fuel oil of 140,000 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.

APPENDIX B

SUMMARY OF RECENT EMISSION TESTS

TABLE B-1
SUMMARY OF RECENT EMISSION TESTS AT THE MAP/DAP PLANTS
CF INDUSTRIES, PLANT CITY FACILITY

Test Date	Unit	Average Process Rate (TPH P_2O_5)	Particulate Matter avg lb/hr	Particulate Matter avg lb/ton P_2O_5[a]	Fluoride avg lb/hr	Fluoride avg lb/ton P_2O_5[a]
A DAP/MAP						
11/12/2005	A DAP/MAP	NA	3.35	NA	0.23	NA
11/11/2005	A DAP/MAP	NA	4.20	NA	0.28	NA
8/7/2000	A DAP/MAP	28.8	7.87	0.273	0.17	0.0059
X DAP						
3/22/2005	X DAP	45.0	1.76	0.0391	0.35	0.0078
4/20/2004	X DAP	NA	3.63	NA	0.79	NA
8/26/2003	X DAP	NA	NA	NA	0.53	NA
3/25/2003	X DAP	NA	2.51	NA	0.33	NA
4/9/2002	X DAP	44.8	6.23	0.139	0.39	0.0087
3/22/2001	X DAP	NA	3.06	NA	1.11	NA
Y DAP						
4/14/2005	Y DAP	45.1	1.55	0.0343	0.53	0.0118
5/5/2004	Y DAP	NA	4.08	NA	0.35	NA
7/1/2003	Y DAP	NA	5.98	NA	0.70	NA
5/8/2002	Y DAP	48.1	7.22	0.150	0.69	0.014
4/26/2001	Y DAP	NA	5.13	NA	2.11	NA
Y MAP						
4/5/2005	Y MAP	44.9	3.54	0.0788	0.81	0.0181
4/27/2004	Y MAP	42.4	8.06	0.1902	0.75	0.0176
9/16/2003	Y MAP	NA	NA	NA	0.44	NA
4/29/2003	Y MAP	NA	3.00	NA	1.05	NA
4/2/2002	Y MAP	46.0	5.37	0.117	1.13	0.025
4/3/2001	Y MAP	NA	5.19	NA	1.58	NA
Z DAP						
3/10/2005	Z DAP	44.9	6.75	0.1503	0.37	0.0082
3/2/2004	Z DAP	44.6	3.70	0.0829	0.69	0.0156
9/4/2003	Z DAP	NA	NA	NA	0.95	NA
3/11/2003	Z DAP	NA	4.99	NA	1.30	NA
3/12/2002	Z DAP	46.0	2.99	0.0650	0.30	0.0065
3/8/2001	Z DAP	NA	4.95	NA	0.57	NA

[a] As calculated.

TABLE B-2
SUMMARY OF RECENT EMISSION TESTS AT THE SAP PLANTS
CF INDUSTRIES, PLANT CITY FACILITY

Test Date	Unit	Average Process Rate (TPD H_2SO_4)	SO_2 avg lb/hr	SO_2 avg lb/ton H_2SO_4[a]	H_2SO_4 avg lb/hr	H_2SO_4 avg lb/ton H_2SO_4[a]
A SAP						
2/5/2003	A SAP	1079.7	153.8	3.42	0.46	0.010
1/29/2002	A SAP	1143.7	151.3	3.18	0.30	0.006
C SAP						
1/14/2003	C SAP	2384.5	384.5	3.87	2.70	0.027
1/7/2002	C SAP	2433.0	359.2	3.54	4.15	0.041
1/9/2001	C SAP	NA	358.7	NA	4.80	NA
D SAP						
1/28/2003	D SAP	2282.2	378.3	3.98	3.86	0.041
1/21/2002	D SAP	2296.1	363.5	3.80	3.19	0.033
1/16/2001	D SAP	NA	372.8	NA	3.86	NA

[a] As calculated.

