GEORGIA-PACIFIC CORPORATION

PALATKA MILL

PSD PERMIT APPLICATION

Lime Kiln Shell Replacement

PALATKA (PUTNAM COUNTY), FLORIDA

AUGUST 2004

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

Georgia-Pacific Corporation (GP) operates an unbleached and bleached Kraft pulp and paper Mill in Palatka, Florida (Putnam County). Processes and systems at the Mill include a batch digester system, multiple effect evaporator (MEE) system, condensate stripper system, recovery boiler and smelt dissolving tanks, lime kiln, tall oil plant, utilities, bleach plant, chlorine dioxide plant, and other equipment to produce finished paper products from virgin wood.

Putnam County has been designated by the U.S. Environmental Protection Agency (US EPA) as in attainment or unclassified for all criteria pollutants. The existing Mill is classified as a major stationary source under Prevention of Significant Deterioration (PSD) and Clean Air Act Title V definitions since it has the potential-to-emit more than 100 tons per year (tpy) of at least one regulated air pollutant.

The Palatka Mill needs to replace a section of the Lime Kiln (Emission Unit 017) shell. In late 2003, the Mill experienced a failure of the Lime Kiln shell. The Kiln had cracks all the way through the shell in several different areas of the "hot end". This outage alone resulted in unbudgeted expenditures of $1.5 million for maintenance repairs and purchased chemicals. An equipment vendor has recommended that the Mill replace 62 feet of the hot end Kiln shell and all ten (10) coolers. The existing coolers are causing excessive stress on the Kiln shell. The new coolers will have an improved mounting bracket design that will eliminate future stress cracking underneath the coolers. The total cost of this project is estimated at approximately $1.8 million, with approximately 75 percent of this total going toward the labor costs needed to complete the project. The Mill plans to complete this work during their spring outage in 2005.

The reformed New Source Review (NSR) regulations that were promulgated by the US Environmental Protection Agency (EPA) on December 31, 2002 allow emission changes from projects of this nature to be evaluated on an "actual-to-projected actual" basis. Using that calculation method, since emissions are not expected to increase as a result of this project, the triggering of NSR permitting would not be an issue. However, since these regulations have not yet been adopted by the Florida Department of Environmental Protection (FDEP), this project is evaluated under the pre-2002 NSR regulations. Those regulations generally require a comparison of past actual emissions to the proposed permitted rates. Furthermore, the exclusion for routine maintenance, repair, and replacement (RMRR) projects, such as the shell replacement, is a case-by-case decision. Even though this is clearly a maintenance project, and a critical one at that, the federal NSR rules that addressed these types of projects has been "stayed". As such, in the meantime, these projects continue to be evaluated on a case-by-case basis. Given the estimated cost of the proposed work and the fact that this type of repair is not made on a routine basis, GP has conducted a PSD applicability assessment for this project.

For this project, PSD review is triggered for nitrogen oxides, particulate matter (including total particulate matter (PM) and particulate matter less than 10 micrometers in aerodynamic diameter (PM_{10})), nitrogen oxides (NO_x), ozone (based on a significant increase in volatile organic compounds (VOCs)), and total reduced sulfur (TRS) compounds (including hydrogen sulfide (H_2S)). The completed PSD permit application includes emission estimates, a Best Available Control Technology (BACT) review, an air quality analysis, and completed permit application forms.

2. PERMIT APPLICATION FORMS

The completed, long version of the Florida Department of Environmental Protection's (FDEP's) permit application is included in Attachment A.

3. INTRODUCTION

3.1 Facility Location and Description

Georgia-Pacific Corporation (GP) operates an unbleached and bleached Kraft pulp and paper Mill in Palatka, Florida (Putnam County). Processes and systems at the Mill include a batch digester system, multiple effect evaporator (MEE) system, condensate stripper system, recovery boiler and smelt dissolving tanks, lime kiln, tall oil plant, utilities, bleach plant, chlorine dioxide plant, and other equipment to produce finished paper products from virgin wood.

The Mill site is located north of County Road 216 and west of U.S. Highway 17. The approximate Universal Trans Mercator (UTM) coordinates are 434.0 kilometers (km) east and 3283.4 km north in Zone 17. The Mill location is shown on a United States Geological Survey (USGS) topographic map in Attachment 3-1. A plot plan of the facility is included as Figure 3-2. This plot plan is representative for the Palatka Mill both before, and after, the proposed change.

While equipment capacities may vary throughout the Mill, the current permitted allowable production level is 118 tons per hour of air dried unbleached pulp (ADUP) and 1,850 tons per day ADUP as a maximum monthly average.

Putnam County has been designated by the U.S. Environmental Protection Agency (US EPA) as in attainment or unclassified for all criteria pollutants. The existing Mill is classified as a major stationary source under Prevention of Significant Deterioration (PSD) and Clean Air Act Title V definitions since it has the potential-to-emit more than 100 tons per year (tpy) of at least one regulated air pollutant. The initial Title V permit was issued to the Palatka Mill on October 30, 2000. The Mill is currently operating under Title V Permit 1070005-023-AV, issued May 2004.

