Holladay, Cleve

From: Gujjarlapudi, Ebenezer S. [GujjarlapudiES@bv.com]
Sent: Wednesday, November 07, 2001 9:48 AM
To: Holladay, Cleve
Cc: Gianazza, N. Bert; Holmes, Allan R.; Hillman, Timothy M.
Subject: Modeling Report

JEABBSummary_Nov.doc

Cleve:

Based on the concerns expressed by FDEP and EPA on the previous modeling effort, we have modified our approach to facilitate a speedy approval of the modeling. We have used the permitted emission parameters and emission rates for the Seminole plant, instead of the actuals, as we proposed earlier.

For this modeling scenario, we have assumed that only one turbine (either one combined cycle or the simple cycle turbine) will operate on 0.05 percent fuel oil for 16 hours a day. The modeling report discusses in brief the methodology and results. Please review the report and let us know when we can call you. We would like to call and discuss the report as soon as possible in order to expedite the approval of this modeling exercise and thereby not significantly affect the issuance of the certification.

<<JEABBSummary_Nov.doc>>

Please let me know as a response to this email, when you receive this report.

If you have any questions or need any additional information, please feel free to call me.

Ebenezer S. Gujjarlapudi
Environmental Engineer
Black & Veatch Corporation
11401 Lamar, Overland Park, KS 66211
Phone: (913) 458-9426
Fax: (913) 458-2934

Holladay, Cleve

From: Halpin, Mike
Sent: Wednesday, November 28, 2001 1:27 PM
To: Holladay, Cleve
Subject: JEA

Importance: High

Cleve-

Please confirm that something like this would be acceptable to EPA. It is based upon the modeling which showed that any one of the 3 units could burn 0.05%S oil for 16 hrs/day with the remainder of all operation on natural gas at 0.2 gr/100 scf. According to this data, the equivalent lbs/hr emissions for each unit on gas are 1.2#/hr and 98.7 #/hr on oil.

a) The facility will have a 3-hr avg SO2 emission limit based upon CEMS and set at 101.1 #/hr (98.7 + 1.2 + 1.2)
b) The facility will have a 24-hr avg SO2 emission limit based upon CEMS and set at 68.6 #/hr [(98.7*16) + (1.2 * 8) + (2* 1.2* 24)]/24

Mike

Holladay, Cleve

From: Halpin, Mike
Sent: Monday, November 26, 2001 1:05 PM
To: 'Hillman, Timothy M. (B&V)'; Holladay, Cleve
Cc: Gianazza, N. Bert; 'GujjarlapudiES@bv.com'
Subject: JEA Permit

Tim -

It is my understanding that the modeling was done with 0.2 grains S per 100 Scf. If this is correct, the BACT and permit will reflect same. We are indifferent as to JEA's preference of 2 grains or 0.2 grains, but the permit, BACT and modeling must all match. It has been my understanding that JEA does not wish to have 0.2 grains as a limit(?) Please advise.
Thanks
Mike Halpin

-----Original Message-----
From: Gujjarlapudi, Ebenezer S. [mailto:GujjarlapudiES@bv.com]
Sent: Wednesday, November 21, 2001 3:41 PM
To: 'krivo.stanley@epa.gov'; Holladay, Cleve
Cc: Hillman, Timothy M.; Holmes, Allan R.; 'GianNB@jea.com'
Subject: Brandy Branch Modeling

Cleve and Stan:

We have performed further modeling for the Brandy Branch Project to include the following scenarios in the permit. I am sending you CDROMs with the modeling information via FedEx for delivery on Monday morning. The CDROM contains modeling information for the following scenarios:

Scenario 1: The Simple Cycle Turbine operating for 16 hours per day on fuel oil and the remainder of the day (8 hours) on natural gas and the two Combined Cycle turbines operating 24 hours a day on natural gas.

Scenario 2: One of the Combined Cycle Turbines operating for 16 hours per day on fuel oil and the remainder of the day on natural gas and the Simple Cycle Turbine and the other Combined Cycle turbines operating 24 hours a day on natural gas.

The modeling analyses were performed using a similar methodology as the previous set of modeling submitted to the FDEP and EPA. The modeling demonstrates that the Brandy Branch Project will not either cause an exceedance of the SO2 increment or significantly contribute to an exceedance. These scenarios will demonstrate that "any one turbine (either simple cycle or combined cycle) can operate on fuel oil for 16 hours and the remainder (8 hours) on natural gas on any calendar day while the other two turbines operate all day (24 hours) on natural gas for the same calendar day".

Upon review and acceptance of these analyses, JEA would like to have the above-mentioned scenarios incorporated as permit conditions for the Brandy Branch Project before the certification hearing. Your prompt attention to this matter will be greatly appreciated.

I will be traveling on Monday and if you need any questions answered immediately, you can call Tim Hillman at (904) 665-5227.

If you have any questions or need any additional information, please feel free to call me.
Regards,
Ebenezer S. Gujjarlapudi
Environmental Engineer
Black & Veatch Corporation
11401 Lamar, Overland Park, KS 66211

Phone: (913) 458-9426
Fax: (913) 458-2934

-----Original Message-----
From: Hillman, Timothy M. (B&V) [mailto:hilltm@jea.com]
Sent: Friday, November 16, 2001 3:35 PM
To: Holladay, Cleve
Cc: Gujjarlapudi, Ebenezer; Gianazza, N. Bert; Halpin, Mike
Subject:
Importance: High

Cleve,

As we discussed, here is a summary of the 40 tpy limit scenario to use in your discussions with Stan. We look forward to our conference call on Monday, 11/19 @ 10 am eastern.

As a parallel path to the modeling exercise currently under way for the Class I Increment at Okefenokee, I would like to offer another alternative for your consideration. If JEA were to assume a facility-wide SO2 emission limit of 40 tpy (including the simple cycle CT and the two converted combined cycle CTs) as an enforceable synthetic limit to avoid PSD review for SO2, would the Class I increment modeling issues that are currently restraining the fuel oil firing options for the Brandy Branch Combined Cycle conversion project become non-applicable, as the facility (after the conversion) would no longer be subject to PSD for SO2? Under this scenario, JEA would fire the CTs (in any combination of simple or combined cycle) at their discretion with 0.05% sulfur distillate fuel oil or natural gas, using SO2 monitors to demonstrate compliance with the 40 tpy SO2 limit.

Thank you for your time and consideration during this process.

Best regards,

Timothy M. Hillman
Black & Veatch - Jacksonville
Environmental Health & Safety
Tel. (904) 665-5227
Fax. (904) 665-5234

Holladay, Cleve

From: Krivo.Stanley@epamail.epa.gov
Sent: Thursday, November 29, 2001 3:24 PM
To: Holladay, Cleve
Cc: Little.James@epamail.epa.gov
Subject: Re: JEA - Suggestions Items for Permit Based on Modeled Scenarios

Cleve,

Based on my understanding on what was recently modeled (Note: I did not receive the CD with the recent modeling files. I have assumed that the modeling was done properly and demonstrates no significant impact at any modeled PSD Class I violation.), the following additional items should be considered for permit conditions:

- Only one combustion turbine can operate on fuel oil in any calendar day.
- Fuel oil can be used in the selected turbine a maximum of 16 hours per calendar day. Natural gas can be used in the combustion turbine for the remaining hours of the day.
- During days with fuel oil use, the remaining two combustion turbines can only operate on natural gas and have unlimited daily hours of operation.
- On days when fuel oil is being used, the following are the maximum SO2 emissions from each combustion turbine for the two short-term periods of concern:

	3-Hour Period	Calendar 24-Hour Period
SSCT		
Nat. Gas	3.333 lbs	26.664 lbs
Fuel Oil	294.525 lbs	1,579.68 lbs
(combined oil/gas operation)		
CCCT		
Nat. Gas	3.572 lbs	28.58 lbs
Fuel Oil	328.095 lbs	1,759.37 lbs
(combined oil/gas operation)		

- Each CCCT can operate a maximum of 288 hours per year on fuel oil.
- The SCCT can operate a maximum of 750 hours per year on fuel oil and has an overall annual operating limit of 4,750 hours.
- The maximum sulfur content limit for the fuel oil used is 0.05 percent.
- For days when fuel oil is used, the sulfur content of the natural gas used must not exceed an average of 0.2 grains per 100 scf over the two averaging periods of concern (i.e., 3-hours and 24-hours).

Let me known of any questions or if the above values do not agree with your calculations.
...sjk

Stanley J. Krivo
USEPA Region 4
404/562-9123 (Phone)
404/562-9095 (Fax)

"Holladay, Cleve" <Cleve.Holladay@dep.state.fl.us> 11/28/2001 01:28 PM

To: Stanley Krivo/R4/USEPA/US@EPA
cc:
Subject: FW: JEA

> -----Original Message-----
> From: Halpin, Mike
> Sent: Wednesday, November 28, 2001 1:27 PM
> To: Holladay, Cleve
> Subject: JEA
> Importance: High
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> and set at 68.6 #/hr [(98.7*16) + (1.2 * 8) + (2* 1.2* 24)]/24
>
> Mike

Holladay, Cleve

From: Halpin, Mike
Sent: Monday, November 26, 2001 8:08 AM
To: Holladay, Cleve
Subject: RE: Brandy Branch Modeling

Cleve -
Please advise once that you can confirm that the permit can include language allowing 16 hours per day oil firing on any one unit, with the remainder of the day on gas AND the other 2 units firing gas for 24 hours per day.

MOST IMPORTANT - I need to know if there is an assumption on the grains S/100scf in the gas. I currently have written up:

"For this project, the applicant has proposed as BACT the use of a limited amount of 0.05% or 0.04% sulfur oil and pipeline natural gas. The Department will set the BACT standard at 2 grains of sulfur per 100 standard cubic feet (gr S/100ft3) although it expects the emissions to be lower, as the typical natural gas in Florida contains less than 1 grain of sulfur per 100 standard cubic feet (gr S/100ft3). This value is well below the "default" maximum value of 20 gr. S/100 ft3."

Mike

Holladay, Cleve

From: Gujjarlapudi, Ebenezer S. [GujjarlapudiES@bv.com]
Sent: Wednesday, November 21, 2001 3:41 PM
To: 'krivo.stanley@epa.gov'; Holladay, Cleve
Cc: Hillman, Timothy M.; Holmes, Allan R.; 'GianNB@jea.com'
Subject: Brandy Branch Modeling

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Scenario 1: The Simple Cycle Turbine operating for 16 hours per day on fuel oil and the remainder of the day (8 hours) on natural gas and the two Combined Cycle turbines operating 24 hours a day on natural gas.

Scenario 2: One of the Combined Cycle Turbines operating for 16 hours per day on fuel oil and the remainder of the day on natural gas and the Simple Cycle Turbine and the other Combined Cycle turbines operating 24 hours a day on natural gas.

The modeling analyses were performed using a similar methodology as the previous set of modeling submitted to the FDEP and EPA. The modeling demonstrates that the Brandy Branch Project will not either cause an exceedance of the SO2 increment or significantly contribute to an exceedance. These scenarios will demonstrate that "any one turbine (either simple cycle or combined cycle) can operate on fuel oil for 16 hours and the remainder (8 hours) on natural gas on any calendar day while the other two turbines operate all day (24 hours) on natural gas for the same calendar day".

Upon review and acceptance of these analyses, JEA would like to have the above-mentioned scenarios incorporated as permit conditions for the Brandy Branch Project before the certification hearing. Your prompt attention to this matter will be greatly appreciated.

I will be traveling on Monday and if you need any questions answered immediately, you can call Tim Hillman at (904) 665-5227.

If you have any questions or need any additional information, please feel free to call me.
Regards,
Ebenezer S. Gujjarlapudi
Environmental Engineer
Black & Veatch Corporation
11401 Lamar, Overland Park, KS 66211
Phone: (913) 458-9426
Fax: (913) 458-2934

14. Maximum allowable hours of operation for the 540 MW Combined Cycle Plant are 8760 hours per year while firing natural gas. The combined hours of fuel oil firing for the two combined cycle combustion turbines is limited to 576 hours per consecutive 12-month period. Unless otherwise authorized by this permit, CT operation below 50% output shall be limited to 2 hours during each calendar day. Additionally, each CT shall be limited to the following hours per day of fuel oil firing:

CT Combination	Daily hours oil operation	Percent Sulfur
~~Both combined cycle plus one simple cycle~~	~~24 hours per day~~	~~0.04%~~
~~Any 2 of the 3 units~~	~~24 hours per day~~	~~0.05%~~
~~Both~~ One combined cycle units ~~plus~~or	~~18~~ 16 hours per day	0.05%
One simple cycle unit	16 hours per day	

[Applicant Request, Rule 62-210.200, F.A.C. (Definitions - Potential Emissions)]

{Permitting note: The maximum allowable hours of oil operation and percent sulfur shown for the simple cycle unit are for informational purposes only and do not supercede any existing permit limits for that emission unit}

10:15 AM 7-0472 Brandy

JEA Brandy Branch Additional Class I Increment Analysis

Introduction

On September 21, 2001, Black & Veatch (B&V) on behalf of JEA submitted a report entitled: Additional SO_2 Class I Increment Analysis for the Brandy Branch Combined Cycle Conversion Project. Upon review of the said report, EPA Region 4 and consequently the FDEP requested that further air dispersion modeling analyses be conducted incorporating additional receptors within the Okefenokee Wilderness Area that lies within 50 km of Brandy Branch facility.

Methodology

The analyses, hereinafter referred to as the "refined analyses", consisted of placing additional discrete receptors spaced at 500 m intervals on the Okefenokee Wilderness area. Cumulative sulfur dioxide (SO_2) Class I area air dispersion modeling analyses were performed using the ISCST3 model to demonstrate that the predicted air quality impacts of the project do not contribute to or cause a Class I SO_2 increment violation at any of the additional receptors. If an exceedance was observed, a further refined 200-m grid was placed around each exceedance receptor, and additional modeling was performed. Except as noted below, all modeling data and information presented in the September 21, 2001 report were used in these additional analyses.

Source Parameter Information

In the course of this additional air dispersion modeling, the source parameters for the Seminole Electric Plant in Palatka, Florida were examined, as this source resulted in the most significant impact on the Class I area. It was determined that the actual stack and emission parameters for Seminole Plant were significantly different then what are included in the inventory provided by the FDEP. B&V contacted the Seminole Plant and obtained updated information regarding stack characteristics and emissions. Based on this information, it was determined that the Seminole Plant installed a 20-ft conical section on the top of each of the stack-flues for Unit #1 and Unit #2. The installation of the conical section increased the stack height, reduced the stack diameter, and resulted in an increased stack exit velocity. It was also determined that the Seminole Plant uses scrubbers to control SO_2 emissions. A review of the SO2 CEMS data provided by the Seminole Plant revealed that the actual SO_2 emission rates are significantly lower than the permitted maximum allowable emission rates that were used in the previous air dispersion modeling exercise.

10700025 Buchover NOT BE LESS THAN 675

In accordance with guidance in EPA's New Source Review Workshop Manual, actual emission rate data for the specific averaging period being modeled may be used to perform the PSD Increment analysis. Using this guidance, the CEM data from the Seminole Plant covering the previous two years (4th quarter of 1999 to 3rd quarter of 2001) of operation were used to determine the maximum 3-hour and 24-hour actual SO_2 emission rates for the two emission units at the facility. Table 1 compares the permitted, or maximum allowable, SO2 emission rate and stack parameters used in the September 21 air dispersion modeling analysis, with the actual emissions and stack parameters based

Get the plume off the shell

on the information provided by Seminole. The actual Seminole Plant SO_2 emissions and stack parameters were used in the air dispersion modeling discussed in this report.

Modeling Analyses

For the refined air dispersion modeling analyses as presented in the following sections, parameters used in the modeling assumed that the emission units at the JEA Brandy Branch facility fire 0.05% sulfur fuel oil. Emission parameters for all other emission sources, except the Seminole Plant, were used as presented in the emission inventory submitted to the FDEP on September 19, 2001. The only change to the inventory were the changes made to the stack and emission parameters for the sources at the Seminole Plant as described above.

Modeling was performed assuming that the combined cycle units at the JEA facility operate 24 hours a day and the simple cycle turbine operates no more than 16 hours per day on 0.05% sulfur fuel oil.

Step 1 Modeling Analysis

The emission units at the JEA Brandy Branch facility (two combined cycle turbines and one simple cycle turbine) in combination with the emission sources presented in the inventory were included in this modeling. As mentioned earlier, a 500m spaced grid was used in the modeling. The highest second high modeled impacts for the short-term averaging periods were used for comparison to the PSD Class I Increments. As presented in Tables 2 and 3, the cumulative modeling impacts exceed the applicable PSD Class I Increment values for the 3-hour and 24-hour averaging periods for SO2 for the year 1988. Therefore, a culpability analysis (a determination of the project impacts at the particular receptor locations for the applicable time periods) was performed as described in the following section.

Step 2 Modeling Analysis

For the Step 2 modeling analyses, each receptor and corresponding time period were identified for each high second high modeled impact greater than the PSD Class I increments. A refined grid of 200 m spacing was placed at each receptor that had a modeled exceedance of the PSD Class I increment in the Step 1 modeling. Modeling was performed at each of the receptors for the time period of the modeled exceedance to determine the contribution of the project at the modeled exceedance.

As presented in Table 4, the project's maximum contribution at each of the receptors and corresponding time periods for which a PSD Class I increment violation was modeled, does not exceed the applicable PSD Class I SILs. Since the project does not significantly contribute to any exceedance of the PSD Class I Increments, no further analyses are warranted.

Conclusions

Based on the summary of results presented in Table 4, the project will not contribute to or cause a modeled Class I SO_2 increment violation at any of the additional receptors that were included in the refined analyses.