TABLE B-3
CEM DATA SUMMARY FOR CFI - "A" SAP

Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)
01-Jan-03	142.0	19-Feb-03	145.8	9-Apr-03	123.4	28-May-03	138.9	16-Jul-03	97.8
02-Jan-03	140.2	20-Feb-03	150.1	10-Apr-03	157.2	29-May-03	139.9	17-Jul-03	135.9
03-Jan-03	123.5	21-Feb-03	146.4	11-Apr-03	161.6	30-May-03	142.6	18-Jul-03	119.4
04-Jan-03	132.2	22-Feb-03	149.1	12-Apr-03	163.0	31-May-03	139.3	19-Jul-03	140.4
05-Jan-03	140.8	23-Feb-03	152.6	13-Apr-03	147.3	01-Jun-03	144.0	20-Jul-03	156.6
06-Jan-03	120.9	24-Feb-03	144.8	14-Apr-03	147.2	02-Jun-03	140.7	21-Jul-03	150.1
07-Jan-03	150.3	25-Feb-03	148.8	15-Apr-03	123.2	03-Jun-03	131.7	22-Jul-03	149.2
08-Jan-03	140.0	26-Feb-03	145.5	16-Apr-03	121.0	04-Jun-03	128.3	23-Jul-03	145.9
09-Jan-03	143.4	27-Feb-03	152.9	17-Apr-03	140.5	05-Jun-03	116.1	24-Jul-03	139.1
10-Jan-03	137.2	28-Feb-03	151.5	18-Apr-03	147.4	06-Jun-03	133.5	25-Jul-03	160.9
11-Jan-03	148.6	01-Mar-03	154.8	19-Apr-03	134.5	07-Jun-03	135.4	26-Jul-03	143.9
12-Jan-03	157.3	02-Mar-03	152.8	20-Apr-03	128.6	08-Jun-03	131.1	27-Jul-03	146.7
13-Jan-03	156.4	03-Mar-03	144.2	21-Apr-03	136.9	09-Jun-03	115.1	28-Jul-03	143.7
14-Jan-03	164.5	04-Mar-03	140.1	22-Apr-03	127.1	10-Jun-03	122.0	29-Jul-03	151.1
15-Jan-03	162.7	05-Mar-03	134.9	23-Apr-03	135.9	11-Jun-03	133.5	30-Jul-03	139.9
16-Jan-03	159.6	06-Mar-03	134.9	24-Apr-03	145.7	12-Jun-03	133.7	31-Jul-03	152.6
17-Jan-03	159.8	07-Mar-03	139.2	25-Apr-03	123.4	13-Jun-03	142.5	01-Aug-03	154.8
18-Jan-03	163.9	08-Mar-03	142.4	26-Apr-03	131.8	14-Jun-03	134.2	02-Aug-03	140.0
19-Jan-03	163.3	09-Mar-03	132.3	27-Apr-03	128.4	15-Jun-03	125.1	03-Aug-03	123.1
20-Jan-03	157.2	10-Mar-03	148.9	28-Apr-03	136.2	16-Jun-03	139.2	04-Aug-03	132.3
21-Jan-03	150.3	11-Mar-03	148.7	29-Apr-03	128.4	17-Jun-03	154.6	05-Aug-03	124.3
22-Jan-03	156.8	12-Mar-03	139.4	30-Apr-03	97.7	18-Jun-03	139.9	06-Aug-03	136.4
23-Jan-03	162.9	13-Mar-03	143.3	1-May-03	130.2	19-Jun-03	125.6	07-Aug-03	146.4
24-Jan-03	171.8	14-Mar-03	139.7	2-May-03	133.0	20-Jun-03	99.8	08-Aug-03	150.6
25-Jan-03	163.1	15-Mar-03	140.2	3-May-03	138.4	21-Jun-03	132.8	09-Aug-03	149.1
26-Jan-03	160.5	16-Mar-03	131.8	4-May-03	142.1	22-Jun-03	152.8	10-Aug-03	149.6
27-Jan-03	165.5	17-Mar-03	133.0	5-May-03	45.5	23-Jun-03	153.5	11-Aug-03	162.2
28-Jan-03	154.3	18-Mar-03	138.2	6-May-03	87.9	24-Jun-03	136.8	12-Aug-03	150.8
29-Jan-03	149.3	19-Mar-03	153.4	7-May-03	78.4	25-Jun-03	138.6	13-Aug-03	151.4
30-Jan-03	151.7	20-Mar-03	143.9	8-May-03	89.4	26-Jun-03	137.8	14-Aug-03	140.7
31-Jan-03	152.7	21-Mar-03	118.6	9-May-03	55.0	27-Jun-03	141.5	15-Aug-03	143.6
01-Feb-03	153.4	22-Mar-03	133.7	10-May-03	129.6	28-Jun-03	135.9	16-Aug-03	133.6
02-Feb-03	151.8	23-Mar-03	158.9	11-May-03	151.3	29-Jun-03	151.6	17-Aug-03	122.1
03-Feb-03	155.0	24-Mar-03	157.7	12-May-03	126.7	30-Jun-03	164.9	18-Aug-03	124.2
04-Feb-03	147.9	25-Mar-03	145.9	13-May-03	136.9	01-Jul-03		19-Aug-03	152.2
05-Feb-03	154.8	26-Mar-03	135.3	14-May-03	148.3	02-Jul-03		20-Aug-03	151.8
06-Feb-03	150.8	27-Mar-03	140.6	15-May-03	144.4	03-Jul-03		21-Aug-03	154.1
07-Feb-03	157.3	28-Mar-03	149.4	16-May-03	144.2	04-Jul-03		22-Aug-03	132.5
08-Feb-03	161.3	29-Mar-03	143.6	17-May-03	113.7	05-Jul-03		23-Aug-03	140.4
09-Feb-03	154.3	30-Mar-03	155.5	18-May-03	155.4	06-Jul-03	105.7	24-Aug-03	149.9
10-Feb-03	160.2	31-Mar-03	161.8	19-May-03	128.1	07-Jul-03	118.9	25-Aug-03	146.9
11-Feb-03	169.9	01-Apr-03	148.6	20-May-03	82.6	08-Jul-03	88.1	26-Aug-03	153.7
12-Feb-03	158.7	02-Apr-03	152.5	21-May-03	124.4	09-Jul-03		27-Aug-03	140.8
13-Feb-03	143.6	03-Apr-03	160.6	22-May-03	104.2	10-Jul-03		28-Aug-03	155.6
14-Feb-03	155.7	04-Apr-03	154.9	23-May-03	128.6	11-Jul-03		29-Aug-03	127.2
15-Feb-03	144.0	05-Apr-03	141.8	24-May-03	124.3	12-Jul-03		30-Aug-03	125.9
16-Feb-03	141.7	06-Apr-03	138.4	25-May-03	111.2	13-Jul-03		31-Aug-03	141.1
17-Feb-03	142.7	07-Apr-03	146.1	26-May-03	74.7	14-Jul-03	113.1	01-Sep-03	137.0
18-Feb-03	155.5	08-Apr-03	142.6	27-May-03	124.8	15-Jul-03	166.4	02-Sep-03	144.4

TABLE B-3
CEM DATA SUMMARY FOR CFI - "A" SAP

Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)
03-Sep-03	141.0	22-Oct-03	139.1	10-Dec-03	150.7				
04-Sep-03	140.7	23-Oct-03	137.4	11-Dec-03	168.1				
05-Sep-03	124.7	24-Oct-03	148.7	12-Dec-03	145.3				
06-Sep-03	141.7	25-Oct-03	145.9	13-Dec-03	128.3				
07-Sep-03	130.8	26-Oct-03	145.4	14-Dec-03	132.3				
08-Sep-03	137.3	27-Oct-03	149.1	15-Dec-03	167.6				
09-Sep-03	148.3	28-Oct-03	141.7	16-Dec-03	140.4				
10-Sep-03	138.0	29-Oct-03	152.2	17-Dec-03	169.0				
11-Sep-03	145.6	30-Oct-03	153.7	18-Dec-03	141.7				
12-Sep-03	140.4	31-Oct-03	152.2	19-Dec-03	134.9				
13-Sep-03	141.8	01-Nov-03		20-Dec-03	136.4				
14-Sep-03	140.0	02-Nov-03		21-Dec-03	156.9				
15-Sep-03	106.8	03-Nov-03		22-Dec-03	158.6				
16-Sep-03	140.0	04-Nov-03		23-Dec-03	167.7				
17-Sep-03	113.1	05-Nov-03		24-Dec-03	116.9				
18-Sep-03	149.7	06-Nov-03		25-Dec-03	132.8				
19-Sep-03	135.2	07-Nov-03		26-Dec-03	147.4				
20-Sep-03	139.6	08-Nov-03		27-Dec-03	161.3				
21-Sep-03	151.4	09-Nov-03		28-Dec-03	145.4				
22-Sep-03	149.0	10-Nov-03		29-Dec-03	137.1				
23-Sep-03	147.5	11-Nov-03		30-Dec-03	148.9				
24-Sep-03	144.8	12-Nov-03		31-Dec-03	132.1				
25-Sep-03	142.6	13-Nov-03							
26-Sep-03	144.9	14-Nov-03		MAX =	172.5				
27-Sep-03	156.2	15-Nov-03							
28-Sep-03	148.9	16-Nov-03							
29-Sep-03	151.8	17-Nov-03							
30-Sep-03	153.4	18-Nov-03							
01-Oct-03	157.1	19-Nov-03							
02-Oct-03	159.0	20-Nov-03							
03-Oct-03	151.4	21-Nov-03							
04-Oct-03	127.7	22-Nov-03							
05-Oct-03	146.4	23-Nov-03							
06-Oct-03	132.6	24-Nov-03	71.2						
07-Oct-03	143.5	25-Nov-03	116.7						
08-Oct-03	144.2	26-Nov-03	85.7						
09-Oct-03	148.7	27-Nov-03	144.7						
10-Oct-03	152.2	28-Nov-03	152.7						
11-Oct-03	153.6	29-Nov-03	163.7						
12-Oct-03	142.3	30-Nov-03	172.5						
13-Oct-03	144.6	01-Dec-03	157.1						
14-Oct-03	147.0	02-Dec-03	147.7						
15-Oct-03	132.2	03-Dec-03	118.5						
16-Oct-03	153.1	04-Dec-03	143.9						
17-Oct-03	145.7	05-Dec-03	140.3						
18-Oct-03	151.2	06-Dec-03	163.3						
19-Oct-03	147.3	07-Dec-03	153.4						
20-Oct-03	158.8	08-Dec-03	159.0						
21-Oct-03	154.3	09-Dec-03	126.6						