3.2 Project Description

The Palatka Mill needs to replace a section of the Lime Kiln (Emission Point 17) shell. In late 2003, the Mill experienced a failure of the Lime Kiln shell. The Kiln had cracks all the way through the shell in several different areas of the "hot end". This outage alone resulted in unbudgeted expenditures of $1.5 million for maintenance repairs and purchased chemicals.

The failure in late 2003 occurred underneath the cooler tubes, which are causing excessive stress on the Kiln shell. At the time, repairs were made for temporary use only. Based on testing and evaluation from the original equipment manufacturer, the failure will occur again if the underlying problems are not properly, and more permanently, corrected.

An equipment vendor has recommended that the Mill replace 62 feet of the hot end Kiln shell and all ten (10) coolers. The new coolers will have an improved mounting bracket design that will eliminate future stress cracking underneath the coolers. The total cost of this project is estimated at approximately $1.8 million, with approximately 75 percent of this total going toward the labor costs needed to complete the project. The Mill plans to complete this work during their spring outage in 2005.

A simplified process flow diagram is provided for the Lime Kiln as Figure 3-3.

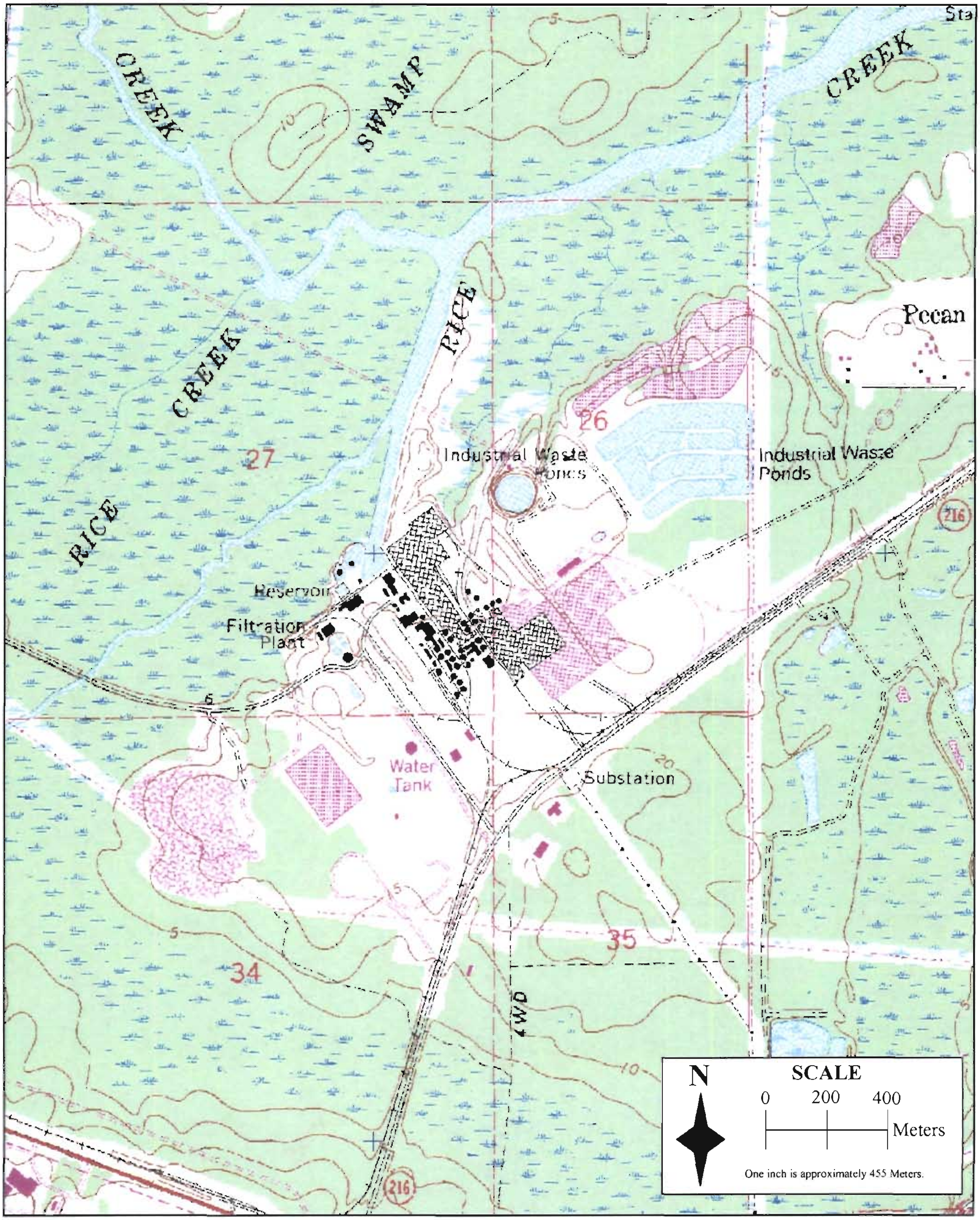
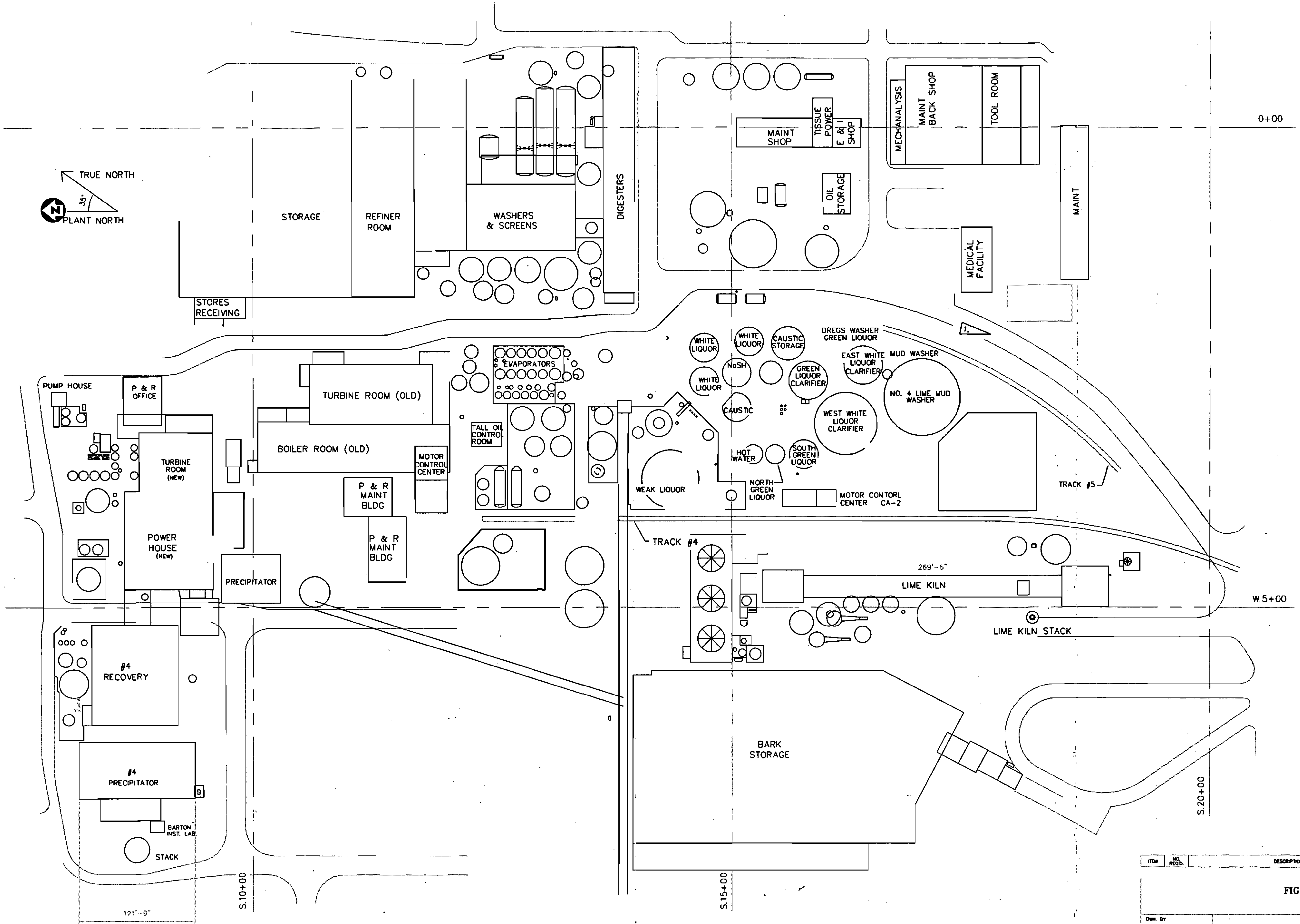


Figure 3-1
Area Map
Georgia-Pacific Corporation, Palatka Mill

Source: Golder, 2004.



ITEM	NO. REQ'D.	DESCRIPTION	MAT'L.	REFERENCE

FIGURE 3-2

DWN. BY
DATE:
CHK. BY
DATE:
APP. BY
DATE:

GEORGIA–PACIFIC PALATKA MILL
SIMPLIFIED PLOT PLAN

SCALE:	EQUIP. NO.	DRAWING NO.	SHT.	REV.
GRAPHIC		FIGURE 3-2		

DESCRIPTION	DRAWING NO.
REFERENCE	

THIS DRAWING IS THE PROPERTY OF A.H. LUNDBERG ASSOCIATES AND IS TO BE RETURNED UPON REQUEST. IT IS LOANED UPON CONDITION THAT IT WILL NOT BE REPRODUCED IN WHOLE OR IN PART, OR USED TO FURNISH INFORMATION TO OTHERS, OR FOR ANY PURPOSE OTHER THAN WORK AUTHORIZED BY A.H. LUNDBERG ASSOCIATES.