500 m spacing

Table 2 Summary of High 2nd High Step 1 Cumulative Source Modeling Results for the 24-hour Averaging Period			
Year	Modeled impact (μg/m3)	PSD Class I Increment	Exceeded PSD Class I Increment?
1984	4.982	5	No
1985	3.734	5	No
1986	3.933	5	No
1987	4.651	5	No
1988	**5.278**	5	Yes

CC2 Full 24 hours
CC 3 Full 24 hours

500m gridspacing

Table 3
Summary of High 2nd High Step 1 Cumulative Source Modeling Results for the 3-hour Averaging Period

Year	Modeled impact ($\mu g/m^3$)	PSD Class I Increment	Exceeded PSD Class I Increment?
1984	22.494	25	No
1985	22.695	25	No
1986	21.156	25	No
1987	23.795	25	No
1988	**25.733**	25	Yes

↑ SC1 16 hrs
0.05% CC2 full 24hrs
↓ CC3 full 24hrs

Table 4
Summary of Step 2 results (culpability analysis) using 200 m grid spacing and JEA's contribution to SO_2 increment exceedances at the Okefenokee NWA

200m

Averaging period	Time period	500m Number of Receptors	Highest 2nd High Modeled Impact ($\mu g/m^3$)	JEA's maximum contribution at exceedance ($\mu g/m^3$)	Class I SIL ($\mu g/m^3$)	Project impacts exceed Class I SIL
24-hr	3/25/88	43	5.31	0.154	0.2	NO
24-hr	4/3/88	2	5.50	0.093	0.2	NO
24-hr	6/7/88	4	5.05	0.075	0.2	NO
3-hr	7/3/88, hour 10-12	1	27.32	0.0015	1	NO

49 total values across all averaging

Subpart Da

Table 1
Comparison of Maximum Allowable and Maximum Actual Seminole Plant Emission Rates and Stack Parameters

	Stack height (ft)	Stack diameter (ft)	Gas exit velocity (ft/sec)	3-hour SO_2 emission rate (lb/hr)	24-hr SO_2 emission rate (lb/hr)
Maximum Allowable (Unit #1 and Unit #2 emission rates are combined)	675	36	26.2	17,213	17,213
Maximum Actual Unit#1	695	26.5	59.9	7,701.7	5,983.2
Maximum Actual Unit#2	695	26.5	60.3	8,390.5	7,715.4

Note:
In the original modeling submitted to the FDEP on September 21, 2001, Seminole Plant emission Units 1 and 2 were represented as a single source in the air dispersion modeling, with an SO2 emission rate of 17,213 lb/hr (8,606 lb/hr per emission unit). For this modeling analysis, a separate emission source was used in the air dispersion modeling for each unit.

Heat Input Limit = 7,172 MMBTU/hr each unit / .8

1.2 lb/MMBTU
1S SO_2 limit

Flow Meters

Dames + Moore

	SH	SV	ST	SFLOW
1979	675	19.2 fps	128° F	2.35 E6 ACFM
				369 E6 ACFM

Certified in ~~Oct~~ Sep 79
Int Appl. Aug 4, 1978

GEP calculation (270'+(70' X 1.5)) = 270 X 2.5 = 675

~~Modifications~~

Mike Opalinski 813-963-0994

CEMs flow monitor

Introduction

JEA is proposing to modify their PSD Air Construction Permit by the Florida Department of Environmental Protection (FDEP) for the Brandy Branch Combined Cycle Conversion project. Specifically, JEA is proposing two phases of analyses to obtain the permit modification.

- Phase I: Perform air dispersion modeling analyses to demonstrate that it is feasible to increase the duct burner size of each combined cycle unit, while complying with the current permit conditions for fuel firing scenarios as outlined in the FDEP PSD Air Construction Permit (PSD-FL-310).
- Phase II: Perform additional air dispersion modeling analyses to investigate the feasibility of additional fuel flexibility at its facility. The permit condition governing the fuel firing scenario limits the number of hours of oil firing available to any one of the three combustion turbines to 16 hours per day, while prohibiting any further firing on natural gas or fuel oil for the remainder of the day for the other two turbines.

As such, JEA would like to suggest the following methodologies for revising the permit for the purpose of expanding the operational flexibility of the Brandy Branch combined cycle combustion turbines.

Brandy Branch Project Description

Based on the aforementioned PSD Permit, JEA intends to convert two of the three simple cycle combustion turbines at their Brandy Branch Facility into a combined cycle configuration. The combined cycle conversion project includes the addition of heat recovery steam generators (HRSGs) to Units 2 and 3 in a standard 2 on 1 configuration, duct burners in each HRSG, a cooling tower, and a steam turbine generator. The combined cycle conversion is permitted to operate 8,760 hours per year at loads ranging from 50 to 100 percent. The combined cycle conversion is primarily fired with natural gas, or with low sulfur (0.05 percent) No. 2 distillate fuel oil as back up. The construction for the combined cycle conversion is currently underway.

Phase 1: Air Dispersion Modeling to Demonstrate Feasibility of Duct Burner Size Increase

Currently the combined cycle Units 2 and 3 are each permitted with a natural gas fired duct burner in the heat recovery steam generator (HRSG). The permitted maximum heat input of each duct burner is 85 MMBtu/hr (HHV) and has a regulatory classification

under 40 CFR Part 60 as a Dc unit. JEA proposes to increase each duct burner's actual maximum heat input from 85 MMBtu/hr to 170 MMBtu/hr (HHV). The change in duct burner size would then classify each burner as a Db unit.

The proposed modification of the duct burners will slightly affect the emissions but the overall increase in project emissions is expected to be minimal. JEA anticipates that, after FDEP review, that this proposed modification will require no change to the BACT or the existing permit limits. Also, the increase in the associated predicted model impacts are expected to be minimal. The demonstration of compliance through air dispersion modeling will be based on the currently permitted operating scenario, as describe in the PSD permit under Condition #14 (page 7 of 14):

> *Maximum allowable hours of operation for the 540 MW Combined Cycle Plant are 8760 hours per year while firing natural gas. The combined hours of fuel oil firing for the two combined cycle combustion turbines is limited to 576 hours per consecutive 12-month period and fuel oil firing for the simple cycle unit is limited to 750 hours per consecutive 12-month period. In the event that any of the 3 emission units (simple or combined cycle) fires fuel oil during a calendar day, that unit shall be limited to 16 hours of daily operation on any fuel. Additionally, the other 2 units shall not be fired on any fuel for the calendar day.*

Proposed analyses for this demonstration include the following:

- modeling PSD SILs for the significantly emitted pollutants in the Class II area,
- modeling PSD SILs for Class I areas Okefenokee National Wildlife Refuge (ONWR) and Wolf Island National Wildlife Reserve (WINWR).

Modeling regional haze and deposition for Class I areas ONWR and WINWR will not be performed for the natural gas firing scenario. The air dispersion modeling protocol is contained as an attachment to this document.

Phase 2: Air Dispersion Modeling to Investigate Additional Fuel Flexibility

Phase 2 of the air dispersion modeling analyses involves investigating the feasibility of increasing Brandy Branch's operational flexibility by increasing the fuel flexibility beyond PSD Permit Condition #14. It should be noted that initiation of Phase 2 is intended to begin after FDEP's acceptance of the revision to the duct burner size and corresponding modification of the Brandy Branch PSD Permit as described in Phase 1.

Phase 2 Background

During the Brandy Branch combined cycle conversion air permitting process, EPA Region IV commented on methodologies used in the dispersion modeling analysis, and both EPA and FDEP requested additional modeling be performed to support permitting efforts. The following paragraphs provide a brief description of each of the major changes to the original submittals made to the FDEP during the air permitting process to aid in understanding the current operating restrictions imposed upon the Brandy Branch facility's three combustion turbines in the PSD permit.

In December of 2000, Black & Veatch, on behalf of JEA, submitted an application to the FDEP proposing to convert two of three previously permitted simple cycle combustion turbines at the Brandy Branch facility to operate in combined cycle mode (hereinafter referred to as the Combined Cycle Conversion Project). In pre-application discussions with FDEP regarding the air permitting methodology and air dispersion modeling protocol, the FDEP determined that the Combined Cycle Conversion Project comprised a modification of an existing major source for the PSD air permitting applicability. Specifically, the determination was that the existing major source was permitted to operate as three simple cycle electric generating facility; and thus, the conversion of two of the three simple cycle turbines to combined cycle operation constitutes the project. Under this submittal, the presented modeling scenario allowed for both combined cycle turbines to operate up to 24 hours per day on fuel oil. That is, their operation was not restricted on a daily basis. Based on the pre-application meeting, the simple cycle turbine was not addressed in this submittal and was assumed to continue to be covered by the previous permit allowing it to operate up to 16 hours per day on fuel oil.

Based on EPA and FDEP comments, the initial modeling analyses were revised to include the following scenarios:

- Addition of the simple cycle turbine to the analyses *{July 18, 2001 – EPA Comment}*.
- Addition of a Class I increment analysis for SO_2 at ONWR using ISC and CALPUFF and the WINWR using CALPUFF *{~July 2001 - FDEP Comment}*.
- Addition of discrete receptors spaced at 500 m intervals on the portion of the ONWR that lies within 50 km of the Brandy Branch facility, and for any

exceedances of the Class I Area SO_2 increment thresholds, a further refined 200-m grid was placed around each receptor where the exceedance occurred *{~October 2001 – EPA & FDEP Comment}*.

- Modification to the emission rates of the Seminole Plant in the inventory from actual emission to potential emissions *{~November 2001– EPA & FDEP Comment }*. Not going to change ?

In the November 21, 2001 submittal in response to FDEP's comment, a 200-m refined grid was placed within the entire 500-m receptor grid on those days where a Cumulative Class I modeled exceedance occurred, as opposed to only "refining" around the individual receptor(s) where there was an exceedance. The cumulative modeling methodology was used as in the previous submittal. Discussions with JEA prompted the inclusion of natural gas back into the modeling equation when firing fuel oil for added permit flexibility. The following scenarios were presented in the submittal:

- The simple cycle turbine can operate for 16 hours per day on fuel oil and the remainder of the day (8 hours) on natural gas and simultaneously the two combined cycle turbines can operate 24 hours a day on natural gas.
- One of the combined cycle turbines can operate for 16 hours per day on fuel oil and the remainder of the day on natural gas and simultaneously the simple cycle turbine and the other combined cycle turbine can operate 24 hours a day on natural gas.

Both EPA and FDEP approved this modeling analysis. As part of discussions with these agencies in regard to obtaining operational flexibility, JEA was notified that the original permit contained a BACT natural gas usage limit of 2 grains per 100 standard cubic feet and the modeling was performed using the EPA natural gas sulfur content of 0.2 grains per 100 standard cubic feet. In keeping with the schedule for issuance of the Conditions of Certification (COC), JEA agreed to the restrictive permit conditions with the option of further investigation of fuel flexibility after permit issuance. The resulting final fuel firing operational limitations contained in the PSD Permit is for one combustion turbine (either one of the combined cycle turbines or the simple cycle turbine) operating on 0.05 percent fuel oil for 16 hours a day, with no additional hours of operation on natural gas (refer to PSD Permit, Condition #14). For the purposes of this modeling exercise, JEA will continue to use the EPA the natural gas sulfur content value of 0.2 grains per 100 standard cubic feet

Additionally, it should be noted that, this permitted operating scenario was forwarded by Mike Halpin of FDEP to Buck Oven and Scott Goorland for inclusion into the COC on November 30, 2001. However, due to time constraints in the process of issuing the COC's, the scenario was not incorporated. Thus, many of the COC regarding the fuel oil firing options for Units 2 and 3 do not agree with the PSD Permit. Currently, the COC's are being revised to incorporate all of the revised conditions.

As mentioned earlier, the BACT discussion in Appendix BD of the PSD Permit, provides an option to include additional fuel firing capability which would allow JEA the option of regaining some of the operational flexibility (with additional requirements) that was lost in the permitting process:

> *One additional scenario may be authorized by permit, but should JEA wish to deviate from these very prescriptive requirements, BACT and modeling will need to be revisited. This scenario allows gas firing to occur on any of the 3 emission units in conjunction with the aforementioned allowances for oil firing. However, the following additional requirements (Table 3) are associated with this scenario, and SO_2 CEMS are required to be installed on each emission unit.*

Table 3

Emission Unit	*Daily Operation of CC unit on oil*		*Daily Operation of SC unit on oil*	
	3 Hr Average SO2 Limit	*24 Hr Average SO2 Limit*	*3 Hr Average SO2 Limit*	*24 Hr Average SO2 Limit*
Simple Cycle	*1.1 lb/hr*	*1.1 lb/hr*	*98.2 lb/hr*	*65.8 lb/hr*
One CC Unit	*109.4 lb/hr*	*73.3 lb/hr*	*1.2 lb/hr*	*1.2 lb/hr*
Other CC Unit	*1.2 lb/hr*	*1.2 lb/hr*	*1.2 lb/hr*	*1.2 lb/hr*

Therefore, JEA proposes that the permitted duct burner size of 85 MMBtu/hr (per CT) be increased to 170 MMBtu/hr as will be demonstrated by Phase 1, and as recommended by FDEP, JEA proposes to submit revised permit application forms for the affected units and a demonstration of compliance through air dispersion modeling for the previously approved November 21, 2001 fuel firing operating scenario. This permitting approach for Phase II – Fuel Firing Flexibility, would be implemented after FDEP's approval of Phase I.

Proposed analyses for this demonstration include the following,

- modeling PSD SILs for the significantly emitted pollutants in the Class II area,

- modeling PSD SILs for Class I areas Okefenokee National Wildlife Refuge (ONWR) and Wolf Island National Wildlife Reserve (WINWR),
- modeling PSD increment where applicable,
- modeling regional haze and deposition for Class I areas ONWR and WINWR.

Note, the air dispersion modeling protocol is contained in the following attachment.

Class I analyses

fbbcg6ev.bst 1986 SO_2 event file 15/24 f.o.
fbbcg5ev.bst 1985 SO_2 event file 15/24 f.o.
fbbcg8ev.bst 1988 SO_2 event file 15/24 f.o.
bbc1ev6y.lst 1986 SO_2 event file 15/24
Bb24t1v6y.
Bb3t1v6y.
bbc1ev5y.lst 1985 SO_2 event file 15/24
Bb24t1v5y.
Bb3t1v5y.
bbc1ev8y.lst 1988
Bb24t1v8y.
Bb3t1v8y

Class I comp

fbbcx8ev.bst →
fbbcx4ev.bst

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

JUL 19 2001

4 APT-ARB

Mr. A. A. Linero, P.E.
FL Department of Environmental Protection
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Dear Mr. Linero:

Thank you for sending the preliminary determination and draft prevention of significant deterioration (PSD) permit for the JEA Brandy Branch facility dated April 26, 2001. The draft PSD permit is for the proposed conversion of two simple cycle combustion turbines (CTs) to combined cycle CTs. This project includes the addition of two heat recovery steam generating (HRSG) units with natural gas fired duct burners, a steam turbine generator and a fresh water cooling tower. This project will add 200 megawatts (MW) of electric generating capacity to the 510 MW capacity of the already permitted JEA Brandy Branch facility. The HRSG duct burners will combust pipeline quality natural gas only, and the combined cycle CTs will primarily combust natural gas with No. 2 fuel oil combusted as backup fuel. As proposed, the combined cycle CTs will be allowed to fire natural gas up to 8,760 hours per year and fire No. 2 fuel oil a maximum of 288 hours per year. Total emissions from the proposed project are above the thresholds requiring PSD review for nitrogen oxides (NO_x), carbon monoxide (CO), and particulate matter (PM/PM_{10}).

The PSD permit to construct the original three simple cycle CTs is dated September 14, 1999. It is our understanding that none of the CTs have begun operating. Therefore, we do not view the proposed conversion as a modification of an existing major source but rather as a change in the design of the entire facility. Accordingly, emissions from the CT that will remain in simple cycle service should be included with emissions from the two converted CTs to assess PSD applicability

Based on our review of the PSD permit application, preliminary determination and draft PSD permit, we have the following comments regarding the BACT analysis and PSD applicability. A comment regarding the air quality impact assessment is provided at the end of this letter.

1. Condition 22 of the draft PSD permit limits emissions of volatile organic compounds (VOC) to 4.8 lb/hour and 8.2 lb/hour when firing natural gas and No. 2 fuel oil, respectively. Table 2-1 (maximum hourly emission rates) of the PSD permit application states the maximum hourly VOC emission rates are 3.49 lb/hour and 7.68 lb/hour when firing natural gas and No. 2 fuel oil, respectively. In order to avoid PSD review for VOC,

the final PSD permit should limit the hourly VOC emission rates to those listed in Table 2-1.

2. Table 2-2 (PSD applicability) of the PSD permit application indicates the potential to emit of sulfur dioxide (SO_2) is based on 0.2 gr/100 scf of sulfur in natural gas and 0.05 percent sulfur by weight in fuel oil. Condition 23 of the draft PSD permit limits the sulfur content of natural gas to 2 gr/100 scf. In order to avoid PSD review for SO_2, the final PSD permit should limit the sulfur content of natural gas to 0.2 gr/100 scf or some other level that ensures emissions of SO_2 do not exceed the PSD significant emissions threshold of 40 tons per year.

3. We are pleased to see that Florida Department of Environmental Protection (FDEP) re-performed the cost analyses for the SCONOx™ and catalytic oxidation add-on control systems. We also questioned a number of items in the applicant's cost evaluation.

In terms of the air quality impact assessment, we have only one comment (below) which has been discussed with FDEP on June 25, 2001.

Project Definition - As discussed above, our view is that the current PSD permit application is not for the modification of an existing major source but an addendum to the PSD permit application. Therefore, the applicable PSD pollutants and air quality impact assessments should include emissions associated with the operation of the two converted combined cycle CTs and the previously permitted simple cycle CT.

Thank you for the opportunity to comment on the JEA Brandy Branch facility preliminary determination and draft permit. If you have any questions regarding these comments, please direct them to either Ms. Katy Forney at 404-562-9130 or Mr. Stan Krivo at 404-562-9123.

Sincerely,

for Gregg M. Worley

R. Douglas Neeley
Chief
Air and Radiation Technology Branch
Air, Pesticides and Toxics
Management Division

cc: T. Halpin
C. Holladay
C. Kurts, AWD
D. Harris, R4 SED
Q. Bunyak, NPS
B. Thomas, DEP Duval
D. Lancaster, JEA

ATTACHMENT 1

BRANDY BRANCH COMBINED CYCLE PROJECT MODIFICATION MODELING PROTOCOL

0310485-006

PREPARED BY
BLACK & VEATCH

JANUARY 2003

Air Dispersion Modeling Assumptions and Methodology

On September 11, 2000, FDEP held a meeting at their offices for the Brandy Branch Combined Cycle Project with JEA, and Black & Veatch. The attached modeling protocols summarize the air dispersion modeling assumptions and methodologies as agreed to between the aforementioned parties for the Class I and Class II analyses to support the PSD permit application for the combined cycle conversion project. For simplicity of following the specific history of this project, the protocols have not been updated. As previously described, during FDEP's permit application review, both EPA and FDEP requested additional modeling be performed to support permitting efforts.