TABLE B-3
CEM DATA SUMMARY FOR CFI - "A" SAP

Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)
01-Jan-04	137.3	19-Feb-04	165.9	8-Apr-04	169.6	27-May-04	168.7	15-Jul-04	151.8
02-Jan-04	135.0	20-Feb-04	157.2	9-Apr-04	160.1	28-May-04	172.5	16-Jul-04	163.8
03-Jan-04	138.4	21-Feb-04	179.0	10-Apr-04	159.5	29-May-04	166.4	17-Jul-04	166.3
04-Jan-04	145.9	22-Feb-04	185.9	11-Apr-04	158.4	30-May-04	161.3	18-Jul-04	167.5
05-Jan-04	151.8	23-Feb-04	174.9	12-Apr-04	161.7	31-May-04	155.1	19-Jul-04	171.9
06-Jan-04	137.2	24-Feb-04	174.4	13-Apr-04	166.8	01-Jun-04	143.2	20-Jul-04	145.6
07-Jan-04	119.8	25-Feb-04	175.5	14-Apr-04	175.9	02-Jun-04	151.3	21-Jul-04	153.4
08-Jan-04	145.8	26-Feb-04	179.4	15-Apr-04	180.5	03-Jun-04	147.8	22-Jul-04	162.3
09-Jan-04	151.9	27-Feb-04	172.4	16-Apr-04	174.2	04-Jun-04	147.8	23-Jul-04	179.0
10-Jan-04	164.7	28-Feb-04	164.0	17-Apr-04	169.0	05-Jun-04	152.3	24-Jul-04	195.2
11-Jan-04	158.8	29-Feb-04	135.2	18-Apr-04	169.3	06-Jun-04	161.2	25-Jul-04	184.4
12-Jan-04	149.6	01-Mar-04	103.4	19-Apr-04	167.7	07-Jun-04	158.9	26-Jul-04	175.2
13-Jan-04	150.1	02-Mar-04	157.7	20-Apr-04	173.4	08-Jun-04	161.4	27-Jul-04	164.4
14-Jan-04	135.5	03-Mar-04	163.4	21-Apr-04	162.0	09-Jun-04	150.8	28-Jul-04	142.3
15-Jan-04	134.7	04-Mar-04	157.2	22-Apr-04	165.4	10-Jun-04	158.0	29-Jul-04	177.3
16-Jan-04	145.6	05-Mar-04	138.0	23-Apr-04	165.8	11-Jun-04	154.4	30-Jul-04	177.0
17-Jan-04	151.2	06-Mar-04	173.7	24-Apr-04	169.8	12-Jun-04	162.0	31-Jul-04	170.1
18-Jan-04	155.2	07-Mar-04	175.0	25-Apr-04	141.1	13-Jun-04	165.5	01-Aug-04	174.5
19-Jan-04	151.0	08-Mar-04	177.1	26-Apr-04	144.1	14-Jun-04	149.3	02-Aug-04	177.7
20-Jan-04	127.8	09-Mar-04	167.6	27-Apr-04	155.3	15-Jun-04	163.1	03-Aug-04	172.7
21-Jan-04	172.8	10-Mar-04	192.6	28-Apr-04	157.7	16-Jun-04	157.6	04-Aug-04	176.1
22-Jan-04	136.3	11-Mar-04	185.6	29-Apr-04	152.1	17-Jun-04	152.4	05-Aug-04	173.5
23-Jan-04	154.3	12-Mar-04	175.5	30-Apr-04	140.8	18-Jun-04	162.3	06-Aug-04	159.7
24-Jan-04	151.3	13-Mar-04	177.0	1-May-04	142.1	19-Jun-04	156.7	07-Aug-04	181.0
25-Jan-04	137.4	14-Mar-04	168.3	2-May-04	145.7	20-Jun-04	161.4	08-Aug-04	163.5
26-Jan-04	153.0	15-Mar-04	167.5	3-May-04	147.9	21-Jun-04	162.4	09-Aug-04	180.9
27-Jan-04	157.3	16-Mar-04	166.6	4-May-04	157.4	22-Jun-04	159.4	10-Aug-04	175.2
28-Jan-04	151.8	17-Mar-04	167.7	5-May-04	163.3	23-Jun-04	154.8	11-Aug-04	175.1
29-Jan-04	149.8	18-Mar-04	173.7	6-May-04	159.8	24-Jun-04	149.7	12-Aug-04	136.2
30-Jan-04	160.8	19-Mar-04	166.9	7-May-04	151.4	25-Jun-04	153.9	13-Aug-04	74.9
31-Jan-04	152.2	20-Mar-04	163.3	8-May-04	170.9	26-Jun-04	133.7	14-Aug-04	113.7
01-Feb-04	142.6	21-Mar-04	164.9	9-May-04	167.1	27-Jun-04	152.5	15-Aug-04	161.7
02-Feb-04	147.5	22-Mar-04	166.6	10-May-04	171.4	28-Jun-04	161.0	16-Aug-04	154.8
03-Feb-04	153.9	23-Mar-04	178.2	11-May-04	169.1	29-Jun-04	153.3	17-Aug-04	178.4
04-Feb-04	143.9	24-Mar-04	173.8	12-May-04	163.1	30-Jun-04	157.6	18-Aug-04	168.9
05-Feb-04	145.5	25-Mar-04	173.5	13-May-04	166.2	01-Jul-04	159.8	19-Aug-04	173.8
06-Feb-04	145.5	26-Mar-04	162.5	14-May-04	169.8	02-Jul-04	158.4	20-Aug-04	162.9
07-Feb-04	168.7	27-Mar-04	165.4	15-May-04	169.0	03-Jul-04	152.3	21-Aug-04	171.6
08-Feb-04	178.1	28-Mar-04	157.1	16-May-04	160.6	04-Jul-04	162.2	22-Aug-04	154.9
09-Feb-04	167.3	29-Mar-04	162.5	17-May-04	159.6	05-Jul-04	139.7	23-Aug-04	157.2
10-Feb-04	164.4	30-Mar-04	174.1	18-May-04	160.2	06-Jul-04	58.3	24-Aug-04	159.2
11-Feb-04		31-Mar-04	162.4	19-May-04	147.9	07-Jul-04	138.7	25-Aug-04	162.4
12-Feb-04	165.1	01-Apr-04	102.1	20-May-04	159.2	08-Jul-04	156.4	26-Aug-04	160.5
13-Feb-04	179.5	02-Apr-04	162.4	21-May-04	155.6	09-Jul-04	155.6	27-Aug-04	171.7
14-Feb-04	176.6	03-Apr-04	172.3	22-May-04	158.3	10-Jul-04	157.2	28-Aug-04	158.8
15-Feb-04	184.3	04-Apr-04	165.7	23-May-04	151.6	11-Jul-04	157.3	29-Aug-04	149.3
16-Feb-04	185.2	05-Apr-04	174.5	24-May-04	156.8	12-Jul-04	151.5	30-Aug-04	136.1
17-Feb-04	182.0	06-Apr-04	170.4	25-May-04	171.0	13-Jul-04	156.9	31-Aug-04	163.6
18-Feb-04	178.1	07-Apr-04	163.4	26-May-04	169.2	14-Jul-04	143.2	01-Sep-04	150.7