REV.	DESCRIPTION	BY	DATE	CHK	DATE	REV.	DESCRIPTION	BY	DATE	CHK	DATE
	REVISIONS						REVISIONS				

SPEC. XXXXXXXX AL-XXXXXXXXX SHT.

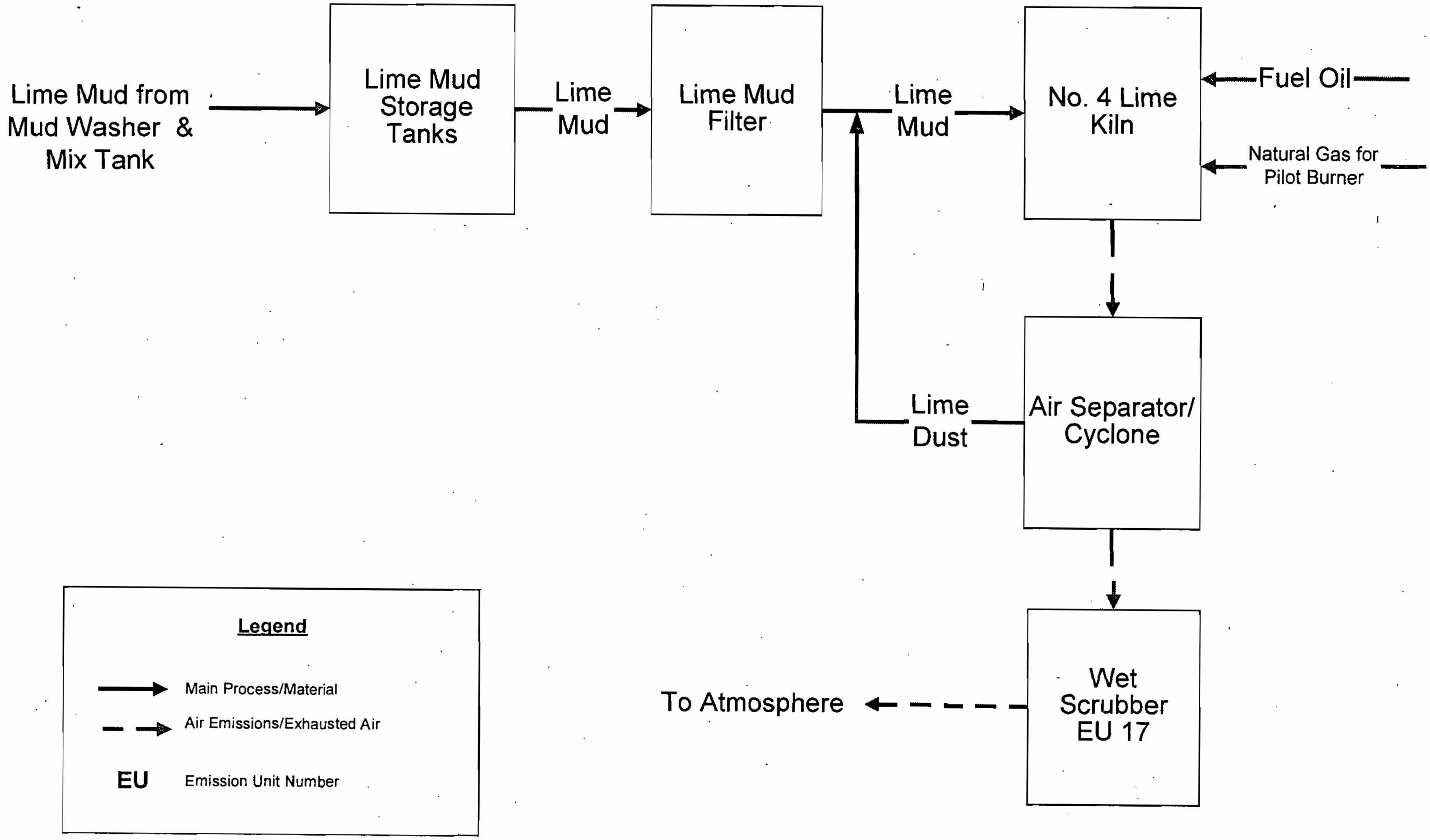


Figure 3-3. Process Flow Diagram
Georgia-Pacific Corporation Palatka Operations
No.4 Lime Kiln
Sheet 1 of 1

4. EMISSION RATES

The detailed emission rate calculations are provided in Attachment B.