The following additional modeling methodologies were included in the analyses:

- Addition of the simple cycle turbine to the analyses *{July 18, 2001 – EPA Comment}*.
- Addition of a Class I increment analysis for SO2 at Okefenokee National Wildlife Refuge (using ISC and CALPUFF) and the Wolf Island National Wildlife Reserve (using CALPUFF) *{~July 2001 - FDEP Comment}*.
- Addition of discrete receptors spaced at 500 m intervals on the portion of the ONWR that lies within 50 km of the Brandy Branch facility, and for any exceedances of the Class I Area SO2 increment thresholds, a further refined 200-m grid was placed around each receptor where the exceedance occurred *{~October 2001 – EPA & FDEP Comment}*.
- Addition of a 200-m refined grid placed within the entire 500-m receptor grid on those days where a Cumulative Class I modeled exceedance occurred, as opposed to only "refining" around the individual receptor(s) where there was an exceedance. *{November 21, 2001 – FDEP Comment}*.

For the proposed modeling demonstration for the duct burner modification and for the increase fuel firing flexibility, Black & Veatch proposes to use the original air dispersion modeling protocols as submitted to FDEP on September 19, 2000 along with the additional aforementioned methodologies.

ENCLOSURE 1

BRANDY BRANCH COMBINED CYCLE PROJECT
ISC MODELING PROTOCOL

PREPARED BY
BLACK & VEATCH

SEPTEMBER 2000

Air Quality Modeling Assumptions and Methodology

Modeling Scenario:	As a major modification to an existing PSD major source, the air quality impact analysis (AQIA) will be performed only for Units 2 and 3, which are proposed to be converted into combined cycle units, and only units undergoing any modification. If the modeled predicted impacts from the combined cycle units exceed the PSD Significant Impact Levels (SILs), then Unit 1 will be included as part of the cumulative impact analysis.
Air Dispersion Model:	ISCST3 (Latest version)
Model Options:	EPA Default and Flat terrain.
GEP & Downwash:	EPA's BPIP program will be used to determine GEP stack height and direction specific building downwash parameters for each of the combined cycle stacks. Structures associated with the existing site, as well as the proposed additions will be included in the BPIP analysis.
Receptor Grids:	A 10 km nested rectangular receptor grid consisting of 100 m spacing out to 1 km, 250 m spacing from 1 km to 2.5 km, 500 m spacing from 2.5 km to 5 km, and 1,000 m spacing from 5 km to 10 km. Fenceline receptors will be placed at 100 m intervals, and a 100 m fine grid will be placed at maximum impact locations.
Dispersion Coefficients:	Rural: Based on visual inspection of a 7.5 minute USGS topographic map of the site using the Auer method.
Meteorological Data:	Refined level modeling sequential meteorological data will consist of surface data from Jacksonville, FL and upper air data from Waycross, GA for the years 1984-1988.
Pollutants to be Modeled: Add SO_2	The only pollutants that are currently expected to be modeled are PM_{10}, NO_x and CO. SO_2 emissions will likely be limited to less than 40 tpy by limiting the amount of fuel oil firing.
Source Modeling Parameters:	Worst-case hourly emission rates and operating parameters will be used for short-term modeling impacts. These data will be enveloped across 50, 75 and 100 percent load cases from representative combustion turbine performance and emissions data. Potential to emit calculations and operating parameters for annual modeling impacts will be based on annual average data.

Modeled impacts:	It is anticipated that the maximum model predicted pollutant impacts will be less than their respective PSD SILs. If the model predicted impacts exceed the SILs, additional agency consultation will be initiated regarding increment and cumulative air quality impact analyses.
Class I Analysis:	A regional haze visibility study and Class I SIL analysis will be performed for the Class I areas within 150 km of the proposed facility location. These areas will consist of the Okefenokee and Wolf Island Wilderness areas. For those areas within 50 km of the proposed facility location, the VISCREEN model will be used. For analysis of Class I areas beyond 50 km, the CALPUFF model will be used. The CALPUFF modeling protocol is discussed in Enclosure 2 of this submittal.
Toxics:	No toxic modeling analysis is required.

ENCLOSURE 2

BRANDY BRANCH COMBINED CYCLE PROJECT
CALPUFF MODELING PROTOCOL

PREPARED BY
BLACK & VEATCH

SEPTEMBER 2000

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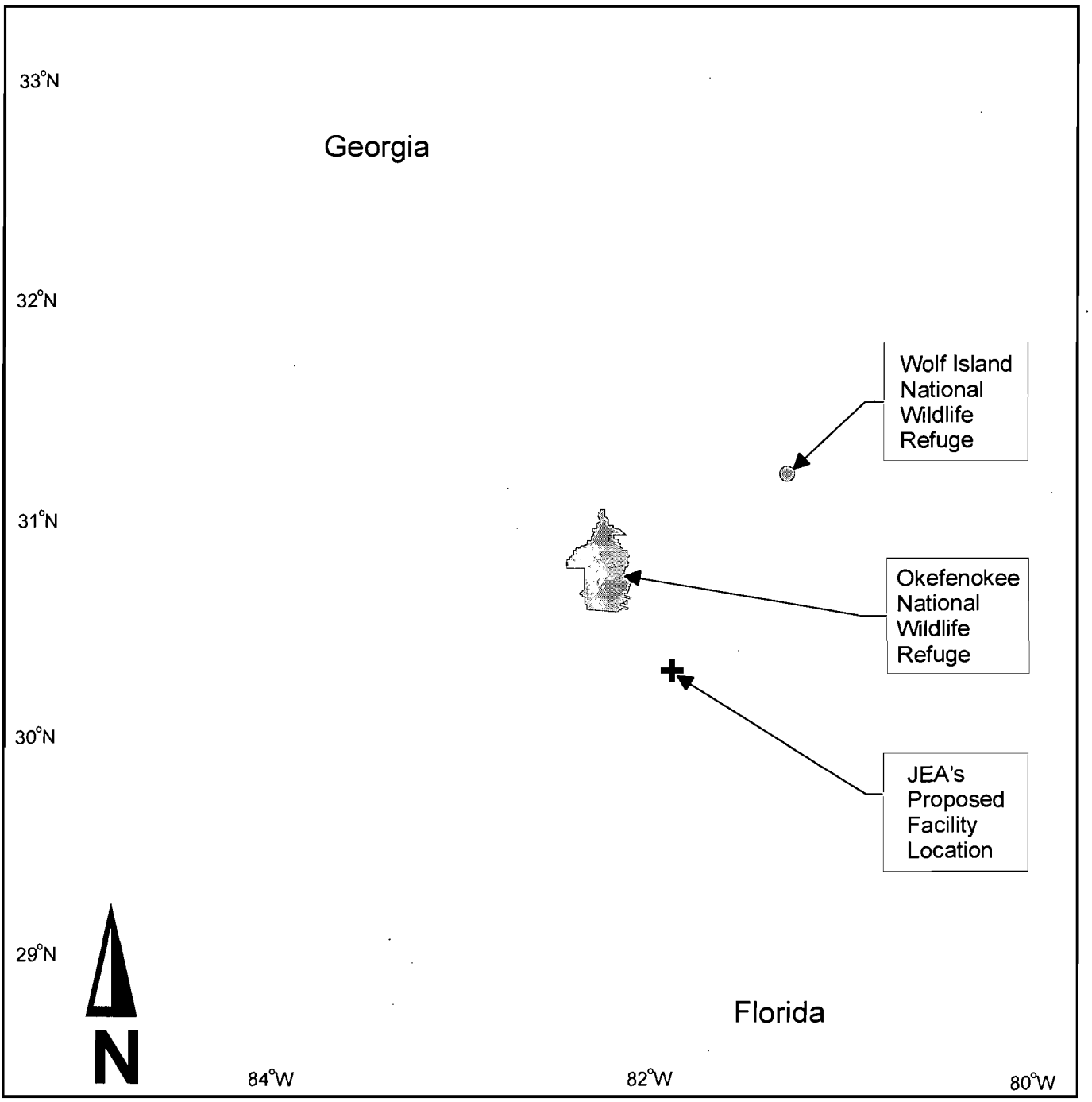
Introduction

JEA is proposing to convert two simple-cycle combustion turbines into combined-cycle combustion turbines serving one steam turbine (2x1), for a total nominal output of approximately 530 MW, at the existing Brandy Branch Facility, which is located near the city of Baldwin in northeastern Florida. As part of the air impact evaluation for the proposed facility, the Florida Department of Environmental Projection (FDEP) has requested that analyses of the proposed facility's affect on the Okefenokee National Wildlife Refuge (ONWR) and Wolf Island National Wildlife Refuge (WINWR) be performed. The ONWR and WINWR are Prevention of Significant Deterioration (PSD) Class I areas located in southeastern Georgia approximately 34 km north-northwest and 127 km north-northeast, respectively, of the proposed facility site. Class I areas are afforded special environmental protection through the use of Air Quality Related Values (AQRVs). The AQRVs of interest in this protocol are regional haze, deposition, and Class I Significant Impact Levels (SILs). Figure 1-1 presents the locations of the proposed project site with respect to the ONWR and WINWR.

The CALPUFF analysis will closely follow those procedures recommended in the Interagency Workgroup on Air Quality Modeling (IWAQM) Phase II report dated December 1998, the Draft Phase I Federal Land Managers' Air Quality Related Values Workgroup (FLAG) dated October 1999, as well as coordination with the FDEP who will in turn communicate as necessary with the U.S. Fish and Wildlife Service (FWS) which is the Federal Land Manager (FLM) for both areas. This protocol includes a discussion of the meteorological and geophysical databases to be used in the analysis, the preparation of those databases for introduction into the modeling system, and the air modeling approach.



Location of Brandy Branch Facility
with Respect to
Okefenokee and Wolf Island
National Wildlife Refuges

Figure 1-1

Model Selection and Inputs

Model Selection

The California Puff (CALPUFF, version 5.4) air modeling system will be used to model the emissions associated with the two combined-cycle combustion turbines at the proposed facility and assess the AQRVs at ONWR and WINWR. CALPUFF is a non-steady state Lagrangian Gaussian puff long-range transport model that includes algorithms for building downwash effects as well as chemical transformations (important for visibility controlling pollutants), and wet/dry deposition. The model will first be used in a screening mode called CALPUFF 'Lite' to determine impacts onto the Class I areas. This method simplifies the modeling process while introducing a high level of conservatism. If the 'Lite' results are below the required thresholds of the previously listed AQRVs, the demonstration will be considered complete and a refined CALPUFF analysis will not be pursued. CALPUFF 'Lite' bypasses the need for the intensive meteorological processor, CALMET. The CALMET model, a preprocessor to CALPUFF, is a diagnostic meteorological model that produces a three-dimensional field of wind and temperature and a two-dimensional field of other meteorological parameters. Simply, CALMET was designed to process raw meteorological, terrain, and land-use databases to be used in the air modeling analysis. The CALPUFF modeling system uses a number of FORTRAN preprocessor programs that extract data from large databases and converts the data into formats suitable for input to CALMET. If a refined analysis is necessary, the processed data produced from CALMET will be input to CALPUFF to assess pollutant specific impacts. Both CALMET and CALPUFF (including the 'Lite' and refined methodology) will be used in a manner that is recommended by the IWAQM Phase 2 Report and Draft Phase I FLAG Report.

CALPUFF Model Settings

The CALPUFF settings contained in Table 2-1 will be used for the modeling analyses.

Building Wake Effects

Both the screening and refined (if necessary) CALPUFF analyses will include the proposed facility's building dimensions to account for the effects of building-induced

Table 2-1 CALPUFF Model Settings	
Parameter	**Setting**
Pollutant Species	SO_2, SO_4, NO_x, HNO_3, and NO_3, and PM_{10}
Chemical Transformation	MESOPUFF II scheme
Deposition	Include both dry and wet deposition, plume depletion
Meteorological/Land Use Input	CALPUFF 'Lite' – screening mode 5 years of Jacksonville data (including precipitation) processed to include such parameters as the surface roughness, Bowen ratio, albedo, etc. CALPUFF – refined mode CALMET
Plume Rise	Transitional, Stack-tip downwash, Partial plume penetration
Dispersion	Puff plume element, PG/MP coefficients, rural mode, ISC building downwash scheme.
Terrain Effects	Partial plume path adjustment.
Output	Create binary concentration and wet/dry deposition files including output species for all pollutants.
Model Processing	Regional Haze: Highest predicted 24-hour SO_4, NO_3 and PM_{10} concentrations for the year. Deposition: Highest predicted annual, SO_4 and NO_3 values in deposition units. Class I SILs: Highest predicted concentrations at the applicable averaging periods for those pollutants that exceed the respective PSD Significant Emission Levels (SELs).
Background Values	Ozone: 80 ppb; Ammonia: 10 ppb

downwash on the emission sources. Dimensions for all significant building structures will be processed with the Building Profile Input Program (BPIP), Version 95086, and included in the CALPUFF model input.

Receptor Locations

The CALPUFF 'Lite' analysis will use rings of discrete Cartesian receptors located at distances equal to that of the closest and furthest boundaries of the Class I areas to the proposed project location. Specifically, the rings will consist of receptor spacing of every 1-degree beginning at the appropriate distances from the proposed facility location.

The refined CALPUFF analysis, if necessary, will use an array of discrete receptors at appropriate distances to ensure sufficient density and aerial extent to adequately characterize the pattern of pollutant impacts in the ONWR and WINWR. The same modeling grid as was used in the simple cycle project will again be used here. Specifically, the array will consist of receptor spacing of 2 km within the Class I areas beginning at a distance of 50 km from the proposed facility location and continuing to the farthest extent of the ONWR and WINWR.

Meteorological Data Processing

The meteorological data that will be used in the CALPUFF screening modeling will consist of 5 years of surface observations (1984-1988) for Jacksonville, Florida extracted from the National Climatic Data Center's (NCDC) Solar and Meteorological Surface Observational Network (SAMSON) CD-ROM set. These five years will be combined with upper air, twice-daily mixing height data from Waycross, Georgia downloaded from the SCRAM BBS for the same five-year period. The data set will be processed with PCRammet for wet deposition to give CALPUFF enough information to perform the Mesopuff II chemistry transformations. This processing allows CALPUFF to run in screening mode by providing extended meteorological variables such as surface friction, surface roughness, albedo, Bowen ratio, precipitation, etc. used in the atmospheric plume dispersion.

If the refined CALPUFF analysis is employed, the California Puff meteorological and geophysical data preprocessor (CALMET, Version 5.2) will be used to develop the gridded parameter fields required for the refined AQRV modeling analyses. The following sections discuss the data to be used and processed in the CALMET model.

CALMET Settings

The CALMET settings, including horizontal and vertical grid coverage, number of weather stations (surface, upper air, and precipitation), and resolution of prognostic mesoscale meteorological data, will be chosen to adequately characterize the area within the CALMET domain.

Modeling Domain

The size of the domain used for the modeling will be based on the distances needed to cover the area from the proposed facility to the receptors at the ONWR and WINWR with at least a 50-km buffer zone in each direction. The air modeling analysis will be performed in the UTM coordinate system.

Mesoscale Model Data

Pennsylvania State University in conjunction with the National Center for Atmospheric Research (NCAR) Assessment Laboratory have developed mesoscale meteorological data sets, prognostic wind fields or "guess" fields, for the United States. The hourly meteorological variables used to create these data sets (wind, temperature, dew point depression, and geopotential height for eight standard levels and up to 15 significant levels) are extensive and only allow for a one-year data base set; specifically, 1990. The analysis will use the MM4 mesoscale meteorological data set to initialize the CALMET wind field. The data will be extracted from a 12-volume CD-ROM set distributed by the National Climatic Data Center (NCDC). The MM4 data have a horizontal spacing or resolution of 80 km and are used to simulate atmospheric variables within the modeling domain.

The mesoscale meteorological data set (MM4) to be used in CALMET, although advanced, lacks the fine detail of specific temporal and spatial meteorological variables and geophysical data. These variables will be processed into the appropriate format and introduced into the CALMET model through the utilization of additional data files obtained from numerous sources. These ancillary data files are described in more detail in the following sections.

Surface Data Stations and Processing

The surface station data for the CALPUFF analyses will consist of data from several National Weather Service (NWS) stations or Federal Aviation Administration (FAA) Flight Service stations. The surface station parameters include wind speed, wind direction, cloud ceiling height, opaque cloud cover, dry bulb temperature, relative humidity, station pressure, and a precipitation code that is based on current weather conditions. The station data may be obtained directly from NCDC or extracted from a

CD-ROM set put out by NCDC. The data will be processed with the CALMET preprocessor utility program, SMERGE, to create one surface file.

Upper Air Data Stations and Processing

The analysis will include several upper air NWS stations located within the CALMET domain. Data for these stations will be obtained from the NCDC Radiosonde Data CD and processed into the NCDC Tape Deck (TD) 6201 format by the READ62 utility program for input to CALMET.

Precipitation Data Stations and Processing

Precipitation data will be processed from a network of hourly precipitation data files collected from primary and secondary NWS precipitation recording stations within the CALMET domain. The precipitation files are contained in a 2-volume CD-ROM set from NCDC. The utility programs PXTRACT and PMERGE will be used to process the data into the format for the Precip.dat file that is used by CALMET.

Geophysical Data Processing

Terrain elevations for each grid cell of the modeling domain will be obtained from Digital Elevation Model (DEM) files obtained from US Geographical Survey (USGS). The DEM data will be extracted for the modeling domain grid using the CALMET preprocessor program TERREL. Land-use data, based on annual averaged values, will also be obtained from the USGS. Land-use values for the domain grid will be extracted with the preprocessor programs CTGCOMP and CTGPROC. Other parameters processed for the modeling domain include surface roughness, surface albedo, Bowen ratio, soil heat flux, and leaf index field. Once preprocessed, all of the land-use parameters will be combined with the terrain information in a processor called MAKEGEO. This processor will produce one GEO.DAT file for input to CALMET.