TABLE B-3
CEM DATA SUMMARY FOR CFI - "A" SAP

Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)
02-Sep-04	168.6	21-Oct-04	152.7	09-Dec-04	175.3				
03-Sep-04	166.3	22-Oct-04	153.1	10-Dec-04	159.6				
04-Sep-04	110.0	23-Oct-04	154.7	11-Dec-04	155.7				
05-Sep-04	45.2	24-Oct-04	155.8	12-Dec-04	159.6				
06-Sep-04	50.2	25-Oct-04	154.0	13-Dec-04	153.5				
07-Sep-04	79.8	26-Oct-04	156.7	14-Dec-04	169.3				
08-Sep-04	117.7	27-Oct-04	157.9	15-Dec-04	175.1				
09-Sep-04	80.5	28-Oct-04	158.5	16-Dec-04	110.5				
10-Sep-04	66.8	29-Oct-04	161.8	17-Dec-04	182.4				
11-Sep-04	78.2	30-Oct-04	160.3	18-Dec-04	167.5				
12-Sep-04	70.5	31-Oct-04	170.4	19-Dec-04	174.2				
13-Sep-04	127.8	01-Nov-04	157.6	20-Dec-04	173.2				
14-Sep-04	161.6	02-Nov-04	157.1	21-Dec-04	172.9				
15-Sep-04	155.5	03-Nov-04	168.4	22-Dec-04	166.9				
16-Sep-04	163.4	04-Nov-04	166.8	23-Dec-04	159.8				
17-Sep-04	155.7	05-Nov-04	172.3	24-Dec-04	139.9				
18-Sep-04	148.2	06-Nov-04	171.0	25-Dec-04	145.2				
19-Sep-04	153.1	07-Nov-04	168.8	26-Dec-04	177.9				
20-Sep-04	159.0	08-Nov-04	163.1	27-Dec-04	160.9				
21-Sep-04	163.8	09-Nov-04	157.5	28-Dec-04	159.7				
22-Sep-04	154.0	10-Nov-04	154.6	29-Dec-04	161.2				
23-Sep-04	150.7	11-Nov-04	153.4	30-Dec-04	163.3				
24-Sep-04	148.1	12-Nov-04	123.8	31-Dec-04	157.4				
25-Sep-04	151.3	13-Nov-04	169.7						
26-Sep-04	105.5	14-Nov-04	163.4	MAX =	195.2				
27-Sep-04	148.3	15-Nov-04	163.4						
28-Sep-04	146.5	16-Nov-04	165.8						
29-Sep-04	153.4	17-Nov-04	160.8						
30-Sep-04	160.2	18-Nov-04	159.0						
01-Oct-04	123.9	19-Nov-04	153.0						
02-Oct-04	162.4	20-Nov-04	160.5						
03-Oct-04	160.5	21-Nov-04	164.7						
04-Oct-04	164.0	22-Nov-04	138.9						
05-Oct-04	159.7	23-Nov-04	169.4						
06-Oct-04	159.3	24-Nov-04	163.2						
07-Oct-04	160.9	25-Nov-04	172.6						
08-Oct-04	139.5	26-Nov-04	166.7						
09-Oct-04	177.6	27-Nov-04	165.4						
10-Oct-04	172.5	28-Nov-04	151.6						
11-Oct-04	165.9	29-Nov-04	160.5						
12-Oct-04	152.9	30-Nov-04	162.7						
13-Oct-04	166.6	01-Dec-04	158.8						
14-Oct-04	175.8	02-Dec-04	165.2						
15-Oct-04	171.4	03-Dec-04	172.2						
16-Oct-04	179.5	04-Dec-04	177.0						
17-Oct-04	167.8	05-Dec-04	166.9						
18-Oct-04	158.5	06-Dec-04	157.4						
19-Oct-04	159.3	07-Dec-04	154.5						
20-Oct-04	153.2	08-Dec-04	170.8						