The baseline annual throughput that is used in calculating past actual emissions is an average for the two-year period, January 2002 through December 2003. Actual source test results and operating hours were used in calculating the average, annual emissions for the baseline period.

A number of updates are being made for the Lime Kiln in this application to allow for the development of emission limits in a more consistent and accurate manner. These updates are as follows:

1. For the pollutants that have had grain loading (grains per dry standard cubic feet) or concentration-based (parts per million by volume) limits established in the past as part of the 1991 and 1995 permitting actions, for the most part, these values correlated to the listed mass emission limits (in pounds per hour and tons per year), with the exception of nitrogen oxides (NO_x) and carbon monoxide (CO)). For this application, the concentration limits for NO_x and CO have been used in calculating updated mass emission limits for these pollutants to insure that the various limits are consistent.

2. The design flow rate for the Lime Kiln was presented as 24,200 dscfm at 4% oxygen (O_2) in the 1991 PSD permit application. The calculation of the corrected design flow rate, based on this value, is as follows:

   24,200 (21-4.0)/ (21-10) = 37,400 dscfm @ 10% O_2

   This corrected flow rate was the basis of the mass emission limits that were established in the 1991 PSD permit (Permit No. AC54-192551/PSD-FL-171). In preparing the 1995 PSD permit application, stack test data for prior years was reviewed to determine if the Lime Kiln design flow rate was still representative. These data are presented in Table 4-1:

Table 4-1. Lime Kiln Stack Flow Rate Data (1992 – 1994)

Stack Test Date	Stack Flow Rate (dscfm)	Corrected Stack Flow Rate @ 10% O_2
1994	33,700 @ 6.4 % O_2	44,700
1993	32,000 @ 5.7 % O_2	44,500
1992	29,500 @ 6.4 % O_2	39,200

This review concluded that the previous design flow of 37,400 dscfm @ 10% O_2 was no longer appropriate. Therefore, the 1995 PSD application presented updated maximum flow rates of 56,000 actual cubic feet per minute (acfm) and 32,000 dscfm (both uncorrected) in the Lime Kiln emission unit information section of the application form. Although not specified on the application form, the 1993 stack test was the basis of the flow rate that was provided in the application forms for the Lime Kiln. As shown in the table above, the associated oxygen content was 5.7%. The uncorrected flow rate of 32,000 dscfm (from the 1995 application) corresponds to the following rate when corrected to 10% O_2:

32,000 (21-5.7)/(21-10) = 44,500 dscfm @ 10% O_2

Even though this issue was brought forward in the 1995 PSD application, GP elected to retain the same allowable mass emission limits for the Lime Kiln as contained in the previous 1991 PSD permit. Therefore, the basis of the allowable emissions was still shown as 37,400 dscfm @ 10% O_2, even though this flow rate was no longer appropriate (permit No. AC54-266676/ PSD-FL-226). In other words, the Mill was willing to accept the same mass emission limits that were previously in place, although the stack flow rate had increased.

The emission calculations in Attachment B of this application utilize the 44,500-dscfm flow rate. In order to demonstrate that this flow rate is still representative, Table 4-2 presents the actual measured stack flow rates for the period 1998 through 2003 based on past compliance test data. As shown, the corrected, average flow rates are no greater than 44,500 dscfm @ 10% O_2.

Table 4-2. Average Flow Rates for Testing Performed 1998-2003

Year Tested	Test Description	Average Flow Rate (dscfm @ 10% Oxygen)
1998	CO, NO_x, SO_2, VOC	33,098
	PM	35,557
1999	CO, NO_x, SO_2, VOC	36,979
	PM	38,474
2000	CO, NO_x, SO_2, VOC, PM	42,619
2001	PM	43,263
2002	CO, NO_x, SO_2, VOC, PM	38,323
2003	CO, NO_x, SO_2, VOC, PM	42,783

Note: NO_x – nitrogen oxides; CO – carbon monoxide; PM – particulate matter; SO_2 – sulfur dioxide; VOC – volatile organic compounds

The capacity, maximum operating rate, or flow rate will not be impacted as a result of this maintenance project.

3. The emission factor for sulfur dioxide (SO_2) has been updated based on National Council for Air and Stream Improvement, Inc. (NCASI) Technical Bulletin 646. The derivation of the emission factor is presented in Attachment B. The NCASI factors are for lime kilns burning oil and equipped with a scrubber, whereas the AP-42 factor only represents uncontrolled emissions. Using the AP-42 factor, it was necessary to estimate a "controlled" factor based on assumptions that had not been verified in practice. For this reason, GP believes that the NCASI-derived factor is more representative. The actual mass emission limits are decreased slightly with the use of the NCASI factor. Since the sulfuric acid mist (SAM) emissions are estimated based on SO_2, the mass emission rates for that pollutant have decreased slightly as well.