Facility Emissions

Performance data for the combustion turbines will be based on vendor data at certain design ambient temperatures at base load operation, considering both natural gas and distillate fuel oil firing. The maximum pound per hour emission rates considering representative ambient temperatures at base load operation for natural gas and distillate fuel oil firing will be used for the pollutants modeled with CALPUFF.

CALPUFF Analyses

The preceding model inputs and settings for the CALPUFF modeling system (either screening or refined mode) will be used to complete the Class I analyses on the ONWR and WINWR, including regional haze, deposition (both sulfur and nitrogen), and Class I SILs. The following analyses will be performed as described regardless of the modeling methodology (i.e., screening or refined modeling).

Regional Haze Analysis

Regional haze analyses will be performed for the Class I areas for ammonium sulfates, ammonium nitrates, and particulate matter by appropriately characterizing model predicted outputs of SO_4, NO_3, and PM_{10} concentrations.

Visibility

Visibility is an AQRV for both the ONWR and WINWR. Visibility can take the form of plume blight for nearby areas, or regional haze for long distances (e.g., distances beyond 50 km). Because either all or portions of the Class I areas lie beyond 50 km from the proposed facility, the change in visibility will be analyzed as regional haze at those locations. Regional haze impairs visibility in all directions over a large area by obscuring the clarity, color, texture, and form of what is seen. Current regional haze guidelines characterize a change in visibility by either of the following methods:

1. Change in the visual range, defined as the greatest distance that a large dark object can be seen, or
2. Change in the light-extinction coefficient (b_{ext}).

Visual range can be related to extinction with the following equation:

$$bext(Mm\text{-}1) = 3912 / vr(Mm\text{-}1)$$

Visual range (vr) is a measure of how far away a large black object can be seen in the atmosphere under several severe assumptions including: an absolutely dark target, uniform lighting conditions (cloud free skies), uniform extinction in all directions, a limiting contrast discrimination level, a target high enough in elevation to account for earth curvature, and several other factors. Visual range is, at best, a limited concept that allows relatively simple comparisons between visual air quality levels and should not be thought of as the absolute distance that can be seen through the atmosphere.

The b_{ext} is the attenuation of light per unit distance due to the scattering (light reduced away from the site path) and absorption (light captured by aerosols and turned into heat energy) by gases and particles in the atmosphere. A change in the extinction coefficient produces a perceived visual change that is measured by a visibility index called the deciview. The deciview (dv) is defined as:

$$dv = 10 \ln (1 + b_{exts} / b_{extb})$$

where: b_{exts} is the extinction coefficient calculated for the source, and
b_{extb} is the background extinction coefficient

A uniform incremental change in b_{extb} or visual range does not necessarily result in uniform changes in perceived visual air quality. In fact, perceived changes in visibility are best related to a change in b_{extb}, or; percent change in extinction. Based on the IWAQM Phase II guidance, if the change in extinction is less than 5 percent, no further analysis is required. An index similar to the deciview that simply quantifies the percent change in visibility due to the operation of a source is calculated as:

$$\Delta\% = (b_{exts} / b_{extsb}) \times 100$$

Background Visual Ranges and Relative Humidity Factors

The background visual range is based on data representative of the top 20-percentile air quality days. The background visual ranges for the ONWR and WINWR will be obtained from the Draft Phase I FLAG document. The average relative humidity factor for each species' worst day will be computed by determining the relative humidity factor for each hour's relative humidity for the 24-hour period that the maximum impact occurred. This factor, based on each relative humidity will be obtained by using Table 2.A-1 of Appendix 2.A of the Draft Phase I FLAG Report. These factors (a relative humidity factor for each relative humidity) will then be used to determine the average relative humidity factor for that day (24-hour period). Again, all of this can be accomplished with the use of the CALPOST post-processor.

Interagency Workgroup On Air Quality Modeling (IWAQM) Guidelines

The CALPUFF air modeling analysis (both screening and refined) will follow the recommendations contained in the IWAQM Phase II Summary Report and Recommendations for Modeling Long Range Transport Impacts, (EPA, 12/98). Table 3-1 summarizes the IWAQM Phase II recommendations. The methodology below will be used to compute the results of the regional haze analysis. However, CALPOST now possesses the ability to post-process the modeling results specific to the regional haze

analysis through the selection of one of six modeling options. The post-processing selection will be made to calculate regional haze based on the appropriate available data/resources. A typical calculation methodology is illustrated below.

Calculation

Refined impacts will be calculated as follows:

1. Obtain maximum 24-hour SO_4, NO_3, and PM_{10} impacts, in units of micrograms per cubic meter ($\mu g/m^3$).
2. Convert the SO_4 impact to $(NH_4)_2SO_4$ by the following formula:

   $(NH_4)_2SO_4$ ($\mu g/m3$) = SO_4 ($\mu g/m^3$) x molecular weight $(NH_4)_2SO_4$ / molecular weight SO_4

   $(NH_4)_2SO_4$ ($\mu g/m^3$) = SO_4 ($\mu g/m^3$) x 132/96 = SO_4 ($\mu g/m^3$) x 1.375

   Convert the NO_3 impact to NH_4NO_3 by the following formula:

   NH_4NO_3 ($\mu g/m3$) = NO_3 ($\mu g/m^3$) x molecular weight NH_4NO_3 / molecular weight NO_3

   NH_4NO_3 ($\mu g/m^3$) = NO_3 ($\mu g/m^3$) x 80/62 = NO_3 ($\mu g/m^3$) x 1.29
3. Compute b_{exts} (extinction coefficient calculated for the source) with the following formula:

   b_{exts} = 3 x NH_4NO_3 x f(RH) + 3 x $(NH_4)_2SO_4$ x f(RH) + 1 x PM_{10}
4. Compute b_{extb} (background extinction coefficient) using the background visual range (km) from the FALG document with the following formula:

   b_{extb} = 3.912 / Visual range (km)
5. Compute the change in extinction coefficients:

in terms of deciviews:

$$dv = 10 \ln (1 + b_{exts} / b_{extb})$$

in terms of percent change of visibility:

$$\Delta\% = (b_{exts} / b_{extsb}) \times 100$$

Based on the predicted SO_4, NO_3, and PM_{10} concentrations, the proposed facility's emissions will be compared to a 5 percent change in light extinction of the background levels. This is equivalent to a change in deciview of 0.5.

Table 3-1
Outline of IWAQM Refined Modeling Analyses Recommendations*

Meteorology	CALPUFF 'Lite' 5 years of the closest surface station and upper air station. Refined CALPUFF Use CALMET (minimum 6 to 10 layers in the vertical; top layer must extend above the maximum mixing depth expected); horizontal domain extends 50 to 80

	km beyond outer receptors and sources being modeled; terrain elevation and land-use data is resolved for the situation.
Receptors	CALPUFF 'Lite' Rings of receptors spaced every 1-degree. Refined CALPUFF Within Class I area(s) of concern.
Dispersion	1. CALPUFF with default dispersion settings. 2. Use MESOPUFF II chemistry with wet and dry deposition. 3. Define background values for ozone and ammonia for area.
Processing	Use highest predicted 24-hr SO_4, NO_3, and PM_{10} values; compute a day-average relative humidity factor (f(RH)) for the worst day for each predicted species, calculate extinction coefficients and compute percent change in extinction using the FLAG supplied background extinction. This can all now be accomplished with the use of the CALPOST post-processor.
**IWAQM Phase II Summary Report and Recommendations for Modeling Long Range Transport Impacts (EPA, 12/98).*	

Deposition Analyses

Deposition analyses will be performed for the ONWR and WINWR for both sulfates and nitrates. The analyses will follow those procedures and methodologies set forth in the IWAQM Phase II Report. Specifically, deposition analyses will be performed as follows:

1. Perform CALPUFF model runs using the specified options previously mentioned in Section 3.1 (including output of both dry and wet deposition).
2. Perform individual CALPOST post-processor runs to output the maximum annual average wet and dry deposition impacts of SO_4 and NO_3 in $g/m^2/s$ units.
3. Apply the appropriate scaling factors found in IWAQM Phase II Report (Section 3.3 Deposition Calculations) to the above CALPOST runs to account for normalization based on the ratio of molecular weights, as well as the conversion of grams to kilograms, square meters to hectares (ha), seconds to hours, and hours to a year. Thus, the CALPOST results will be in kg/ha/yr.
4. For sulfate deposition, sum the results of both the wet deposition and dry deposition values for the SO_4 CALPOST runs.
5. For nitrate deposition, sum the results of both the wet deposition and dry deposition values for the NO_3 CALPOST runs.

Class I Impact Analysis

Ground-level impacts (in g/m^3) onto to the ONWR and WINWR will be calculated for the criteria pollutants that exceed PSD Significant Emission Levels (SELs) for each applicable averaging period. The results of this analysis will be compared with the Class I Significant Impact Levels (SILs) calculated as 4 percent of the Class I Increment values.

JEA BRANDY BRANCH GENERATING STATION

AIR CONSTRUCTION PERMIT REVISION MODELING PROTOCOL AND DISCUSSION DOCUMENT

13:35

Prepared for
The Florida Department of Environmental Protection
Tallahassee, FL

February 2003

Prepared by
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Introduction

JEA is proposing to modify their PSD Air Construction Permit by the Florida Department of Environmental Protection (FDEP) for the Brandy Branch Combined Cycle Conversion project. Specifically, JEA is proposing two phases of analyses to obtain the permit modification.

- Phase I: Perform air dispersion modeling analyses to demonstrate that it is feasible to increase the duct burner size of each combined cycle unit, while complying with the current permit conditions for fuel firing scenarios as outlined in the FDEP PSD Air Construction Permit (PSD-FL-310).
- Phase II: Perform additional air dispersion modeling analyses to investigate the feasibility of additional fuel flexibility at its facility. The permit condition governing the fuel firing scenario limits the number of hours of oil firing available to any one of the three combustion turbines to 16 hours per day, while prohibiting any further firing on natural gas or fuel oil for the remainder of the day for the other two turbines.

As such, JEA would like to suggest the following methodologies for revising the permit for the purpose of expanding the operational flexibility of the Brandy Branch combined cycle combustion turbines.

Brandy Branch Project Description

Based on the aforementioned PSD Permit, JEA intends to convert two of the three simple cycle combustion turbines at their Brandy Branch Facility into a combined cycle configuration. The combined cycle conversion project includes the addition of heat recovery steam generators (HRSGs) to Units 2 and 3 in a standard 2 on 1 configuration, duct burners in each HRSG, a cooling tower, and a steam turbine generator. The combined cycle conversion is permitted to operate 8,760 hours per year at loads ranging from 50 to 100 percent. The combined cycle conversion is primarily fired with natural gas, or with low sulfur (0.05 percent) No. 2 distillate fuel oil as back up. The construction for the combined cycle conversion is currently underway.

Phase 1: Air Dispersion Modeling to Demonstrate Feasibility of Duct Burner Size Increase

Currently the combined cycle Units 2 and 3 are each permitted with a natural gas fired duct burner in the heat recovery steam generator (HRSG). The permitted maximum heat input of each duct burner is 85 MMBtu/hr (HHV) and has a regulatory classification

gas duct burners

under 40 CFR Part 60 as a Dc unit. JEA proposes to increase each duct burner's actual maximum heat input from 85 MMBtu/hr to 170 MMBtu/hr (HHV). The change in duct burner size would then classify each burner as a Db unit.

The proposed modification of the duct burners will slightly affect the emissions but the overall increase in project emissions is expected to be minimal. JEA anticipates that, after FDEP review, that this proposed modification will require no change to the BACT or the existing permit limits. Also, the increase in the associated predicted model impacts are expected to be minimal. The demonstration of compliance through air dispersion modeling will be based on the currently permitted operating scenario, as describe in the PSD permit under Condition #14 (page 7 of 14):

> *Maximum allowable hours of operation for the 540 MW Combined Cycle Plant are 8760 hours per year while firing natural gas. The combined hours of fuel oil firing for the two combined cycle combustion turbines is limited to 576 hours per consecutive 12-month period and fuel oil firing for the simple cycle unit is limited to 750 hours per consecutive 12-month period. In the event that any of the 3 emission units (simple or combined cycle) fires fuel oil during a calendar day, that unit shall be limited to 16 hours of daily operation on any fuel. Additionally, the other 2 units shall not be fired on any fuel for the calendar day.*

Proposed analyses for this demonstration include the following:

- modeling PSD SILs for the significantly emitted pollutants in the Class II area,
- modeling PSD SILs for Class I areas Okefenokee National Wildlife Refuge (ONWR) and Wolf Island National Wildlife Reserve (WINWR).

Modeling regional haze and deposition for Class I areas ONWR and WINWR will not be performed for the natural gas firing scenario. The air dispersion modeling protocol is contained as an attachment to this document.

Phase 2: Air Dispersion Modeling to Investigate Additional Fuel Flexibility

Phase 2 of the air dispersion modeling analyses involves investigating the feasibility of increasing Brandy Branch's operational flexibility by increasing the fuel flexibility beyond PSD Permit Condition #14. It should be noted that initiation of Phase 2 is intended to begin after FDEP's acceptance of the revision to the duct burner size and corresponding modification of the Brandy Branch PSD Permit as described in Phase 1.

Phase 2 Background

During the Brandy Branch combined cycle conversion air permitting process, EPA Region IV commented on methodologies used in the dispersion modeling analysis, and both EPA and FDEP requested additional modeling be performed to support permitting efforts. The following paragraphs provide a brief description of each of the major changes to the original submittals made to the FDEP during the air permitting process to aid in understanding the current operating restrictions imposed upon the Brandy Branch facility's three combustion turbines in the PSD permit.

In December of 2000, Black & Veatch, on behalf of JEA, submitted an application to the FDEP proposing to convert two of three previously permitted simple cycle combustion turbines at the Brandy Branch facility to operate in combined cycle mode (hereinafter referred to as the Combined Cycle Conversion Project). In pre-application discussions with FDEP regarding the air permitting methodology and air dispersion modeling protocol, the FDEP determined that the Combined Cycle Conversion Project comprised a modification of an existing major source for the PSD air permitting applicability. Specifically, the determination was that the existing major source was permitted to operate as three simple cycle electric generating facility; and thus, the conversion of two of the three simple cycle turbines to combined cycle operation constitutes the project. Under this submittal, the presented modeling scenario allowed for both combined cycle turbines to operate up to 24 hours per day on fuel oil. That is, their operation was not restricted on a daily basis. Based on the pre-application meeting, the simple cycle turbine was not addressed in this submittal and was assumed to continue to be covered by the previous permit allowing it to operate up to 16 hours per day on fuel oil.

Based on EPA and FDEP comments, the initial modeling analyses were revised to include the following scenarios:

- Addition of the simple cycle turbine to the analyses *{July 18, 2001 – EPA Comment}*.
- Addition of a Class I increment analysis for SO_2 at ONWR using ISC and CALPUFF and the WINWR using CALPUFF *{~July 2001 - FDEP Comment}*.
- Addition of discrete receptors spaced at 500 m intervals on the portion of the ONWR that lies within 50 km of the Brandy Branch facility, and for any

exceedances of the Class I Area SO_2 increment thresholds, a further refined 200-m grid was placed around each receptor where the exceedance occurred *{~October 2001 – EPA & FDEP Comment}*.

- Modification to the emission rates of the Seminole Plant in the inventory from actual emission to potential emissions *{~November 2001– EPA & FDEP Comment }*.

In the November 21, 2001 submittal in response to FDEP's comment, a 200-m refined grid was placed within the entire 500-m receptor grid on those days where a Cumulative Class I modeled exceedance occurred, as opposed to only "refining" around the individual receptor(s) where there was an exceedance. The cumulative modeling methodology was used as in the previous submittal. Discussions with JEA prompted the inclusion of natural gas back into the modeling equation when firing fuel oil for added permit flexibility. The following scenarios were presented in the submittal:

- The simple cycle turbine can operate for 16 hours per day on fuel oil and the remainder of the day (8 hours) on natural gas and simultaneously the two combined cycle turbines can operate 24 hours a day on natural gas.
- One of the combined cycle turbines can operate for 16 hours per day on fuel oil and the remainder of the day on natural gas and simultaneously the simple cycle turbine and the other combined cycle turbine can operate 24 hours a day on natural gas.

Both EPA and FDEP approved this modeling analysis. As part of discussions with these agencies in regard to obtaining operational flexibility, JEA was notified that the original permit contained a BACT natural gas usage limit of 2 grains per 100 standard cubic feet and the modeling was performed using the EPA natural gas sulfur content of 0.2 grains per 100 standard cubic feet. In keeping with the schedule for issuance of the Conditions of Certification (COC), JEA agreed to the restrictive permit conditions with the option of further investigation of fuel flexibility after permit issuance. The resulting final fuel firing operational limitations contained in the PSD Permit is for one combustion turbine (either one of the combined cycle turbines or the simple cycle turbine) operating on 0.05 percent fuel oil for 16 hours a day, with no additional hours of operation on natural gas (refer to PSD Permit, Condition #14). For the purposes of this modeling exercise, JEA will continue to use the EPA the natural gas sulfur content value of 0.2 grains per 100 standard cubic feet

Additionally, it should be noted that, this permitted operating scenario was forwarded by Mike Halpin of FDEP to Buck Oven and Scott Goorland for inclusion into the COC on November 30, 2001. However, due to time constraints in the process of issuing the COC's, the scenario was not incorporated. Thus, many of the COC regarding the fuel oil firing options for Units 2 and 3 do not agree with the PSD Permit. Currently, the COC's are being revised to incorporate all of the revised conditions.