TABLE B-3
CEM DATA SUMMARY FOR CFI - "A" SAP

Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)
01-Jan-05	157.8	19-Feb-05	135.0	9-Apr-05	148.4	28-May-05	171.2	16-Jul-05	155.7
02-Jan-05	161.7	20-Feb-05	158.2	10-Apr-05	154.2	29-May-05	175.9	17-Jul-05	169.5
03-Jan-05	161.4	21-Feb-05	152.6	11-Apr-05	174.4	30-May-05	180.6	18-Jul-05	175.2
04-Jan-05	162.7	22-Feb-05	165.7	12-Apr-05	173.1	31-May-05	166.8	19-Jul-05	147.9
05-Jan-05	162.2	23-Feb-05	86.6	13-Apr-05	170.1	01-Jun-05	181.9	20-Jul-05	190.5
06-Jan-05	162.5	24-Feb-05	82.4	14-Apr-05	170.0	02-Jun-05	177.8	21-Jul-05	179.2
07-Jan-05	164.3	25-Feb-05	147.4	15-Apr-05	183.1	03-Jun-05	158.0	22-Jul-05	163.7
08-Jan-05	164.5	26-Feb-05	163.5	16-Apr-05	185.2	04-Jun-05	171.2	23-Jul-05	168.7
09-Jan-05	155.3	27-Feb-05	167.8	17-Apr-05	172.3	05-Jun-05	177.7	24-Jul-05	181.3
10-Jan-05	143.4	28-Feb-05	162.9	18-Apr-05	176.7	06-Jun-05	181.0	25-Jul-05	192.1
11-Jan-05	174.8	01-Mar-05	177.6	19-Apr-05	180.2	07-Jun-05	148.3	26-Jul-05	190.4
12-Jan-05	165.5	02-Mar-05	176.1	20-Apr-05	169.9	08-Jun-05	165.9	27-Jul-05	173.7
13-Jan-05	169.9	03-Mar-05	166.9	21-Apr-05	173.1	09-Jun-05	164.3	28-Jul-05	170.3
14-Jan-05	168.6	04-Mar-05	177.2	22-Apr-05	173.8	10-Jun-05	157.1	29-Jul-05	181.0
15-Jan-05	181.8	05-Mar-05	175.0	23-Apr-05	168.5	11-Jun-05	173.6	30-Jul-05	183.7
16-Jan-05	180.8	06-Mar-05	172.2	24-Apr-05	164.6	12-Jun-05	181.3	31-Jul-05	186.6
17-Jan-05	176.3	07-Mar-05	167.9	25-Apr-05	176.7	13-Jun-05	176.4	01-Aug-05	192.4
18-Jan-05	165.1	08-Mar-05	167.9	26-Apr-05	178.3	14-Jun-05	175.3	02-Aug-05	182.3
19-Jan-05	167.3	09-Mar-05	160.3	27-Apr-05	179.1	15-Jun-05	140.2	03-Aug-05	165.1
20-Jan-05	168.4	10-Mar-05	167.7	28-Apr-05	140.7	16-Jun-05	155.8	04-Aug-05	182.0
21-Jan-05	167.5	11-Mar-05	140.8	29-Apr-05	181.1	17-Jun-05	161.2	05-Aug-05	191.1
22-Jan-05	154.5	12-Mar-05	152.9	30-Apr-05	178.0	18-Jun-05	158.0	06-Aug-05	189.7
23-Jan-05	170.7	13-Mar-05	149.7	1-May-05	138.2	19-Jun-05	171.0	07-Aug-05	188.1
24-Jan-05	161.2	14-Mar-05	158.3	2-May-05	171.7	20-Jun-05	186.3	08-Aug-05	176.0
25-Jan-05	166.2	15-Mar-05	167.9	3-May-05	180.7	21-Jun-05	151.7	09-Aug-05	178.0
26-Jan-05	158.8	16-Mar-05	157.2	4-May-05	174.0	22-Jun-05	157.7	10-Aug-05	176.0
27-Jan-05	175.2	17-Mar-05	174.4	5-May-05	174.2	23-Jun-05	106.4	11-Aug-05	191.8
28-Jan-05	170.7	18-Mar-05	179.5	6-May-05	174.4	24-Jun-05	169.1	12-Aug-05	188.4
29-Jan-05	164.0	19-Mar-05	183.8	7-May-05	184.7	25-Jun-05	172.9	13-Aug-05	183.9
30-Jan-05	154.2	20-Mar-05	175.7	8-May-05	175.9	26-Jun-05	178.8	14-Aug-05	171.1
31-Jan-05	124.1	21-Mar-05	174.3	9-May-05	182.3	27-Jun-05	162.4	15-Aug-05	165.0
01-Feb-05	147.4	22-Mar-05	171.9	10-May-05	175.3	28-Jun-05	152.0	16-Aug-05	169.4
02-Feb-05	142.9	23-Mar-05	164.1	11-May-05	178.0	29-Jun-05	127.6	17-Aug-05	180.8
03-Feb-05	148.8	24-Mar-05	163.9	12-May-05	180.4	30-Jun-05	160.4	18-Aug-05	181.2
04-Feb-05	117.5	25-Mar-05	170.5	13-May-05	154.7	01-Jul-05	173.0	19-Aug-05	183.2
05-Feb-05	144.1	26-Mar-05	160.6	14-May-05	179.8	02-Jul-05	190.5	20-Aug-05	175.4
06-Feb-05	144.0	27-Mar-05	163.1	15-May-05	159.0	03-Jul-05	182.7	21-Aug-05	174.7
07-Feb-05	170.0	28-Mar-05	166.8	16-May-05	164.7	04-Jul-05	174.5	22-Aug-05	182.3
08-Feb-05	159.2	29-Mar-05	170.2	17-May-05	173.3	05-Jul-05	169.8	23-Aug-05	188.2
09-Feb-05	161.0	30-Mar-05	162.3	18-May-05	176.0	06-Jul-05	189.1	24-Aug-05	184.0
10-Feb-05	159.6	31-Mar-05	169.8	19-May-05	173.4	07-Jul-05	165.8	25-Aug-05	186.5
11-Feb-05	186.0	01-Apr-05	174.6	20-May-05	178.9	08-Jul-05	175.1	26-Aug-05	179.0
12-Feb-05	166.4	02-Apr-05	178.9	21-May-05	175.9	09-Jul-05	161.8	27-Aug-05	179.3
13-Feb-05	169.0	03-Apr-05	187.7	22-May-05	177.9	10-Jul-05	160.2	28-Aug-05	186.1
14-Feb-05	138.9	04-Apr-05	189.3	23-May-05	158.7	11-Jul-05	166.7	29-Aug-05	192.5
15-Feb-05	77.9	05-Apr-05	172.6	24-May-05	164.8	12-Jul-05	153.2	30-Aug-05	184.4
16-Feb-05	81.2	06-Apr-05	181.6	25-May-05	184.6	13-Jul-05	174.5	31-Aug-05	167.9
17-Feb-05	67.0	07-Apr-05	171.3	26-May-05	188.7	14-Jul-05	169.6	01-Sep-05	167.9
18-Feb-05	16.6	08-Apr-05	166.0	27-May-05	185.7	15-Jul-05	173.2	02-Sep-05	117.7