4. The concentration-based limit for NO_x is lowered from 290 to 275 parts per million by volume dry basis (ppmvd). The 290 ppmvd value was set in the prior PSD permitting actions. This change is made in order to avoid the time and effort associated with a "full" air quality impact analysis. At 290 ppmvd, and using the updated flow rate (see Item 2 above), the actual-to-potential increase in NOx emissions would have exceeded the modeling significance level, resulting in full analyses for PSD increment consumption and National Ambient Air Quality Standards (NAAQS) compliance. There were no potential violations identified for NO_x, GP simply chose this alternative to accelerate preparation and submittal of the application. At the higher rate, NO_x would have been the only pollutant that triggered the full modeling assessment.

5. An updated emission factor was used for lead based on factors contained in NCASI Technical Bulletin 701. The factor and detailed calculations are presented in Attachment B. The mass emission rates for lead indicate a decrease based on the use of the more current NCASI factor.

With the inclusion of these updates, the proposed emission limit changes are summarized in Table 4-3. The detailed calculations are provided in Attachment B.

Table 4-3. Current and Proposed Emission Rate Limits

Pollutant	Past Permitting Actions			Proposed Permitted Rates		
	Grain Loading, Concentration or Factor	Hourly Mass Rate (lbs/hour)	Annual Mass Rate (tpy)	Grain Loading, Concentration or Factor	Hourly Mass Rate (lbs/hour)	Annual Mass Rate (tpy)
PM/PM_{10}	0.081 grain/dscf	26.0	113.9	0.081 grain/dscf	30.9	135.3
NO_x	290 ppmvd	50.3	223.3	275 ppmvd	87.6	383.7
CO	69 ppmvd	7.3	32.0	69 ppmvd	13.4	58.6
VOCs	185 ppmvd	17.2	75.3	185 ppmvd	20.5	89.8
TRS	20 ppmvd	4.0	7.5	20 ppmvd	4.7	20.7
SO_2	0.15 lb/ADTP	10.9	47.7	0.47 lb/ton CaO	9.1	40.0
SAM	4% of SO_2 as SO_3	0.53	2.34	4% of SO_2 as SO_3	0.45	2.0
Pb	530 lbs/10^6 tons CaO	0.010	0.045	0.00021 lb/ton CaO	0.0041	0.018

Notes for Table:
[1] All concentration (ppmvd) values are at 10% O_2
[2] ADTP = air-dried ton of pulp
[3] CaO = calcium oxide
[4] NO_x – nitrogen oxides; CO – carbon monoxide; PM – particulate matter; PM_{10} – particulate matter less than 10 microns in aerodynamic diameter; SO_2 – sulfur dioxide; VOCs – volatile organic compounds; Pb – lead; TRS – total reduced sulfur compounds (also represents H_2S); SAM – sulfuric acid mist

As discussed previously, the capacity or maximum operating rate (19.44 tons calcium oxide (CaO) per hour) will not change for the Lime Kiln following this maintenance project. Although, while the Mill is proposing to increase some of the mass emission rate limits, no increases are being proposed for any of the concentrations or grain loadings. This is simply an effort to correct past discrepancies and to establish all of the limits on a consistent basis in an effort to avoid confusion in the future.

5. REGULATORY APPLICABILITY

5.1 PSD Applicability

The existing Mill, as constructed, and as operated today, is classified as a major stationary source under PSD definitions since it has the potential-to-emit more than 100 tons per year of at least one regulated air pollutant.

As discussed above, had the December 2002 NSR reform rules been adopted by FDEP, the triggering of NSR permitting would not be an issue for this project. Emissions for all pollutants are expected to remain constant, and any increase or decrease that might occur would be unrelated to this maintenance work. However, since these regulations have not yet been adopted by FDEP, this project is evaluated under the pre-2002 NSR regulations. Policy statements that have been issued around the pre-2002 regulations generally require a comparison of past actual emissions to the proposed permitted rates. As such, that calculus is utilized in this analysis.

The past actual and proposed allowable emission limits are presented in Table 5-1. The table also shows the emission increases and compares them to the PSD significant increase levels.

Table 5-1. Past Actual and Proposed Allowable Emissions Compared to PSD Significance Levels

	Emissions (tons per year)							
	NO_x	**CO**	**PM/ PM_{10}**	**SO_2**	**VOCs**	**Pb**	**TRS**	**SAM**
Potential Emissions	383.7	58.6	135.3	40.0	89.8	0.018	20.7	2.0
Past Actual Emissions	100.6	5.6	42.5/36.6	10.5	2.4	0.011	2.3	0.51
Emissions Increase	283.1	53.0	92.8/98.7	29.5	87.4	0.007	18.4	1.5
PSD Significance Level	40	100	25/15	40	40	0.6	10	7
PSD Triggered?	Yes	No	Yes	No	Yes	No	Yes	No

Note: NO_x – nitrogen oxides; CO – carbon monoxide; PM – particulate matter; PM_{10} – particulate matter less than 10 microns in aerodynamic diameter; SO_2 – sulfur dioxide; VOCs – volatile organic compounds; Pb – lead; TRS – total reduced sulfur compounds (also represents H_2S); SAM – sulfuric acid mist

As shown in Table 5-1, PSD review is triggered for NO_x, particulate matter (including total particulate matter (PM) and particulate matter less than 10 micrometers in aerodynamic diameter (PM_{10})), ozone (based on a significant increase in volatile organic compounds (VOCs)), and total reduced sulfur (TRS) compounds (including hydrogen sulfide (H_2S)).