As mentioned earlier, the BACT discussion in Appendix BD of the PSD Permit, provides an option to include additional fuel firing capability which would allow JEA the option of regaining some of the operational flexibility (with additional requirements) that was lost in the permitting process:

> *One additional scenario may be authorized by permit, but should JEA wish to deviate from these very prescriptive requirements, BACT and modeling will need to be revisited. This scenario allows gas firing to occur on any of the 3 emission units in conjunction with the aforementioned allowances for oil firing. However, the following additional requirements (Table 3) are associated with this scenario, and SO_2 CEMS are required to be installed on each emission unit.*

Table 3

Emission Unit	*Daily Operation of CC unit on oil*		*Daily Operation of SC unit on oil*	
	3 Hr Average SO2 Limit	*24 Hr Average SO2 Limit*	*3 Hr Average SO2 Limit*	*24 Hr Average SO2 Limit*
Simple Cycle	*1.1 lb/hr*	*1.1 lb/hr*	*98.2 lb/hr*	*65.8 lb/hr*
One CC Unit	*109.4 lb/hr*	*73.3 lb/hr*	*1.2 lb/hr*	*1.2 lb/hr*
Other CC Unit	*1.2 lb/hr*	*1.2 lb/hr*	*1.2 lb/hr*	*1.2 lb/hr*

Therefore, JEA proposes that the permitted duct burner size of 85 MMBtu/hr (per CT) be increased to 170 MMBtu/hr as will be demonstrated by Phase 1, and as recommended by FDEP, JEA proposes to submit revised permit application forms for the affected units and a demonstration of compliance through air dispersion modeling for the previously approved November 21, 2001 fuel firing operating scenario. This permitting approach for Phase II – Fuel Firing Flexibility, would be implemented after FDEP's approval of Phase I.

Proposed analyses for this demonstration include the following,

- modeling PSD SILs for the significantly emitted pollutants in the Class II area,

- modeling PSD SILs for Class I areas Okefenokee National Wildlife Refuge (ONWR) and Wolf Island National Wildlife Reserve (WINWR),
- modeling PSD increment where applicable,
- modeling regional haze and deposition for Class I areas ONWR and WINWR.

Note, the air dispersion modeling protocol is contained in the following attachment.

ATTACHMENT 1

BRANDY BRANCH COMBINED CYCLE PROJECT
MODIFICATION
MODELING PROTOCOL

PREPARED BY
BLACK & VEATCH

JANUARY 2003

Air Dispersion Modeling Assumptions and Methodology

On September 11, 2000, FDEP held a meeting at their offices for the Brandy Branch Combined Cycle Project with JEA, and Black & Veatch. The attached modeling protocols summarize the air dispersion modeling assumptions and methodologies as agreed to between the aforementioned parties for the Class I and Class II analyses to support the PSD permit application for the combined cycle conversion project. For simplicity of following the specific history of this project, the protocols have not been updated. As previously described, during FDEP's permit application review, both EPA and FDEP requested additional modeling be performed to support permitting efforts.

The following additional modeling methodologies were included in the analyses:

- Addition of the simple cycle turbine to the analyses *{July 18, 2001 – EPA Comment}*.
- Addition of a Class I increment analysis for SO2 at Okefenokee National Wildlife Refuge (using ISC and CALPUFF) and the Wolf Island National Wildlife Reserve (using CALPUFF) *{~July 2001 - FDEP Comment}*.
- Addition of discrete receptors spaced at 500 m intervals on the portion of the ONWR that lies within 50 km of the Brandy Branch facility, and for any exceedances of the Class I Area SO2 increment thresholds, a further refined 200-m grid was placed around each receptor where the exceedance occurred *{~October 2001 – EPA & FDEP Comment}*.
- Addition of a 200-m refined grid placed within the entire 500-m receptor grid on those days where a Cumulative Class I modeled exceedance occurred, as opposed to only "refining" around the individual receptor(s) where there was an exceedance. *{November 21, 2001 – FDEP Comment}*.

For the proposed modeling demonstration for the duct burner modification and for the increase fuel firing flexibility, Black & Veatch proposes to use the original air dispersion modeling protocols as submitted to FDEP on September 19, 2000 along with the additional aforementioned methodologies.

ENCLOSURE 1

BRANDY BRANCH COMBINED CYCLE PROJECT
ISC MODELING PROTOCOL

PREPARED BY
BLACK & VEATCH

SEPTEMBER 2000

Air Quality Modeling Assumptions and Methodology

Modeling Scenario:	As a major modification to an existing PSD major source, the air quality impact analysis (AQIA) will be performed only for Units 2 and 3, which are proposed to be converted into combined cycle units, and only units undergoing any modification. If the modeled predicted impacts from the combined cycle units exceed the PSD Significant Impact Levels (SILs), then Unit 1 will be included as part of the cumulative impact analysis.
Air Dispersion Model:	ISCST3 (Latest version)
Model Options:	EPA Default and Flat terrain.
GEP & Downwash:	EPA's BPIP program will be used to determine GEP stack height and direction specific building downwash parameters for each of the combined cycle stacks. Structures associated with the existing site, as well as the proposed additions will be included in the BPIP analysis.
Receptor Grids:	A 10 km nested rectangular receptor grid consisting of 100 m spacing out to 1 km, 250 m spacing from 1 km to 2.5 km, 500 m spacing from 2.5 km to 5 km, and 1,000 m spacing from 5 km to 10 km. Fenceline receptors will be placed at 100 m intervals, and a 100 m fine grid will be placed at maximum impact locations.
Dispersion Coefficients:	Rural: Based on visual inspection of a 7.5 minute USGS topographic map of the site using the Auer method.
Meteorological Data:	Refined level modeling sequential meteorological data will consist of surface data from Jacksonville, FL and upper air data from Waycross, GA for the years 1984-1988.
Pollutants to be Modeled:	The only pollutants that are currently expected to be modeled are PM_{10}, NO_x and CO. SO_2 emissions will likely be limited to less than 40 tpy by limiting the amount of fuel oil firing.
Source Modeling Parameters:	Worst-case hourly emission rates and operating parameters will be used for short-term modeling impacts. These data will be enveloped across 50, 75 and 100 percent load cases from representative combustion turbine performance and emissions data. Potential to emit calculations and operating parameters for annual modeling impacts will be based on annual average data.

Modeled impacts:	It is anticipated that the maximum model predicted pollutant impacts will be less than their respective PSD SILs. If the model predicted impacts exceed the SILs, additional agency consultation will be initiated regarding increment and cumulative air quality impact analyses.
Class I Analysis:	A regional haze visibility study and Class I SIL analysis will be performed for the Class I areas within 150 km of the proposed facility location. These areas will consist of the Okefenokee and Wolf Island Wilderness areas. For those areas within 50 km of the proposed facility location, the VISCREEN model will be used. For analysis of Class I areas beyond 50 km, the CALPUFF model will be used. The CALPUFF modeling protocol is discussed in Enclosure 2 of this submittal.
Toxics:	No toxic modeling analysis is required.

ENCLOSURE 2

BRANDY BRANCH COMBINED CYCLE PROJECT
CALPUFF MODELING PROTOCOL

PREPARED BY
BLACK & VEATCH

SEPTEMBER 2000

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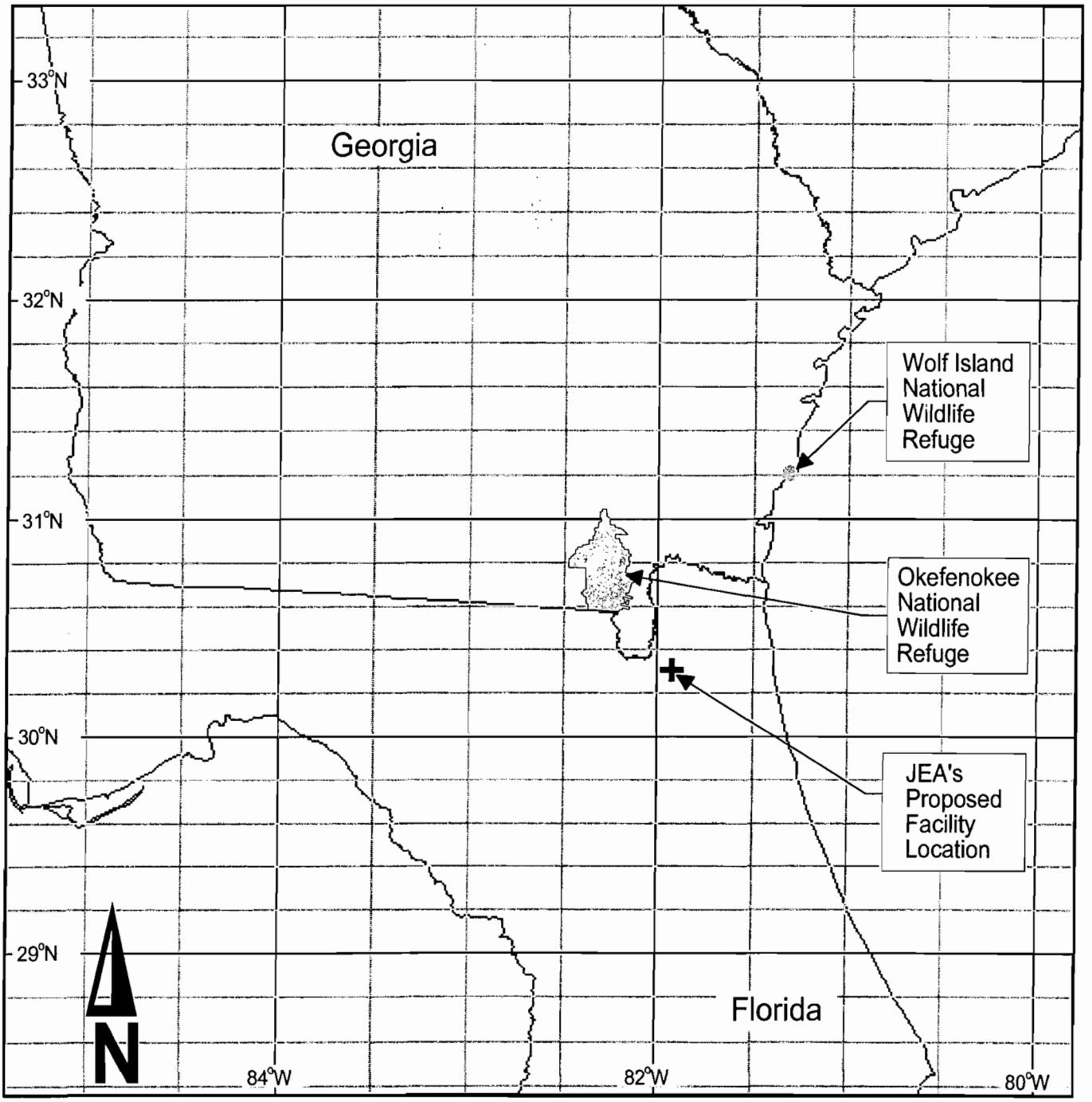
Introduction

JEA is proposing to convert two simple-cycle combustion turbines into combined-cycle combustion turbines serving one steam turbine (2x1), for a total nominal output of approximately 530 MW, at the existing Brandy Branch Facility, which is located near the city of Baldwin in northeastern Florida. As part of the air impact evaluation for the proposed facility, the Florida Department of Environmental Projection (FDEP) has requested that analyses of the proposed facility's affect on the Okefenokee National Wildlife Refuge (ONWR) and Wolf Island National Wildlife Refuge (WINWR) be performed. The ONWR and WINWR are Prevention of Significant Deterioration (PSD) Class I areas located in southeastern Georgia approximately 34 km north-northwest and 127 km north-northeast, respectively, of the proposed facility site. Class I areas are afforded special environmental protection through the use of Air Quality Related Values (AQRVs). The AQRVs of interest in this protocol are regional haze, deposition, and Class I Significant Impact Levels (SILs). Figure 1-1 presents the locations of the proposed project site with respect to the ONWR and WINWR.

The CALPUFF analysis will closely follow those procedures recommended in the Interagency Workgroup on Air Quality Modeling (IWAQM) Phase II report dated December 1998, the Draft Phase I Federal Land Managers' Air Quality Related Values Workgroup (FLAG) dated October 1999, as well as coordination with the FDEP who will in turn communicate as necessary with the U.S. Fish and Wildlife Service (FWS) which is the Federal Land Manager (FLM) for both areas. This protocol includes a discussion of the meteorological and geophysical databases to be used in the analysis, the preparation of those databases for introduction into the modeling system, and the air modeling approach.



Location of Brandy Branch Facility
with Respect to
Okefenokee and Wolf Island
National Wildlife Refuges

Figure 1-1

Model Selection and Inputs

Model Selection

The California Puff (CALPUFF, version 5.4) air modeling system will be used to model the emissions associated with the two combined-cycle combustion turbines at the proposed facility and assess the AQRVs at ONWR and WINWR. CALPUFF is a non-steady state Lagrangian Gaussian puff long-range transport model that includes algorithms for building downwash effects as well as chemical transformations (important for visibility controlling pollutants), and wet/dry deposition. The model will first be used in a screening mode called CALPUFF 'Lite' to determine impacts onto the Class I areas. This method simplifies the modeling process while introducing a high level of conservatism. If the 'Lite' results are below the required thresholds of the previously listed AQRVs, the demonstration will be considered complete and a refined CALPUFF analysis will not be pursued. CALPUFF 'Lite' bypasses the need for the intensive meteorological processor, CALMET. The CALMET model, a preprocessor to CALPUFF, is a diagnostic meteorological model that produces a three-dimensional field of wind and temperature and a two-dimensional field of other meteorological parameters. Simply, CALMET was designed to process raw meteorological, terrain, and land-use databases to be used in the air modeling analysis. The CALPUFF modeling system uses a number of FORTRAN preprocessor programs that extract data from large databases and converts the data into formats suitable for input to CALMET. If a refined analysis is necessary, the processed data produced from CALMET will be input to CALPUFF to assess pollutant specific impacts. Both CALMET and CALPUFF (including the 'Lite' and refined methodology) will be used in a manner that is recommended by the IWAQM Phase 2 Report and Draft Phase I FLAG Report.

CALPUFF Model Settings

The CALPUFF settings contained in Table 2-1 will be used for the modeling analyses.

Building Wake Effects

Both the screening and refined (if necessary) CALPUFF analyses will include the proposed facility's building dimensions to account for the effects of building-induced

Table 2-1 CALPUFF Model Settings	
Parameter	**Setting**
Pollutant Species	SO_2, SO_4, NO_x, HNO_3, and NO_3, and PM_{10}
Chemical Transformation	MESOPUFF II scheme
Deposition	Include both dry and wet deposition, plume depletion
Meteorological/Land Use Input	CALPUFF 'Lite' – screening mode 5 years of Jacksonville data (including precipitation) processed to include such parameters as the surface roughness, Bowen ratio, albedo, etc. CALPUFF – refined mode CALMET
Plume Rise	Transitional, Stack-tip downwash, Partial plume penetration
Dispersion	Puff plume element, PG/MP coefficients, rural mode, ISC building downwash scheme.
Terrain Effects	Partial plume path adjustment.
Output	Create binary concentration and wet/dry deposition files including output species for all pollutants.
Model Processing	Regional Haze: Highest predicted 24-hour SO_4, NO_3 and PM_{10} concentrations for the year. Deposition: Highest predicted annual, SO_4 and NO_3 values in deposition units. Class I SILs: Highest predicted concentrations at the applicable averaging periods for those pollutants that exceed the respective PSD Significant Emission Levels (SELs).
Background Values	Ozone: 80 ppb; Ammonia: 10 ppb

downwash on the emission sources. Dimensions for all significant building structures will be processed with the Building Profile Input Program (BPIP), Version 95086, and included in the CALPUFF model input.

Receptor Locations

The CALPUFF 'Lite' analysis will use rings of discrete Cartesian receptors located at distances equal to that of the closest and furthest boundaries of the Class I areas to the proposed project location. Specifically, the rings will consist of receptor spacing of every 1-degree beginning at the appropriate distances from the proposed facility location.

The refined CALPUFF analysis, if necessary, will use an array of discrete receptors at appropriate distances to ensure sufficient density and aerial extent to adequately characterize the pattern of pollutant impacts in the ONWR and WINWR. The same modeling grid as was used in the simple cycle project will again be used here. Specifically, the array will consist of receptor spacing of 2 km within the Class I areas beginning at a distance of 50 km from the proposed facility location and continuing to the farthest extent of the ONWR and WINWR.

Meteorological Data Processing

The meteorological data that will be used in the CALPUFF screening modeling will consist of 5 years of surface observations (1984-1988) for Jacksonville, Florida extracted from the National Climatic Data Center's (NCDC) Solar and Meteorological Surface Observational Network (SAMSON) CD-ROM set. These five years will be combined with upper air, twice-daily mixing height data from Waycross, Georgia downloaded from the SCRAM BBS for the same five-year period. The data set will be processed with PCRammet for wet deposition to give CALPUFF enough information to perform the Mesopuff II chemistry transformations. This processing allows CALPUFF to run in screening mode by providing extended meteorological variables such as surface friction, surface roughness, albedo, Bowen ratio, precipitation, etc. used in the atmospheric plume dispersion.

If the refined CALPUFF analysis is employed, the California Puff meteorological and geophysical data preprocessor (CALMET, Version 5.2) will be used to develop the gridded parameter fields required for the refined AQRV modeling analyses. The following sections discuss the data to be used and processed in the CALMET model.

CALMET Settings

The CALMET settings, including horizontal and vertical grid coverage, number of weather stations (surface, upper air, and precipitation), and resolution of prognostic mesoscale meteorological data, will be chosen to adequately characterize the area within the CALMET domain.

Modeling Domain

The size of the domain used for the modeling will be based on the distances needed to cover the area from the proposed facility to the receptors at the ONWR and WINWR with at least a 50-km buffer zone in each direction. The air modeling analysis will be performed in the UTM coordinate system.

Mesoscale Model Data

Pennsylvania State University in conjunction with the National Center for Atmospheric Research (NCAR) Assessment Laboratory have developed mesoscale meteorological data sets, prognostic wind fields or "guess" fields, for the United States. The hourly meteorological variables used to create these data sets (wind, temperature, dew point depression, and geopotential height for eight standard levels and up to 15 significant levels) are extensive and only allow for a one-year data base set; specifically, 1990. The analysis will use the MM4 mesoscale meteorological data set to initialize the CALMET wind field. The data will be extracted from a 12-volume CD-ROM set distributed by the National Climatic Data Center (NCDC). The MM4 data have a horizontal spacing or resolution of 80 km and are used to simulate atmospheric variables within the modeling domain.