TABLE B-3
CEM DATA SUMMARY FOR CFI - "A" SAP

Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)
03-Sep-05	192.106237	22-Oct-05	77.2	10-Dec-05					
04-Sep-05	181.322991	23-Oct-05	68.4	11-Dec-05					
05-Sep-05	137.040839	24-Oct-05	38.2	12-Dec-05					
06-Sep-05	140.156548	25-Oct-05	64.8	13-Dec-05					
07-Sep-05	159.325423	26-Oct-05	56.7	14-Dec-05					
08-Sep-05	187.069646	27-Oct-05	90.4	15-Dec-05					
09-Sep-05	194.667743	28-Oct-05	66.0	16-Dec-05					
10-Sep-05	191.770414	29-Oct-05		17-Dec-05					
11-Sep-05	181.507497	30-Oct-05		18-Dec-05					
12-Sep-05	174.922302	31-Oct-05		19-Dec-05					
13-Sep-05	161.276961	01-Nov-05		20-Dec-05					
14-Sep-05	148.596564	02-Nov-05	85.2	21-Dec-05					
15-Sep-05	118.236879	03-Nov-05	138.9	22-Dec-05					
16-Sep-05	150.964744	04-Nov-05	133.3	23-Dec-05					
17-Sep-05	177.432234	05-Nov-05	122.1	24-Dec-05					
18-Sep-05	192.995778	06-Nov-05	76.0	25-Dec-05					
19-Sep-05	186.749279	07-Nov-05	148.0	26-Dec-05					
20-Sep-05	178.01416	08-Nov-05	164.8	27-Dec-05					
21-Sep-05	183.003782	09-Nov-05	174.4	28-Dec-05					
22-Sep-05	182.782876	10-Nov-05	171.6	29-Dec-05					
23-Sep-05	181.835263	11-Nov-05	166.3	30-Dec-05					
24-Sep-05	191.833416	12-Nov-05	173.2	31-Dec-05					
25-Sep-05	174.327873	13-Nov-05	165.0						
26-Sep-05	160.989243	14-Nov-05	178.1	MAX =	194.7				
27-Sep-05	122.963656	15-Nov-05	187.2						
28-Sep-05	113.449309	16-Nov-05	144.6						
29-Sep-05	48.2002838	17-Nov-05	180.6						
30-Sep-05	65.5312277	18-Nov-05	185.1						
01-Oct-05	65.866188	19-Nov-05	182.1						
02-Oct-05	45.9404202	20-Nov-05	177.2						
03-Oct-05	66.617414	21-Nov-05	168.0						
04-Oct-05	91.6937919	22-Nov-05	147.5						
05-Oct-05	45.2842938	23-Nov-05	183.8						
06-Oct-05	55.2898426	24-Nov-05	182.4						
07-Oct-05	70.702944	25-Nov-05	180.6						
08-Oct-05	64.2162266	26-Nov-05	185.1						
09-Oct-05	41.2315309	27-Nov-05	170.2						
10-Oct-05	53.041062	28-Nov-05	167.8						
11-Oct-05	49.8358965	29-Nov-05	161.2						
12-Oct-05	33.192146	30-Nov-05	119.8						
13-Oct-05	70.1168135	01-Dec-05							
14-Oct-05	55.1410251	02-Dec-05							
15-Oct-05	65.1802686	03-Dec-05							
16-Oct-05	45.3340754	04-Dec-05							
17-Oct-05	61.8834762	05-Dec-05							
18-Oct-05	55.7926171	06-Dec-05							
19-Oct-05	71.8995993	07-Dec-05							
20-Oct-05	58.729391	08-Dec-05							
21-Oct-05	52.7520755	09-Dec-05							