5.2 NSPS Applicability

The Lime Kiln is potentially subject to New Source Performance Standards (NSPS) contained at 40 CFR 60 Subpart BB. In order to be subject to the federal NSPS contained in 40 CFR 60, an emission unit must be in a listed NSPS category and must have been constructed, modified, or reconstructed after the effective date of the respective NSPS.

In order to evaluate NSPS applicability for the proposed project, it is important to understand the following definitions that can be found at 40 CFR 60:

Construction	*means fabrication, erection, or installation of an affected facility.*
Modification	*means any physical change in, or change in the method of operation of, an existing facility which increases the amount of any air pollutant (to which a standard applies) emitted into the atmosphere by that facility or which results in the emission of any air pollutant (to which a standard applies) into the atmosphere not previously emitted.*

With regard to modifications, 40 CFR 60.14 goes on to specify that the increase in emissions is evaluated on an hourly basis. Comparisons of hourly emission rates (before and after the modification) are made by comparing the capacity of the unit both before and after the modification (*e.g.*, potential-to-potential evaluation). This approach is supported by numerous, and consistent, determinations from the US EPA on this issue in the past.

The NSPS, at 40 CFR 60.14, go on to state that certain changes are exempt and do not trigger new source standards. These include, but are not limited to the following:

40 CFR 60.14(e)(1)	*Maintenance, repair, and replacement which the Administrator determines to be routine for a source category...*
40 CFR 60.14(e)(2)	*An increase in production rate of an existing facility, if that increase can be accomplished without a capital expenditure on that facility.*
40 CFR 60.14(e)(3)	*An increase in the hours of operation..*
40 CFR 60.14(e)(6)	*The relocation or change in ownership of an existing facility.*

Reconstruction	*means the replacement of components of an existing facility to such an extent that...The fixed capital cost of the new components exceeds 50 percent of the fixed capital cost that would be required to construct a comparable entirely new facility, and...It is technologically and economically feasible to meet the applicable standards set forth in this part...*

As discussed in Section 3, the shell and coolers are not being replaced for the purpose of increasing the throughput (or maximum hourly emissions) of the Lime Kiln. This is strictly a maintenance project that is being subjected to permitting as a result of having to apply the actual-to-potential accounting scheme. As such, this project is not being implemented for the purposes of increasing either the maximum hourly capacity or emissions of the Lime Kiln. Therefore, NSPS applicability will not be triggered for this unit as a result of the "construction" or "modification" provisions.

The estimated replacement cost of the Lime Kiln is in the range of $30 to $40 million. The preliminary cost estimate for this project is $1.8 million. This is much less than 50 percent of the replacement cost of the unit that would be required in order to trigger coverage under the "reconstruction" provisions.

Based on these facts, the Lime Kiln will not become subject to the NSPS as a result of the proposed maintenance work.

5.3 NESHAP Applicability

Section 112(d) of the Clean Air Act, as amended in November, 1990, requires that the US EPA, "promulgate regulations establishing emission standards for each category or subcategory of major sources and area sources of hazardous air pollutants listed for regulation...". These National Emission Standards for Hazardous Air Pollutants (NESHAPs), to be codified in 40 CFR 63, are to be based on the Maximum Achievable Control Technology (MACT). A final MACT rule was promulgated for lime kilns on January 12, 2001. This Rule, promulgated as 40 CFR 63, Subpart MM, is known as the "National Emission Standards for Hazardous Air Pollutants for Chemical Recovery Combustion Sources at Kraft, Soda, Sulfite, and Stand-Alone Semichemical Pulp Mills". The Rule, commonly referred to as MACT II, applies to both existing and new lime kilns.

The MACT General Provisions, in 40 CFR 63.2, define a new source as, "...any affected source the construction or reconstruction of which is commenced after the Administrator first proposes a relevant emission standard under this part". The Lime Kiln was constructed well prior to the proposal date for this NESHAP. Under the MACT General Provisions (40 CFR 63, Subpart A), the Rule states that reconstruction, "...means the replacement of components of an affected or a previously unaffected stationary source to such an extent that...The fixed capital cost of the new components exceeds 50 percent of the fixed capital cost that would be required to construct a comparable new source..." Since the proposed maintenance work constitutes much less than 50 percent of the replacement cost, the Lime Kiln is not considered to be reconstructed for the purposes of MACT applicability.