The mesoscale meteorological data set (MM4) to be used in CALMET, although advanced, lacks the fine detail of specific temporal and spatial meteorological variables and geophysical data. These variables will be processed into the appropriate format and introduced into the CALMET model through the utilization of additional data files obtained from numerous sources. These ancillary data files are described in more detail in the following sections.

Surface Data Stations and Processing

The surface station data for the CALPUFF analyses will consist of data from several National Weather Service (NWS) stations or Federal Aviation Administration (FAA) Flight Service stations. The surface station parameters include wind speed, wind direction, cloud ceiling height, opaque cloud cover, dry bulb temperature, relative humidity, station pressure, and a precipitation code that is based on current weather conditions. The station data may be obtained directly from NCDC or extracted from a

CD-ROM set put out by NCDC. The data will be processed with the CALMET preprocessor utility program, SMERGE, to create one surface file.

Upper Air Data Stations and Processing

The analysis will include several upper air NWS stations located within the CALMET domain. Data for these stations will be obtained from the NCDC Radiosonde Data CD and processed into the NCDC Tape Deck (TD) 6201 format by the READ62 utility program for input to CALMET.

Precipitation Data Stations and Processing

Precipitation data will be processed from a network of hourly precipitation data files collected from primary and secondary NWS precipitation recording stations within the CALMET domain. The precipitation files are contained in a 2-volume CD-ROM set from NCDC. The utility programs PXTRACT and PMERGE will be used to process the data into the format for the Precip.dat file that is used by CALMET.

Geophysical Data Processing

Terrain elevations for each grid cell of the modeling domain will be obtained from Digital Elevation Model (DEM) files obtained from US Geographical Survey (USGS). The DEM data will be extracted for the modeling domain grid using the CALMET preprocessor program TERREL. Land-use data, based on annual averaged values, will also be obtained from the USGS. Land-use values for the domain grid will be extracted with the preprocessor programs CTGCOMP and CTGPROC. Other parameters processed for the modeling domain include surface roughness, surface albedo, Bowen ratio, soil heat flux, and leaf index field. Once preprocessed, all of the land-use parameters will be combined with the terrain information in a processor called MAKEGEO. This processor will produce one GEO.DAT file for input to CALMET.

Facility Emissions

Performance data for the combustion turbines will be based on vendor data at certain design ambient temperatures at base load operation, considering both natural gas and distillate fuel oil firing. The maximum pound per hour emission rates considering representative ambient temperatures at base load operation for natural gas and distillate fuel oil firing will be used for the pollutants modeled with CALPUFF.

CALPUFF Analyses

The preceding model inputs and settings for the CALPUFF modeling system (either screening or refined mode) will be used to complete the Class I analyses on the ONWR and WINWR, including regional haze, deposition (both sulfur and nitrogen), and Class I SILs. The following analyses will be performed as described regardless of the modeling methodology (i.e., screening or refined modeling).

Regional Haze Analysis

Regional haze analyses will be performed for the Class I areas for ammonium sulfates, ammonium nitrates, and particulate matter by appropriately characterizing model predicted outputs of SO_4, NO_3, and PM_{10} concentrations.

Visibility

Visibility is an AQRV for both the ONWR and WINWR. Visibility can take the form of plume blight for nearby areas, or regional haze for long distances (e.g., distances beyond 50 km). Because either all or portions of the Class I areas lie beyond 50 km from the proposed facility, the change in visibility will be analyzed as regional haze at those locations. Regional haze impairs visibility in all directions over a large area by obscuring the clarity, color, texture, and form of what is seen. Current regional haze guidelines characterize a change in visibility by either of the following methods:

1. Change in the visual range, defined as the greatest distance that a large dark object can be seen, or
2. Change in the light-extinction coefficient (b_{ext}).

Visual range can be related to extinction with the following equation:

$$bext(Mm\text{-}1) = 3912 / vr(Mm\text{-}1)$$

Visual range (vr) is a measure of how far away a large black object can be seen in the atmosphere under several severe assumptions including: an absolutely dark target, uniform lighting conditions (cloud free skies), uniform extinction in all directions, a limiting contrast discrimination level, a target high enough in elevation to account for earth curvature, and several other factors. Visual range is, at best, a limited concept that allows relatively simple comparisons between visual air quality levels and should not be thought of as the absolute distance that can be seen through the atmosphere.

The b_{ext} is the attenuation of light per unit distance due to the scattering (light reduced away from the site path) and absorption (light captured by aerosols and turned into heat energy) by gases and particles in the atmosphere. A change in the extinction coefficient produces a perceived visual change that is measured by a visibility index called the deciview. The deciview (dv) is defined as:

$$dv = 10 \ln (1 + b_{exts} / b_{extb})$$

where: b_{exts} is the extinction coefficient calculated for the source, and
b_{extb} is the background extinction coefficient

A uniform incremental change in b_{extb} or visual range does not necessarily result in uniform changes in perceived visual air quality. In fact, perceived changes in visibility are best related to a change in b_{extb}, or; percent change in extinction. Based on the IWAQM Phase II guidance, if the change in extinction is less than 5 percent, no further analysis is required. An index similar to the deciview that simply quantifies the percent change in visibility due to the operation of a source is calculated as:

$$\Delta\% = (b_{exts} / b_{extsb}) \times 100$$

Background Visual Ranges and Relative Humidity Factors

The background visual range is based on data representative of the top 20-percentile air quality days. The background visual ranges for the ONWR and WINWR will be obtained from the Draft Phase I FLAG document. The average relative humidity factor for each species' worst day will be computed by determining the relative humidity factor for each hour's relative humidity for the 24-hour period that the maximum impact occurred. This factor, based on each relative humidity will be obtained by using Table 2.A-1 of Appendix 2.A of the Draft Phase I FLAG Report. These factors (a relative humidity factor for each relative humidity) will then be used to determine the average relative humidity factor for that day (24-hour period). Again, all of this can be accomplished with the use of the CALPOST post-processor.

Interagency Workgroup On Air Quality Modeling (IWAQM) Guidelines

The CALPUFF air modeling analysis (both screening and refined) will follow the recommendations contained in the IWAQM Phase II Summary Report and Recommendations for Modeling Long Range Transport Impacts, (EPA, 12/98). Table 3-1 summarizes the IWAQM Phase II recommendations. The methodology below will be used to compute the results of the regional haze analysis. However, CALPOST now possesses the ability to post-process the modeling results specific to the regional haze

analysis through the selection of one of six modeling options. The post-processing selection will be made to calculate regional haze based on the appropriate available data/resources. A typical calculation methodology is illustrated below.

Calculation

Refined impacts will be calculated as follows:

1. Obtain maximum 24-hour SO_4, NO_3, and PM_{10} impacts, in units of micrograms per cubic meter ($\mu g/m^3$).
2. Convert the SO_4 impact to $(NH_4)_2SO_4$ by the following formula:

   $(NH_4)_2SO_4$ ($\mu g/m3$) = SO_4 ($\mu g/m^3$) x molecular weight $(NH_4)_2SO_4$ / molecular weight SO_4

   $(NH_4)_2SO_4$ ($\mu g/m^3$) = SO_4 ($\mu g/m^3$) x 132/96 = SO_4 ($\mu g/m^3$) x 1.375

   Convert the NO_3 impact to NH_4NO_3 by the following formula:

   NH_4NO_3 ($\mu g/m3$) = NO_3 ($\mu g/m^3$) x molecular weight NH_4NO_3 / molecular weight NO_3

   NH_4NO_3 ($\mu g/m^3$) = NO_3 ($\mu g/m^3$) x 80/62 = NO_3 ($\mu g/m^3$) x 1.29
3. Compute b_{exts} (extinction coefficient calculated for the source) with the following formula:

   b_{exts} = 3 x NH_4NO_3 x f(RH) + 3 x $(NH_4)_2SO_4$ x f(RH) + 1 x PM_{10}
4. Compute b_{extb} (background extinction coefficient) using the background visual range (km) from the FALG document with the following formula:

   b_{extb} = 3.912 / Visual range (km)
5. Compute the change in extinction coefficients:

   in terms of deciviews:

   $$dv = 10 \ln (1 + b_{exts} / b_{extb})$$

   in terms of percent change of visibility:

   $$\Delta\% = (b_{exts} / b_{extsb}) \times 100$$

Based on the predicted SO_4, NO_3, and PM_{10} concentrations, the proposed facility's emissions will be compared to a 5 percent change in light extinction of the background levels. This is equivalent to a change in deciview of 0.5.

Table 3-1

Outline of IWAQM Refined Modeling Analyses Recommendations*

Meteorology	CALPUFF 'Lite' 5 years of the closest surface station and upper air station. Refined CALPUFF Use CALMET (minimum 6 to 10 layers in the vertical; top layer must extend above the maximum mixing depth expected); horizontal domain extends 50 to 80

	km beyond outer receptors and sources being modeled; terrain elevation and land-use data is resolved for the situation.
Receptors	CALPUFF 'Lite' Rings of receptors spaced every 1-degree. Refined CALPUFF Within Class I area(s) of concern.
Dispersion	1. CALPUFF with default dispersion settings. 2. Use MESOPUFF II chemistry with wet and dry deposition. 3. Define background values for ozone and ammonia for area.
Processing	Use highest predicted 24-hr SO_4, NO_3, and PM_{10} values; compute a day-average relative humidity factor (f(RH)) for the worst day for each predicted species, calculate extinction coefficients and compute percent change in extinction using the FLAG supplied background extinction. This can all now be accomplished with the use of the CALPOST post-processor.
**IWAQM Phase II Summary Report and Recommendations for Modeling Long Range Transport Impacts (EPA, 12/98).*	

Deposition Analyses

Deposition analyses will be performed for the ONWR and WINWR for both sulfates and nitrates. The analyses will follow those procedures and methodologies set forth in the IWAQM Phase II Report. Specifically, deposition analyses will be performed as follows:

1. Perform CALPUFF model runs using the specified options previously mentioned in Section 3.1 (including output of both dry and wet deposition).
2. Perform individual CALPOST post-processor runs to output the maximum annual average wet and dry deposition impacts of SO_4 and NO_3 in $g/m^2/s$ units.
3. Apply the appropriate scaling factors found in IWAQM Phase II Report (Section 3.3 Deposition Calculations) to the above CALPOST runs to account for normalization based on the ratio of molecular weights, as well as the conversion of grams to kilograms, square meters to hectares (ha), seconds to hours, and hours to a year. Thus, the CALPOST results will be in kg/ha/yr.
4. For sulfate deposition, sum the results of both the wet deposition and dry deposition values for the SO_4 CALPOST runs.
5. For nitrate deposition, sum the results of both the wet deposition and dry deposition values for the NO_3 CALPOST runs.

Class I Impact Analysis

Ground-level impacts (in $\mu g/m^3$) onto to the ONWR and WINWR will be calculated for the criteria pollutants that exceed PSD Significant Emission Levels (SELs) for each applicable averaging period. The results of this analysis will be compared with the Class I Significant Impact Levels (SILs) calculated as 4 percent of the Class I Increment values.

Nov 2001

0310485

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Black & Veatch Corporation

JEA
Brandy Branch Combined Cycle Conversion Project

B&V Project 99262
B&V File 32.0581
November 7, 2001

Mr. Cleve Holladay
Florida Department of Environmental Protection
Twin Towers Office Building
2600 Blair Stone Road, MS #5505
Tallahassee, Florida 32399

Subject: Refined SO_2 Class I Increment Analysis for Brandy Branch Combined Cycle Conversion Project

Cleve:

On behalf of the JEA, Black & Veatch hereby submits the attached CD-ROM containing the modeling files for the Refined SO_2 Class I Increment Analysis for Brandy Branch Combined Cycle Conversion Project as a follow-up to the summary report submitted via email on November 7,2001.

If you should have any questions regarding this submittal, please do not hesitate to call me at (904) 665-5227, or Ebenezer Gujjarlapudi at (913) 458-9426.

Very truly yours,

BLACK & VEATCH Corporation

Ebeneger. S Gujjarlapudi

for Timothy M. Hillman
Project Air Permitting Manager

tmh
Enclosure[s]

cc: Mr. Bert Gianazza, JEA
Mr.Ebenezer S.Gujjarlapudi, B&V
Project File

11/07 Submittal

JEA Brandy Branch Additional Class I Increment Analysis

Operate any one of 3
No other operation on gas

Introduction

On September 21, 2001, Black & Veatch on behalf of JEA submitted a report entitled: Additional SO_2 Class I Increment Analysis for the Brandy Branch Combined Cycle Conversion Project. Upon review of the said report, EPA Region 4 and consequently the FDEP requested that further analyses be conducted incorporating additional receptors within the Okefenokee Wilderness Area that lies within 50 km of Brandy Branch facility.

Methodology

The analyses, hereinafter referred to as the "refined analyses", consisted of placing additional discrete receptors spaced at 500 m on the Okefenokee Wilderness area. Cumulative sulfur dioxide (SO_2) Class I area modeling analysis was performed using the ISCST3 model to demonstrate that the modeled air quality impacts of the project will not contribute to or cause a Class I SO_2 increment violation at any of the additional receptors. If an exceedance was observed, a further refined 200-m grid was placed around each receptor where an exceedance occurred and modeling was performed. All other modeling information presented in the September 21, 2001 report was used in the analyses.

Source Parameter Information

The source parameter information as presented in the September 21, 2001 report was used in this analysis.

Modeling Analyses

For the refined modeling analyses as presented in the following sections, parameters used in the modeling assumed that the emission units at the JEA Brandy Branch facility fire 0.05% sulfur fuel oil. Emission parameters for all other emission sources were used as presented in the emission inventory submitted to the FDEP.

Modeling was performed assuming that each combined cycle turbine and the simple cycle turbine at the JEA facility operate no more than 16 hours per day on 0.05% sulfur fuel oil. In addition, it was assumed that at any given time only one of the turbines (either the one combined cycle turbine or the simple cycle turbine) is operational.

Step 1 Modeling Analysis

500 M
JEA Br
only

The emission units at the JEA Brandy Branch facility (two combined cycle turbines and one simple cycle turbine) were modeled individually with the impacts compared against the PSD Class I Significant Impact Levels (SILs). As mentioned earlier, it was assumed that at any given time, only one of the turbines at the JEA Brandy Branch facility is operational. The maximum modeled impacts for each combustion turbine at the facility are compared to the PSD Class I SILs in Table 1. For those scenarios where the maximum modeled impacts exceed the SILs, Step 2 modeling was performed as discussed in the following section.

16 hrs
Permit condition at any given

87_rev14_step

bbs 237

Step 2 Modeling Analysis

The emission units at the JEA Brandy Branch facility (two combined cycle turbines and one simple cycle turbine) in combination with the emission sources presented in the inventory were included in this modeling. For Step 2 modeling purposes, the cumulative source inventory with either a combined cycle turbine or a simple cycle turbine were included. As mentioned earlier, a 500m spaced grid was used in the modeling. As allowed by the PSD regulations, the highest second high modeled impacts for the short-term averaging periods were used for comparison to the PSD Class I Increments. As presented in table 2, the cumulative modeling SO_2 impacts exceed the applicable PSD Class I Increment values for the 3-hour averaging period for the years 1985, 1987 and 1988, and the 24-hour averaging period for the years 1986 and 1988. Therefore, a culpability analysis (a determination of the project impacts at the particular receptor locations for the applicable time periods) was performed as described in the following section.

Cum

500m

Step 3 Modeling Analysis

For the Step 3 modeling analyses, each receptor and corresponding time period with a modeled predicted impact greater than the PSD Class I Increment was identified. A refined grid of 200 m spacing was placed at each receptor that had a modeled exceedance of the PSD Class I increment, up to and including model predicted impacts in the highest 5th highest table. It was verified that the maximum model predicted impacts at the highest 6th high level were all less than the PSD Class I Increments.

200m

As presented in Table 3, the project's maximum contribution at each of the receptors and corresponding time periods for which a PSD Increment violation was modeled does not exceed the applicable PSD Class I SILs. Since the project does not significantly contribute to any exceedance of the PSD Class I Increments, no further analyses are warranted.

Conclusions

Based on the summary of results presented in Table 4, the project will not contribute to or cause a Class I SO_2 increment violation at any of the additional receptors that were included in the refined analyses.

9.187 cc 24hr

9.24 would have 8hrs gas

bbs137.bst
step 1 1987 3hours 500m spacing

Identified yrs

Table 1
Class I Area SO_2 Step 1 Modeling Results
JEA Brandy Branch Impacts

JEA Brandy Branch unit in operation	Averaging Period	Year	Project Maximum Impact (ug/m^3)	SIL (ug/m^3)	Exceed SIL
Simple cycle	3-hr	1984	0.613	1	NO
		1985	0.625	1	NO
		1986	0.907	1	NO
		1987	0.622	1	NO
		1988	0.614	1	NO
Combined cycle unit #1	3-hr	1984	0.965	1	NO
		1985	**1.204**	**1**	**YES**
		1986	**1.453**	**1**	**YES**
		1987	**1.328**	**1**	**YES**
		1988	**1.173**	**1**	**YES**
Combined cycle unit #2	3-hr	1984	0.967	1	NO
		1985	**1.204**	**1**	**YES**
		1986	**1.456**	**1**	**YES**
		1987	**1.326**	**1**	**YES**
		1988	**1.174**	**1**	**YES**
Simple cycle	24-hr	1984	0.105	0.2	NO
		1985	0.087	0.2	NO
		1986	**0.208**	**0.2**	**YES**
		1987	0.094	0.2	NO
		1988	0.089	0.2	NO
Combined cycle unit #1 JEACCCT1	24-hr	1984	0.196	0.2	NO
		1985	0.16	0.2	NO
		1986	**0.344**	**0.2**	**YES**
		1987	0.162	0.2	NO
		1988	**0.233**	**0.2**	**YES**
Combined cycle unit #2 JEACCCT2	24-hr	1984	0.197	0.2	NO
		1985	0.161	0.2	NO
		1986	**0.344**	**0.2**	**YES**
		1987	0.162	0.2	NO
		1988	**0.234**	**0.2**	**YES**

Notes:
Basis for modeling runs is that only one unit is in operation at one time and the unit in operation is running with 0.05 percent sulfur fuel oil and for 16 hours per day.
Highlighted years represent those scenarios included in the Step 2 modeling analysis.