TABLE B-4
CEM DATA SUMMARY FOR CFI - "C" SAP

Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)
01-Jan-05	357.2	19-Feb-05	343.3	9-Apr-05	363.0	28-May-05	360.3	16-Jul-05	356.4
02-Jan-05	356.8	20-Feb-05	357.0	10-Apr-05	356.6	29-May-05	363.3	17-Jul-05	355.0
03-Jan-05	357.2	21-Feb-05	355.0	11-Apr-05	355.4	30-May-05	358.3	18-Jul-05	356.4
04-Jan-05	345.5	22-Feb-05	350.2	12-Apr-05	349.9	31-May-05	358.1	19-Jul-05	359.2
05-Jan-05	351.9	23-Feb-05	347.7	13-Apr-05	366.6	01-Jun-05	358.8	20-Jul-05	356.1
06-Jan-05	352.7	24-Feb-05	352.6	14-Apr-05	367.7	02-Jun-05	358.0	21-Jul-05	353.6
07-Jan-05	353.2	25-Feb-05	352.8	15-Apr-05	370.7	03-Jun-05	364.3	22-Jul-05	351.7
08-Jan-05	354.5	26-Feb-05	344.0	16-Apr-05	370.7	04-Jun-05	359.4	23-Jul-05	357.8
09-Jan-05	350.8	27-Feb-05	341.3	17-Apr-05	366.5	05-Jun-05	362.8	24-Jul-05	354.2
10-Jan-05	351.1	28-Feb-05	362.5	18-Apr-05	361.8	06-Jun-05	357.5	25-Jul-05	353.9
11-Jan-05	354.0	01-Mar-05	362.0	19-Apr-05	367.3	07-Jun-05	356.2	26-Jul-05	356.0
12-Jan-05	352.1	02-Mar-05	373.1	20-Apr-05	280.6	08-Jun-05	358.0	27-Jul-05	358.3
13-Jan-05	350.3	03-Mar-05	370.1	21-Apr-05	334.2	09-Jun-05	360.4	28-Jul-05	266.9
14-Jan-05	353.3	04-Mar-05	20.8	22-Apr-05	361.7	10-Jun-05	359.8	29-Jul-05	355.3
15-Jan-05	356.9	05-Mar-05	83.3	23-Apr-05	358.4	11-Jun-05	358.6	30-Jul-05	359.2
16-Jan-05	361.0	06-Mar-05	337.9	24-Apr-05	368.9	12-Jun-05	352.1	31-Jul-05	357.9
17-Jan-05	367.1	07-Mar-05	348.5	25-Apr-05	367.5	13-Jun-05	356.6	01-Aug-05	358.8
18-Jan-05	362.7	08-Mar-05	359.1	26-Apr-05	361.8	14-Jun-05	294.0	02-Aug-05	358.8
19-Jan-05	366.9	09-Mar-05	365.0	27-Apr-05	367.3	15-Jun-05	352.2	03-Aug-05	355.3
20-Jan-05	335.7	10-Mar-05	364.8	28-Apr-05	363.6	16-Jun-05	358.2	04-Aug-05	356.2
21-Jan-05	364.2	11-Mar-05	202.3	29-Apr-05	360.6	17-Jun-05	360.5	05-Aug-05	356.9
22-Jan-05	357.5	12-Mar-05	363.7	30-Apr-05	358.1	18-Jun-05	361.2	06-Aug-05	358.5
23-Jan-05	370.9	13-Mar-05	355.7	1-May-05	359.0	19-Jun-05	358.8	07-Aug-05	356.4
24-Jan-05	367.9	14-Mar-05	353.1	2-May-05	364.7	20-Jun-05	358.5	08-Aug-05	355.9
25-Jan-05	351.8	15-Mar-05	362.2	3-May-05	360.1	21-Jun-05	362.7	09-Aug-05	357.1
26-Jan-05	349.7	16-Mar-05	353.2	4-May-05	363.7	22-Jun-05	357.8	10-Aug-05	356.5
27-Jan-05	361.2	17-Mar-05	352.9	5-May-05	359.7	23-Jun-05	358.9	11-Aug-05	352.6
28-Jan-05	361.7	18-Mar-05	365.5	6-May-05	368.4	24-Jun-05	363.1	12-Aug-05	351.7
29-Jan-05	359.2	19-Mar-05	362.4	7-May-05	366.5	25-Jun-05	357.6	13-Aug-05	352.4
30-Jan-05	360.0	20-Mar-05	357.2	8-May-05	362.7	26-Jun-05	357.3	14-Aug-05	356.5
31-Jan-05	366.8	21-Mar-05	350.4	9-May-05	363.2	27-Jun-05	356.0	15-Aug-05	354.6
01-Feb-05	361.0	22-Mar-05	351.5	10-May-05	364.2	28-Jun-05	357.5	16-Aug-05	354.5
02-Feb-05	361.0	23-Mar-05	348.9	11-May-05	364.9	29-Jun-05	360.2	17-Aug-05	355.5
03-Feb-05	361.4	24-Mar-05	355.1	12-May-05	362.0	30-Jun-05	358.2	18-Aug-05	298.7
04-Feb-05	367.0	25-Mar-05	353.8	13-May-05	301.4	01-Jul-05	356.3	19-Aug-05	350.4
05-Feb-05	364.7	26-Mar-05	343.6	14-May-05	358.6	02-Jul-05	357.0	20-Aug-05	356.5
06-Feb-05	363.2	27-Mar-05	350.8	15-May-05	360.1	03-Jul-05	358.9	21-Aug-05	350.6
07-Feb-05	357.8	28-Mar-05	364.0	16-May-05	359.0	04-Jul-05	360.6	22-Aug-05	351.9
08-Feb-05	354.6	29-Mar-05	360.5	17-May-05	361.6	05-Jul-05	358.2	23-Aug-05	357.2
09-Feb-05	357.1	30-Mar-05	358.8	18-May-05	362.1	06-Jul-05	254.4	24-Aug-05	287.2
10-Feb-05	362.4	31-Mar-05	355.4	19-May-05	360.8	07-Jul-05	353.8	25-Aug-05	336.8
11-Feb-05	366.4	01-Apr-05	360.7	20-May-05	357.9	08-Jul-05	353.7	26-Aug-05	351.7
12-Feb-05	361.0	02-Apr-05	350.3	21-May-05	358.2	09-Jul-05	355.8	27-Aug-05	350.1
13-Feb-05	356.4	03-Apr-05	370.6	22-May-05	346.7	10-Jul-05	355.6	28-Aug-05	353.8
14-Feb-05	350.5	04-Apr-05	365.8	23-May-05	284.6	11-Jul-05	359.8	29-Aug-05	354.2
15-Feb-05		05-Apr-05	360.5	24-May-05	333.3	12-Jul-05	360.3	30-Aug-05	360.6
16-Feb-05		06-Apr-05	360.6	25-May-05	354.5	13-Jul-05	358.3	31-Aug-05	359.9
17-Feb-05	276.3	07-Apr-05	362.3	26-May-05	287.7	14-Jul-05	356.1	01-Sep-05	358.7
18-Feb-05	319.2	08-Apr-05	364.3	27-May-05	358.4	15-Jul-05	360.9	02-Sep-05	363.2

TABLE B-4
CEM DATA SUMMARY FOR CFI - "C" SAP

Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)
03-Sep-05	360.3	22-Oct-05	33.3	10-Dec-05					
04-Sep-05	361.6	23-Oct-05	33.0	11-Dec-05					
05-Sep-05	360.8	24-Oct-05	227.6	12-Dec-05					
06-Sep-05	361.7	25-Oct-05	299.5	13-Dec-05					
07-Sep-05	356.1	26-Oct-05	354.6	14-Dec-05					
08-Sep-05	356.0	27-Oct-05	161.8	15-Dec-05					
09-Sep-05	360.4	28-Oct-05	145.6	16-Dec-05					
10-Sep-05	363.5	29-Oct-05	292.6	17-Dec-05					
11-Sep-05	361.2	30-Oct-05	313.6	18-Dec-05					
12-Sep-05	357.7	31-Oct-05	259.4	19-Dec-05					
13-Sep-05	360.0	01-Nov-05	356.0	20-Dec-05					
14-Sep-05	160.8	02-Nov-05	366.1	21-Dec-05					
15-Sep-05	207.8	03-Nov-05	365.1	22-Dec-05					
16-Sep-05	152.3	04-Nov-05	362.1	23-Dec-05					
17-Sep-05	172.0	05-Nov-05	246.5	24-Dec-05					
18-Sep-05	195.7	06-Nov-05	150.0	25-Dec-05					
19-Sep-05	210.2	07-Nov-05	341.3	26-Dec-05					
20-Sep-05	205.9	08-Nov-05	361.2	27-Dec-05					
21-Sep-05	315.9	09-Nov-05	363.8	28-Dec-05					
22-Sep-05	356.5	10-Nov-05	365.2	29-Dec-05					
23-Sep-05	355.9	11-Nov-05	367.5	30-Dec-05					
24-Sep-05	355.9	12-Nov-05	365.4	31-Dec-05					
25-Sep-05	348.1	13-Nov-05	365.3						
26-Sep-05	357.4	14-Nov-05	362.4	MAX =	373.1				
27-Sep-05	357.5	15-Nov-05	362.9						
28-Sep-05	207.0	16-Nov-05	345.6						
29-Sep-05	49.4	17-Nov-05	368.0						
30-Sep-05	19.6	18-Nov-05	360.5						
01-Oct-05	27.3	19-Nov-05	351.2						
02-Oct-05	56.6	20-Nov-05	358.8						
03-Oct-05	77.5	21-Nov-05	363.2						
04-Oct-05	312.2	22-Nov-05	365.2						
05-Oct-05	352.7	23-Nov-05	365.1						
06-Oct-05	349.2	24-Nov-05	362.9						
07-Oct-05	351.6	25-Nov-05	365.7						
08-Oct-05	353.3	26-Nov-05	363.0						
09-Oct-05	352.4	27-Nov-05	359.4						
10-Oct-05	104.4	28-Nov-05	354.7						
11-Oct-05	55.1	29-Nov-05	361.9						
12-Oct-05	99.6	30-Nov-05	200.8						
13-Oct-05	115.2	01-Dec-05							
14-Oct-05	114.5	02-Dec-05							
15-Oct-05	227.0	03-Dec-05							
16-Oct-05	358.9	04-Dec-05							
17-Oct-05	83.4	05-Dec-05							
18-Oct-05	121.7	06-Dec-05							
19-Oct-05	60.1	07-Dec-05							
20-Oct-05	32.5	08-Dec-05							
21-Oct-05	32.4	09-Dec-05							