500 m

Table 2
Class I Area SO_2 Step 2 Modeling Results
Maximum Cumulative Inventory Impacts Including Project

JEA Brandy Branch unit in operation	Averaging Period	Year	Overall High 2nd High Cumulative Impact (ug/m^3)	Class I Increment (ug/m^3)	Exceeds Class I Increment
Combined cycle unit #1	3-hr	**1985**	**26.089**	**25**	**YES**
		1986	22.756	25	NO
		1987	**26.595**	**25**	**YES**
		1988	**27.660**	**25**	**YES**
Combined cycle unit #2	3-hr	**1985**	**26.092**	**25**	**YES**
		1986	22.756	25	NO
		1987	**26.608**	**25**	**YES**
		1988	**27.660**	**25**	**YES**
Simple cycle	24-hr	**1986**	**5.390**	**5**	**YES**
Combined cycle unit #1	24-hr	**1986**	**5.413**	**5**	**YES**
		1988	**7.425**	**5**	**YES**
Combined cycle unit #2	24-hr	**1986**	**5.413**	**5**	**YES**
		1988	**7.424**	**5**	**YES**

Notes:
Basis for modeling runs is that only one unit is in operation at any given time and 0.05 percent sulfur fuel oil and for 16 hours per day.
Highlighted years represent those scenarios included in the Step 3 modeling analysis.

All receptors

Table 3
Class I Area SO_2 Modeling Step 3 Results
Culpability Analyses - Project's Contribution to Increment Exceedances

JEA Brandy Branch unit in operation	Averaging Period	Year	Specific period of exceedance	Project's Maximum Contribution at Exceedance (ug/m^3)	Class I SIL (ug/m^3)	Project Impacts Exceed Class I SIL
Combined cycle unit #1	3-hr	1985	010212	0.103	1	NO
			102415	0.528	1	NO
			110309	0.103	1	NO
		1987	032924	0.735	1	NO
			033003	0.314	1	NO
			062209	0.419	1	NO
			091221	0.000	1	NO
		1988	070312	0.002	1	NO
Combined cycle unit #2	3-hr	1985	010212	0.108	1	NO
			102415	0.532	1	NO
			110309	0.109	1	NO
		1987	032924	0.736	1	NO
			033003	0.315	1	NO
			062209	0.418	1	NO
			091221	0.000	1	NO
		1988	070312	0.002	1	NO
Simple cycle	24-hr	1986	1025	0.016	0.2	NO
			1223	0.000	0.2	NO
Combined cycle unit #1	24-hr	1986	1025	0.038	0.2	NO
			1223	0.058	0.2	NO
		1988	0325	0.074	0.2	NO
			0403	0.057	0.2	NO
			0607	0.058	0.2	NO
			0719	0.033	0.2	NO
			0903	0.115	0.2	NO
			1126	0.043	0.2	NO
Combined cycle unit #2	24-hr	1986	1025	0.038	0.2	NO
			1223	0.058	0.2	NO
		1988	0325	0.074	0.2	NO
			0403	0.057	0.2	NO
			0607	0.059	0.2	NO
			0719	0.033	0.2	NO
			0903	0.115	0.2	NO
			1126	0.043	0.2	NO

Notes:
Basis for modeling runs is that only one unit is in operation at one time and the unit in operation is running with 0.05 percent sulfur fuel oil and for 16 hours per day.

The results presented above also provide information about the maximum impacts at the highest to the highest fifth high impacts where applicable

Table 1
Class I Area SO_2 Step 1 Modeling Results
JEA Brandy Branch Impacts

JEA Brandy Branch unit in operation	Averaging Period	Year	Project Maximum Impact (ug/m^3)	SIL (ug/m^3)	Exceed SIL
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		1985	**1.204**	**1**	**YES**
		1986	**1.456**	**1**	**YES**
		1987	**1.326**	**1**	**YES**
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Simple cycle	24-hr	1984	0.105	0.2	NO
		1985	0.087	0.2	NO
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		1985	0.161	0.2	NO
		1986	**0.344**	**0.2**	**YES**
		1987	0.162	0.2	NO
		1988	**0.234**	**0.2**	**YES**

Notes:
Basis for modeling runs is that only one unit is in operation at one time and the unit in operation is running with 0.05 percent sulfur fuel oil and for 16 hours per day.
Highlighted years represent those scenarios included in the Step 2 modeling analysis.

Table 2
Class I Area SO_2 Step 2 Modeling Results
Maximum Cumulative Inventory Impacts Including Project

JEA Brandy Branch unit in operation	Averaging Period	Year	Overall High 2nd High Cumulative Impact (ug/m^3)	Class I Increment (ug/m^3)	Exceeds Class I Increment
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		1988	**7.425**	**5**	**YES**
Combined cycle unit #2	24-hr	**1986**	**5.413**	**5**	**YES**
		1988	**7.424**	**5**	**YES**

Notes:
Basis for modeling runs is that only one unit is in operation at any given time and 0.05 percent sulfur fuel oil and for 16 hours per day.
Highlighted years represent those scenarios included in the Step 3 modeling analysis.

Table 3
Class I Area SO_2 Modeling Step 3 Results
Culpability Analyses - Project's Contribution to Increment Exceedances

JEA Brandy Branch unit in operation	Averaging Period	Year	Specific period of exceedance	Project's Maximum Contribution at Exceedance (ug/m^3)	Class I SIL (ug/m^3)	Project Impacts Exceed Class I SIL
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			033003	0.315	1	NO
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			1223	0.058	0.2	NO
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			0403	0.057	0.2	NO
			0607	0.058	0.2	NO
			0719	0.033	0.2	NO
			0903	0.115	0.2	NO
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			0403	0.057	0.2	NO
			0607	0.059	0.2	NO
			0719	0.033	0.2	NO
			0903	0.115	0.2	NO
			1126	0.043	0.2	NO

Notes:
Basis for modeling runs is that only one unit is in operation at one time and the unit in operation is running with 0.05 percent sulfur fuel oil and for 16 hours per day.

The results presented above also provide information about the maximum impacts at the highest to the highest fifth high impacts where applicable

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Black & Veatch Corporation

JEA
Brandy Branch Combined Cycle Conversion Project

B&V Project 99262
B&V File 32.0581
November 21, 2001

Mr. Cleve Holladay
Florida Department of Environmental Protection
Twin Towers Office Building
2600 Blair Stone Road, MS #5505
Tallahassee, Florida 32399

Subject: Additional SO_2 Class I Increment Analysis for Brandy Branch Combined Cycle Conversion Project

Cleve:

On behalf of the JEA, Black & Veatch hereby submits the CDROM with additional modeling analyses for the Brandy Branch Combined Cycle Project. The CDROM contains the modeling analyses for the following scenarios:

Scenario 1: The Simple Cycle Turbine operating for 16 hours per day on fuel oil and the remainder of the day (8 hours) on natural gas and the two Combined Cycle turbines operating 24 hours a day on natural gas.

Scenario 2: One of the Combined Cycle Turbines operating for 16 hours per day on fuel oil and the remainder of the day on natural gas and the Simple Cycle Turbine and the other Combined Cycle turbines operating 24 hours a day on natural gas.

The modeling analyses were performed similar to the previous set of modeling submitted to the FDEP and EPA and demonstrate that the Brandy Branch Project will not cause an exceedance of the SO_2 increment. Upon review and acceptance of these analyses, JEA would like to have the above-mentioned scenarios incorporated as permit conditions for the Brandy Branch Project before the certification hearing. Your prompt attention to this matter will be greatly appreciated.

If you should have any question regarding this submittal, please do not hesitate to call me at (904) 665-5227, or Ebenezer Gujjarlapudi at (913) 458-9426.

Very truly yours,

BLACK & VEATCH Corporation

Ebenezer S. Gujjarlapudi

for Timothy M. Hillman
Project Air Permitting Manager

tmh
Enclosure[s]

cc: Mr. Stan Krivo, EPA Region 4
Mr. Bert Gianazza, JEA
Mr. Ebenezer S.Gujjarlapudi, B&V

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Black & Veatch Corporation

JEA
Brandy Branch Project

B&V Project 133972
B&V File 32.0000
January 12, 2004

Mike Halpin
Florida Department of Environmental Protection
Bureau of Air Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Subject: Ultra-Low Sulfur Fuel Oil Class II and Class I Air Dispersion Modeling Protocols

JEA is proposing to modify their PSD Air Construction Permit by the Florida Department of Environmental Protection (FDEP) for the Brandy Branch project. Specifically, JEA is proposing to perform additional air dispersion modeling analyses to add fuel firing flexibility at its facility. Current Permit Condition #14, governing the fuel firing scenario, limits the number of hours of oil firing available to any one of the three combustion turbines to 16 hours per day, while prohibiting any further firing on natural gas or fuel oil for the remainder of the day for the other two turbines.

The increased operational flexibility will be obtained through the use of an ultra-low sulfur fuel oil in the combustion turbines and demonstrated via air dispersion modeling at both the surrounding Class II area and the nearby Okefenokee Class I area. It is the purpose of this document to detail the methodologies to be used for the Class II and Class I area air dispersion modeling analyses. The air dispersion modeling protocols are contained in the following attachments for your review and approval.

If you have any questions or comments, please feel free to contact me at 913-458-9062.

Must model at grain loading for NG that you are willing to accept

Very truly yours,

BLACK & VEATCH

Kyle Lucas
Air Quality Specialist

Enclosure

cc: B. Gianazza – JEA
B. O'Neal – B&V
File
C. Holladay, DEP
B. Owen, DEP
C. Kirts, NFD
R. Robinson, Duval Co
G. Worley, EPA
J. Bunyak, NPS

BRANDY BRANCH COMBINED CYCLE PROJECT MODIFICATION

CLASS II AND CLASS I AIR DISPERSION MODELING PROTOCOLS

PREPARED BY
BLACK & VEATCH

JANUARY 2004

ATTACHMENT 1

BRANDY BRANCH COMBINED CYCLE PROJECT
ISC MODELING PROTOCOL

PREPARED BY
BLACK & VEATCH

JANUARY 2004

Air Quality Modeling Assumptions and Methodology

Modeling Scenario:	As a major modification to an existing PSD major source, the air quality impact analysis (AQIA) will be performed for Unit 1, simple cycle combustion turbine, and Units 2 and 3, which are proposed to be converted into combined cycle units.
Air Dispersion Model:	ISCST3 (Latest version)
Model Options:	EPA Default and Flat terrain.
GEP & Downwash:	EPA's BPIP program will be used to determine GEP stack height and direction specific building downwash parameters for each of the combined cycle stacks. Structures associated with the existing site, as well as the proposed additions will be included in the BPIP analysis.
Receptor Grids:	A 10 km nested rectangular receptor grid consisting of 100 m spacing out to 1 km, 250 m spacing from 1 km to 2.5 km, 500 m spacing from 2.5 km to 5 km, and 1,000 m spacing from 5 km to 10 km. Fenceline receptors will be placed at 100 m intervals, and a 100 m fine grid will be placed at maximum impact locations.
Dispersion Coefficients:	Rural: Based on visual inspection of a 7.5 minute USGS topographic map of the site using the Auer method.
Meteorological Data:	Refined level modeling sequential meteorological data will consist of surface data from Jacksonville, FL and upper air data from Waycross, GA for the years 1984-1988.
Pollutants to be Modeled:	The only pollutants that are currently expected to be modeled are PM_{10}, NO_x, SO_2, and CO.
Source Modeling Parameters:	Worst-case hourly emission rates and operating parameters will be used for short-term modeling impacts. These data will be enveloped across 50, 75 and 100 percent load cases from representative combustion turbine performance and emissions data. Potential to emit calculations and operating parameters for annual modeling impacts will be based on annual average data.
Modeled impacts:	It is anticipated that the maximum model predicted pollutant impacts will be less than their respective PSD SILs. If the model predicted impacts exceed the SILs,

anything that is within 10% could flip

FLPA

3 at 50% not likely to happen 100, 1 at 50% Various scenarios 1 at 50% 1 at 75% 1 at 100%

ATTACHMENT 2

BRANDY BRANCH COMBINED CYCLE PROJECT
CALPUFF MODELING PROTOCOL

PREPARED BY
BLACK & VEATCH

JANUARY 2004

additional agency consultation will be initiated regarding increment and cumulative air quality impact analyses.

Class I Analysis: Portions of the Okefenokee National Wildlife Refuge (ONWR), the closest Class I area, lie within 50 km of the facility. For those areas within 50 km of the proposed facility location, the VISCREEN model will be used to assess the project's impact upon visibility. Additionally, the ISC model will be used to assess ground-level pollutant impacts for comparison to the PSD Class I SILs, calculated as 4% of the PSD Class I increment values.

For analysis of the ONWR Class I area beyond 50 km, the CALPUFF model will be used. The CALPUFF modeling protocol is discussed in Attachment 2 of this submittal.

Toxics: No toxic modeling analysis is required.

VISCREEN

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1.0 Introduction

As part of the air impact evaluation for the proposed modification to the Brandy Branch project, analyses of the proposed project's effect on the Okefenokee National Wildlife Refuge (ONWR) will be performed. The ONWR is a Prevention of Significant Deterioration (PSD) Class I area located in south-east Georgia approximately 34 km north-northwest of the proposed project site. Federal Class I areas are afforded special environmental protection through the use of Air Quality Related Values (AQRVs). The AQRVs of interest in this protocol are regional haze, deposition, and Class I Significant Impact Levels (SILs). Figure 1-1 presents the location of the proposed project site with respect to the ONWR.

The methodology of the refined CALPUFF analysis will follow those procedures recommended in the Interagency Workgroup on Air Quality Modeling (IWAQM) Phase II report dated December 1998, the Phase I Federal Land Managers' Air Quality Related Values Workgroup (FLAG) report dated December 2000 where appropriate for model option selections. This protocol includes a discussion of the meteorological and geophysical databases to be used in the analysis, the preparation of those databases for introduction into the modeling system, and the air modeling approach to assess impacts at ONWR.

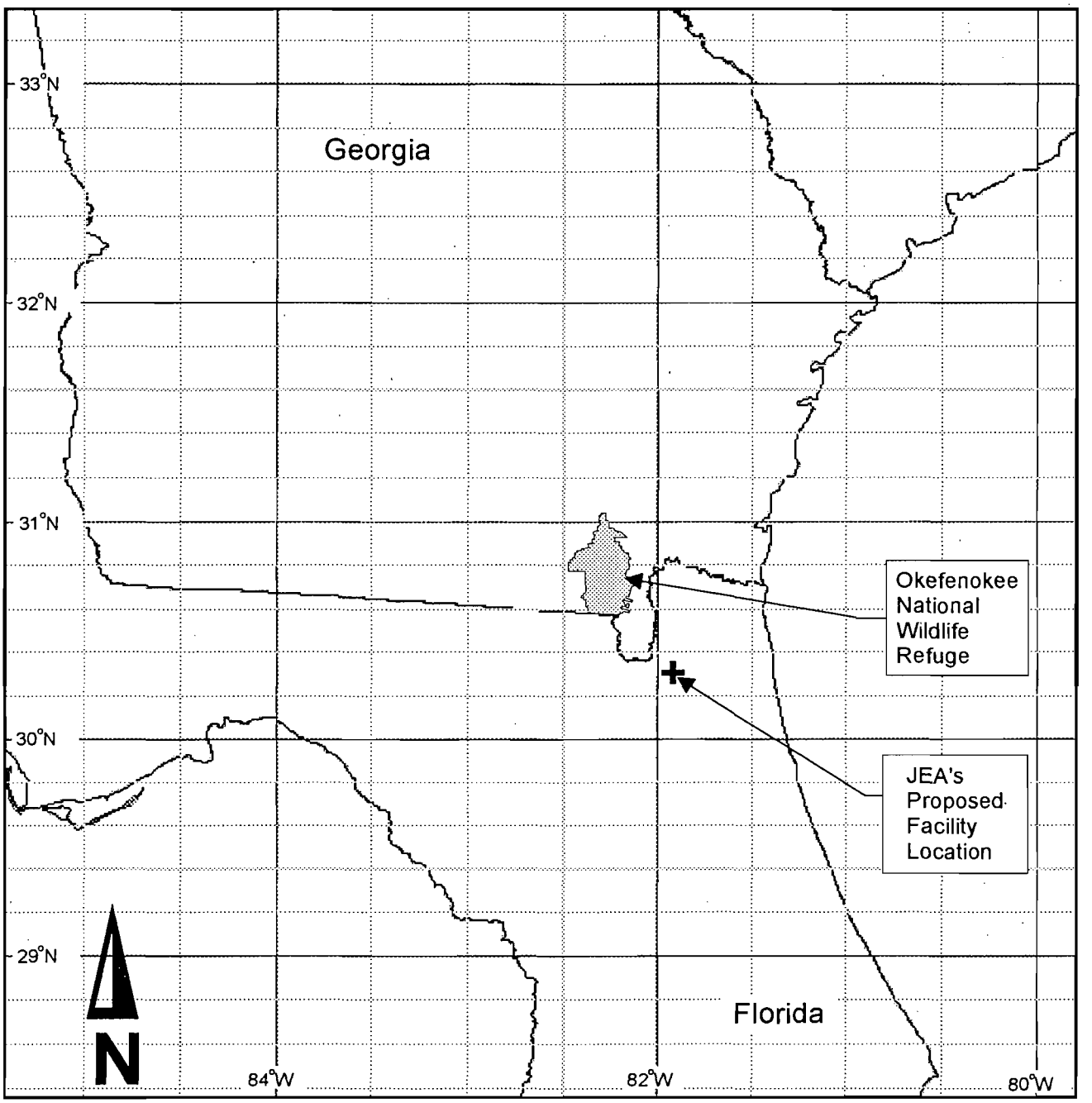

Figure 1-1
Proposed Project Location

2.0 Model Selection and Inputs

2.1 Model Selection

The California Puff (CALPUFF, Version 5.711, Level 030625) air modeling system will be used to model the proposed project and assess the AQRVs at ONWR. CALPUFF is a non-steady state Lagrangian Gaussian puff long-range transport model that includes algorithms for building downwash effects as well as chemical transformations (important for visibility controlling pollutants), and wet/dry deposition. The CALMET model, a preprocessor to CALPUFF, is a diagnostic meteorological model that produces three-dimensional fields of wind and temperature and two-dimensional fields of other meteorological parameters. CALMET was designed to process raw meteorological, terrain, and land-use databases to be used in the air modeling analysis. The CALPUFF modeling system uses a number of FORTRAN preprocessor programs that extract data from large databases and converts the data into formats suitable for input to CALMET. The processed data produced from CALMET will be input to CALPUFF to assess pollutant specific impacts.

2.2 CALPUFF Model Settings

The CALPUFF settings contained in Table 2-1 will be used for the modeling analyses.

2.3 Building Wake Effects

The CALPUFF analysis will include the proposed project's building dimensions to account for the effects of building-induced downwash on the emission sources. Dimensions for all significant building structures will be processed with the Building Profile Input Program (BPIP), Version 95086, and included in the CALPUFF model input.

2.4 Receptor Locations

The CALPUFF analysis will use an array of discrete receptors for ONWR, which were created and distributed by the NPS for standardized use in Class I analyses. Specifically, the array consists of 500 receptors spaced approximately every 1,750 meters, which cover the extent of the ONWR. Terrain throughout the ONWR is included in the same NPS-

Table 2-1 CALPUFF Model Settings	
Parameter	**Setting**
Pollutant Species	SO_2, SO_4, NO_x, HNO_3, and NO_3, and PM_{10}
Chemical Transformation	MESOPUFF II scheme
Deposition	Include both dry and wet deposition, plume depletion
Meteorological/Land Use Input	CALMET
Plume Rise	Transitional plume rise, Stack-tip downwash, Partial plume penetration
Dispersion	Puff plume element, PG/MP coefficients, rural ISC mode, ISC building downwash scheme
Terrain Effects	Partial plume path adjustment
Output	Create binary concentration and wet/dry deposition files including output species for all pollutants.
Model Processing	Regional Haze: Highest predicted 24-hour change as processed by CALPOST. Deposition: Highest predicted annual total sulfur and nitrogen values in deposition units. Class I SILs: Highest predicted concentrations at the applicable averaging periods for those pollutants that exceed the respective PSD Significant Emission Levels (SELs).
Background Values	Monthly Ammonia: 0.5 ppb; Monthly background ozone will be based on a review of the available monitoring stations' values averaged for each month. Additionally, hourly background ozone values from several reporting stations may be assessed for inclusion into the CALPUFF modeling.

provided receptor file. Only those receptors in the NPS file that lie beyond 50 km from the facility will be used in these analyses.

2.5 Meteorological Data Processing

The California Puff meteorological and geophysical data preprocessor (CALMET, Version 5.53, Level 030709) will be used to develop the gridded parameter fields required for the refined AQRV modeling analyses. The following sections discuss the data to be used and processed in the CALMET model.

2.5.1 CALMET Settings

The CALMET settings, including horizontal and vertical grid coverage and resolution of prognostic mesoscale meteorological data, will be chosen to adequately characterize the area within the CALMET domain.

2.5.2 Modeling Domain

The size of the domain used for the modeling will be based on the distances needed to cover the area from the proposed project to the receptors at the ONWR with at least a 80-km buffer zone in each direction. The modeling analysis will be performed in the UTM coordinate system. A rectangular modeling domain extending 325 km in the east-west (x) direction and 250 km in the north-south (y) direction will be used for the refined modeling analysis. The southwest corner of the domain is the origin and is located at 29.25 N degrees latitude and 84 W degrees longitude. The grid resolution for the domain will be 5 km. A grid spacing of 5 km yields 65 grid cells in the x-direction and 50 grid cells in the y-direction. Figure 2-1 illustrates the size and location of the modeling domain.

2.5.3 Mesoscale Model Data

Pennsylvania State University in conjunction with the National Center for Atmospheric Research (NCAR) Assessment Laboratory have developed mesoscale meteorological data sets of prognostic wind fields, or "guess" fields, for the United States. The hourly meteorological variables used to create these data sets (wind, temperature, dew point depression, and geopotential height for eight standard levels and up to 15 significant levels) are extensive and are used to populate the modeling domain with meteorological data. The analysis will use 1990 MM4, 1992 MM5, and 1996 MM5 mesoscale meteorological data sets to initialize the CALMET wind fields for each modeled year. The three years of MM data will be obtained from a NPS database provided to Black & Veatch. The extraction program accompanying the data will be used to obtain the

Need to have some observations 5 years of MET DATA controlling

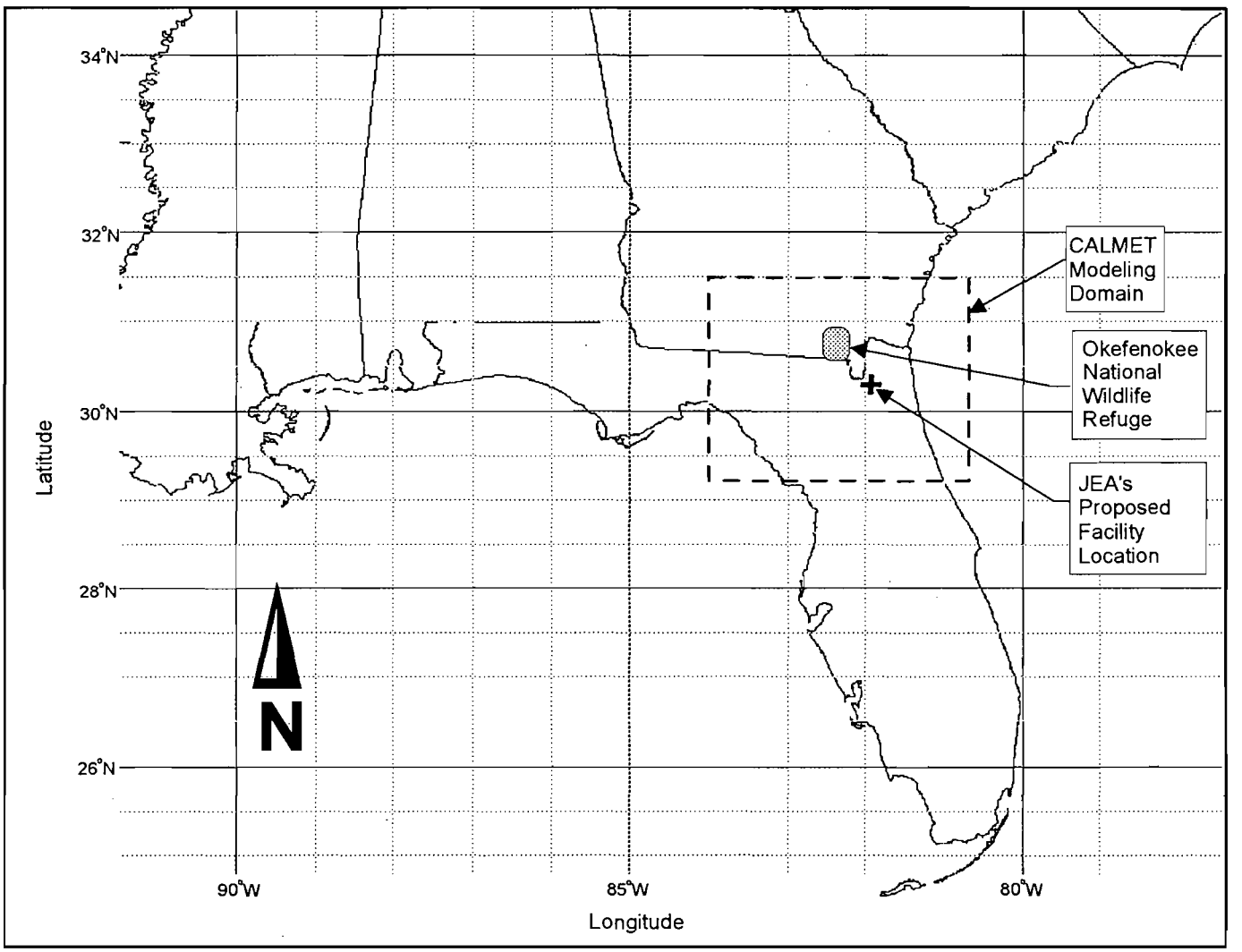

Figure 2-1
Modeling Domain

appropriate MM data points to cover the modeling domain. The 1990 MM4 and 1992 MM5 data have a horizontal spacing, or resolution, of 80 km. The 1996 MM5 data has a resolution of 36 km. The meteorological observations contained with the MM data sets are assumed to be of sufficient density, both temporally and spatially, to make the need for discrete meteorological station observation unnecessary. Thus, CALMET will be run with the No Observations mode developed in the latest version available from the model developer, EarthTech.

2.5.4 Geophysical Data Processing

Terrain elevations for each grid cell of the modeling domain will be obtained from1-degree Digital Elevation Model (DEM) files obtained from US Geographical Survey (USGS). The DEM data will be extracted for the modeling domain grid using the CALMET preprocessor program TERREL. Land-use data, based on annual averaged values, will also be obtained from the USGS. Land-use values for the domain grid will be extracted with the preprocessor programs CTGCOMP and CTGPROC. Other parameters processed for the modeling domain include surface roughness, surface albedo, Bowen ratio, soil heat flux, and leaf index field. Once preprocessed, all of the land-use parameters will be combined with the terrain information in a processor called MAKEGEO. This processor will produce one GEO.DAT file for input to CALMET.

2.6 Project Emissions

The maximum pound per hour emission rates at 100% load and the average annual temperature will be used for the pollutants modeled with CALPUFF. Those pollutants include NO_x, SO_2, and PM_{10}.

↓
Must look at worst case
on since this is so close
to Class I

3.0 CALPUFF Analyses

The preceding model inputs and settings for the CALPUFF modeling system will be used to complete the Class I analyses on the ONWR, including regional haze, deposition, and Class I SILs.

3.1 Regional Haze Analysis

A regional haze analysis will be performed for the ONWR for ammonium sulfates, ammonium nitrates, and particulate matter by appropriately characterizing model predicted outputs of SO_4, NO_3, and PM_{10} concentrations.

3.1.1 Visibility

Visibility is an AQRV for the ONWR. Visibility can take the form of plume blight for nearby areas, or regional haze for long distances (e.g., distances beyond 50 km). Because portions of the ONWR lie beyond 50 km from the proposed project, the change in visibility is analyzed as regional haze at those locations of the ONWR. Regional haze impairs visibility in all directions over a large area by obscuring the clarity, color, texture, and form of what is seen. Current regional haze guidelines characterize a change in visibility by either of the following methods:

1. Change in the visual range, defined as the greatest distance that a large dark object can be seen, or
2. Change in the light-extinction coefficient (b_{ext}).

Visual range can be related to extinction with the following equation:

$$b_{ext}(Mm^{-1}) = 3912 / vr(Mm^{-1})$$

Visual range (vr) is a measure of how far away a large black object can be seen in the atmosphere under several severe assumptions including: an absolutely dark target, uniform lighting conditions (cloud free skies), uniform extinction in all directions, a limiting contrast discrimination level, a target high enough in elevation to account for earth curvature, and several other factors. Visual range is, at best, a limited concept that allows relatively simple comparisons between visual air quality levels and should not be thought of as the absolute distance that can be seen through the atmosphere.

The b_{ext} is the attenuation of light per unit distance due to the scattering (light reduced away from the site path) and absorption (light captured by aerosols and turned into heat energy) by gases and particles in the atmosphere. A change in the extinction coefficient produces a perceived visual change that is measured by a visibility index called the deciview. The deciview (dv) is defined as:

$$dv = 10 \ln (1 + b_{exts} / b_{extb})$$

where: b_{exts} is the extinction coefficient calculated for the source, and
b_{extb} is the background extinction coefficient

A uniform incremental change in b_{extb} or visual range does not necessarily result in uniform changes in perceived visual air quality. In fact, perceived changes in visibility are best related to a change in b_{extb}, or; percent change in extinction. Based on NPS guidance, if the change in extinction is less than 5 percent, no further analysis is required. An index similar to the deciview that simply quantifies the percent change in visibility due to the operation of a source is calculated as:

$$\Delta\% = (b_{exts} / b_{extsb}) \times 100$$

3.1.2 Background Visual Ranges and Relative Humidity Factors

The background visual range is based on data representative of historical conditions at the ONWR. The background visual range, or constituents thereof, for the ONWR will be obtained from the Phase I FLAG Report, December 2000. The average relative humidity factor for each day will be computed by determining the relative humidity factor for each hour's relative humidity for the 24-hour period that the impact occurred. This factor, based on each relative humidity will be obtained by using Table 2.A-1 of Appendix 2.A of the Phase I FLAG Report. These factors (a relative humidity factor for each relative humidity) will then be used to determine the average relative humidity factor for that day (24-hour period). All of this is accomplished with the use of the CALPOST post-processor.

3.1.3 Interagency Workgroup On Air Quality Modeling (IWAQM) Guidelines

The CALPUFF air modeling analysis will follow the recommendations contained in the *IWAQM Phase II Summary Report and Recommendations for Modeling Long Range Transport Impacts*, (EPA, 12/98) where appropriate. Table 3-1 summarizes the IWAQM Phase II recommendations. The methodology in Table 3-1 will be used to compute the results of the regional haze analysis. However, CALPOST now possesses the ability to

Table 3-1 Outline of IWAQM Refined Modeling Analyses Recommendations *	
Meteorology	Use CALMET (minimum 6 to 10 layers in the vertical; top layer must extend above the maximum mixing depth expected); horizontal domain extends 50 to 80 km beyond outer receptors and source being modeled; terrain elevation and land-use data is resolved for the situation.
Receptors	Within Class I area(s) of concern; NPS will provide the modeling receptors.
Dispersion	1. CALPUFF with default dispersion settings. 2. Use MESOPUFF II chemistry with wet and dry deposition 3. Define background values for ozone and ammonia for area
Processing	Use highest predicted 24-hr SO_4, PM_{10} and NO_3 values; compute a day-average relative humidity factor (f(RH)) for the worst day for each predicted species, calculate extinction coefficients and compute percent change in extinction using the FLAG supplied background extinction where appropriate. This can all now be accomplished with the use of the CALPOST post-processor.
* *IWAQM Phase II Summary Report and Recommendations for Modeling Long Range Transport Impacts* (EPA, 12/98).	

post-process the modeling results specific to the regional haze analysis through the selection of one of seven modeling options. The post-processing selection will be made to calculate regional haze based on the appropriate available data/resources. Specifically, regional haze will be calculated using methods 2, which consists of computing extinctions from speciated PM measurements using hourly relative humidity adjustments for observed and modeled sulfate and nitrates. Based on recent correspondence with staff of the NPS, the relative humidity will be capped at 95 percent. A supplementary analysis will be performed with the relative humidity capped at 98 percent for informational purposes. While this process occurs within CALPOST, a typical calculation methodology is illustrated below.

Calculation

Refined impacts will be calculated as follows:

1. Obtain 24-hour SO_4, NO_3, and PM_{10} impacts, in units of micrograms per cubic meter ($\mu g/m^3$).
2. Convert the SO_4 impact to $(NH_4)_2SO_4$ by the following formula:

   $(NH_4)_2SO_4$ ($\mu g/m3$) = SO_4 ($\mu g/m^3$) x molecular weight $(NH_4)_2SO_4$ / molecular weight SO_4

   $(NH_4)_2SO_4$ ($\mu g/m^3$) = SO_4 ($\mu g/m^3$) x 132/96 = SO_4 ($\mu g/m^3$) x 1.375

   Convert the NO_3 impact to NH_4NO_3 by the following formula:

   NH_4NO_3 ($\mu g/m3$) = NO_3 ($\mu g/m^3$) x molecular weight NH_4NO_3 / molecular weight NO_3

   NH_4NO_3 ($\mu g/m^3$) = NO_3 ($\mu g/m^3$) x 80/62 = NO_3 ($\mu g/m^3$) x 1.29
3. Compute b_{exts} (extinction coefficient calculated for the source) with the following formula:

   b_{exts} = 3 x NH_4NO_3 x f(RH) + 3 x $(NH_4)_2SO_4$ x f(RH) + 1 x PM_{10}
4. Compute b_{extb} (background extinction coefficient) using the background visual range (km) from the FLAG document with the following formula:

   b_{extb} = 3.912 / Visual range (km)
5. Compute the change in extinction coefficients:

   in terms of deciviews:

   $$dv = 10 \ln (1 + b_{exts} / b_{extb})$$

   in terms of percent change of visibility:

   $$\Delta\% = (b_{exts} / b_{extsb}) \times 100$$

Based on the predicted SO_4, NO_3, and PM_{10} concentrations, the proposed project's emissions will be compared to a 5 percent change in light extinction of the background levels. This is equivalent to a change in deciview of 0.5.

3.2 Deposition Analyses

Deposition analyses will be performed for the ONWR for both total sulfur and total nitrogen. The analyses will follow those procedures and methodologies set forth in the IWAQM Phase II Report. Specifically, deposition analyses will be performed as follows:

1. Perform CALPUFF model runs using the specified options previously mentioned (including output of both dry and wet deposition).
2. Perform individual CALPOST post-processor runs to output the maximum annual average wet and dry deposition impacts of SO_2, SO_4, NO_x, NO_3, and HNO_3 in $g/m^2/s$ units.
3. Apply the appropriate scaling factors found in IWAQM Phase II Report (Section 3.3 Deposition Calculations of the IWAQM document) to the above CALPOST runs to account for normalization based on the ratio of molecular weights, as well as the conversion of grams to kilograms, square meters to hectares (ha), seconds to hours, and hours to a year. Thus, the CALPOST results will be in kg/ha/yr.
4. For sulfur deposition, sum the results of both the wet deposition and dry deposition values.
5. For nitrogen deposition, sum the results of both the wet deposition and dry deposition values.

3.3 Class I Impact Analysis

Ground-level impacts (in $\mu g/m^3$) onto to the ONWR will be calculated for NO_x, SO_2, and PM_{10} criteria pollutants for each applicable averaging period. The results of this analysis will be compared with the Class I Significant Impact Levels (SILs) calculated as 4 percent of the Class I Increment values. Should the model predicted impacts onto the ONWR exceed the Class I SILs, an appropriately derived inventory of PSD increment consuming sources will be developed through FDEP and modeled with the CALPUFF modeling system for comparison to the Class I Increment values.