TABLE B-5
CEM DATA SUMMARY FOR CFI - "D" SAP

Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)
01-Jan-05	346.5	19-Feb-05		9-Apr-05	362.1				
02-Jan-05	348.5	20-Feb-05		10-Apr-05	368.4				
03-Jan-05	348.2	21-Feb-05		11-Apr-05	363.1				
04-Jan-05	346.2	22-Feb-05		12-Apr-05	363.6				
05-Jan-05	338.4	23-Feb-05		13-Apr-05	367.7				
06-Jan-05	340.1	24-Feb-05		14-Apr-05	365.8				
07-Jan-05	337.4	25-Feb-05		15-Apr-05	348.0				
08-Jan-05	336.7	26-Feb-05		16-Apr-05	320.8				
09-Jan-05	337.3	27-Feb-05		17-Apr-05	328.8				
10-Jan-05	346.9	28-Feb-05		18-Apr-05	331.7				
11-Jan-05	345.5	01-Mar-05	51.1	19-Apr-05	345.8				
12-Jan-05	343.7	02-Mar-05	141.5	20-Apr-05	331.1				
13-Jan-05	334.6	03-Mar-05	190.1	21-Apr-05	332.8				
14-Jan-05	353.2	04-Mar-05	76.9	22-Apr-05	336.6				
15-Jan-05	357.3	05-Mar-05	68.2	23-Apr-05	363.0				
16-Jan-05	361.4	06-Mar-05	178.0	24-Apr-05	368.5				
17-Jan-05	364.2	07-Mar-05	187.2	25-Apr-05	364.8				
18-Jan-05	369.7	08-Mar-05	318.3	26-Apr-05	348.8				
19-Jan-05	362.0	09-Mar-05	354.8	27-Apr-05	367.6				
20-Jan-05	355.0	10-Mar-05	347.4	28-Apr-05	281.7				
21-Jan-05	346.0	11-Mar-05	350.5	29-Apr-05	363.4				
22-Jan-05	337.0	12-Mar-05	352.8	30-Apr-05	361.4				
23-Jan-05	360.6	13-Mar-05	331.1						
24-Jan-05	357.5	14-Mar-05	337.5	MAX =	377.9				
25-Jan-05	352.6	15-Mar-05	338.2						
26-Jan-05	307.8	16-Mar-05	322.9						
27-Jan-05	360.7	17-Mar-05	343.1						
28-Jan-05	372.1	18-Mar-05	358.7						
29-Jan-05	370.3	19-Mar-05	343.5						
30-Jan-05	370.0	20-Mar-05	326.9						
31-Jan-05	377.9	21-Mar-05	217.2						
01-Feb-05	343.5	22-Mar-05							
02-Feb-05	361.3	23-Mar-05	254.6						
03-Feb-05	364.5	24-Mar-05	298.4						
04-Feb-05	370.1	25-Mar-05	243.3						
05-Feb-05		26-Mar-05	313.0						
06-Feb-05		27-Mar-05	362.1						
07-Feb-05		28-Mar-05	316.9						
08-Feb-05		29-Mar-05	361.7						
09-Feb-05		30-Mar-05	351.6						
10-Feb-05		31-Mar-05	359.0						
11-Feb-05		01-Apr-05	361.4						
12-Feb-05		02-Apr-05	357.7						
13-Feb-05		03-Apr-05	374.9						
14-Feb-05		04-Apr-05	366.0						
15-Feb-05		05-Apr-05	367.9						
16-Feb-05		06-Apr-05	367.1						
17-Feb-05		07-Apr-05	367.6						
18-Feb-05		08-Apr-05	189.6						

TABLE B-5
CEM DATA SUMMARY FOR CFI - "D" SAP

Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)	Date	SO_2 24hr Avg. (lb/hr)

APPENDIX C

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


--------

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

     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

Source No.	Beg. X Coordinate (km)	Beg. Y Coordinate (km)	End. X Coordinate (km)	End. Y Coordinate (km)	Release Height (m)	Base Elevation (m)	Emission Rates[a]

---

[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)

BUOYANT LINE SOURCE: VARIABLE EMISSIONS DATA[a]

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)

NON-GRIDDED (DISCRETE) RECEPTOR DATA [a]

Receptor No.	X Coordinate (km)	Y Coordinate (km)	Ground Elevation (m)	Height [b] Above Ground (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: **CF Industries, Inc.**	
2. Site Name: **Plant City Phosphate Complex**	
2. Facility Identification Number: **0570005**	
3. Facility Location...: Street Address or Other Locator: **10608 Paul Buchman Highway** City: **Plant City** County: **Hillsborough** Zip Code: **33565**	
4. Relocatable Facility? ☐ Yes ☒ No	5. Existing Title V Permitted Facility? ☒ Yes ☐ No

Application Contact

1. Application Contact Name: **Tom Edwards**
2. Application Contact Mailing Address... Organization/Firm: **CF Industries, Inc.** Street Address: **P.O. Drawer L** City: **Plant City** State: **FL** Zip Code: **33567-9007**
3. Application Contact Telephone Numbers... Telephone: **(813) 782-1591** ext. Fax: **(813) 788-9126**
4. Application Contact Email Address: **tedwards@cfifl.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 CF Industries Plant City 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	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 : **Herschel Morris, Vice President Phosphate Operations/General Manager**
2.	Application Responsible Official Mailing Address... Organization/Firm: **CF Industries, Inc.** Street Address: **P.O. Drawer L** City: **Plant City** State: **FL** Zip Code: **33567-9007**
3.	Application Responsible Official Telephone Numbers... Telephone: **(813) 782-1591** ext. Fax: **(813) 788-9126**
4.	Application Responsible Official Email Address: **hmorris@cfifl.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 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: ( ) 1 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