As the Lime Kiln currently exists, it is considered an "existing source" for the purposes of MACT applicability. With that designation, the unit had to be in compliance with the MACT II Rule in March 2004. None of the actions being proposed as part of this project will impact the unit's designation or compliance dates. As the FDEP may be aware, the Mill will comply with the MACT rule through the use of the "bubble" provision contained in the final rule at 40 CFR 63, Subpart MM, Section 63.862(a)(ii). As such, the Lime Kiln is not required to meet the individual source limit for existing sources of 0.064 grain per dry standard cubic foot (gr/dscf).

5.4 FDEP Rule Applicability

In addition to the federal rules addressed above, there are a number of Florida Department of Environmental Protection (FDEP) rules that are applicable for the Lime Kiln as well. Table 5-2 contains a summary of the applicable FDEP rules.

Table 5-2. Applicable FDEP Rules for Lime Kiln

Rule	Applicable Sub-Sections	Brief Description
62-296.320	(4)(a) and (b)	General Pollutant Emission Limiting Standards
62-296.404	(2)(b); (3)(e); (4)(f); (5)(a) and (b); (6)(a), (b), (c)2, (d)	Kraft (Sulfate) Pulp Mills and Tall Oil Plants
	(4)(b)	Lime Kilns and Calciners
62-297.310		General Test Requirements
62-297.401	(1)(a)	EPA Method 1 (Velocity Traverse)
	(2)	EPA Method 2 (Velocity and Flow)
	(3)	EPA Method 3 (CO_2, O_2, Excess Air)
	(4)	EPA Method 4 (Moisture Content)
	(5)	EPA Method 5 (PM)
	(7) and (7)(e)	EPA Method 7 and 7E (NO_x)
	(8)	EPA Method 8 (SAM and SO_2)
	(10)	EPA Method 10 (CO)
	(16) and (16)(a)	EPA Methods 16 and 16A (TRS)
	(25) and (25)(a)	EPA Method 25 (VOCs)

Note: NO_x – nitrogen oxides; CO – carbon monoxide; PM – particulate matter; SO_2 – sulfur dioxide; VOCs – volatile organic compounds; TRS – total reduced sulfur compounds; SAM – sulfuric acid mist

6. AIR QUALITY ANALYSIS

An applicant for a PSD permit is required to conduct an air quality analysis to determine the ambient impacts associated with the modified source. The primary purpose is to demonstrate that new or increased emissions will not cause or contribute to a violation of the NAAQS or a PSD increment. Applicants for a PSD permit are also required to make a demonstration that there will be no adverse impacts upon soils, vegetation, visibility, or growth.

The results of the dispersion modeling analysis, demonstrating compliance with both the NAAQS and PSD increments, are provided in Attachment C.

7. BACT ANALYSIS

As part of the PSD permitting process, an applicant is required to conduct a BACT review. This requirement is set forth in the PSD regulations at 40 CFR 52.21(j) as follows:

> *"...an emission limitation based on the maximum degree of reduction for each pollutant subject to regulation under the Act which would be emitted from any...source...which on a case-by-case basis is determined to be achievable taking into account energy, environmental and economic impacts and other costs."*

A BACT analysis is required only for the pollutants found to be subject to PSD review. For the maintenance project on the Lime Kiln, this includes NO_x, PM, PM_{10}, ozone (as a result of a significant increase in VOCs), and TRS compounds (including H_2S).

The BACT analysis is conducted based on the "top-down" approach outlined in US EPA's, December 1, 1987 policy memorandum and their New Source Review Workshop Manual (Draft, October, 1990).

The results of the BACT analysis are discussed in detail in Attachment D. As presented in the Attachment, based on other, recent BACT determinations, the Lime Kiln, as designed and operated, employs BACT-level controls and operation. As such, the Mill is not proposing additional controls in conjunction with this project.

Attachment A
Permit Application Forms

Department of Environmental Protection

Division of Air Resource Management

RECEIVED
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BUREAU OF AIR REGULATION

APPLICATION FOR AIR PERMIT - LONG FORM

I. APPLICATION INFORMATION

Air Construction Permit – Use this form to apply for an air construction permit for a proposed project:

- subject to prevention of significant deterioration (PSD) review, nonattainment area (NAA) new source review, or maximum achievable control technology (MACT) review; or
- where the applicant proposes to assume a restriction on the potential emissions of one or more pollutants to escape a federal program requirement such as PSD review, NAA new source review, Title V, or MACT; or
- at an existing federally enforceable state air operation permit (FESOP) or Title V permitted facility.

Air Operation Permit – Use this form to apply for:

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

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

To ensure accuracy, please see form instructions.

Identification of Facility

1. Facility Owner/Company Name: **Georgia-Pacific Corporation**
2. Site Name: **Palatka Mill**
3. Facility Identification Number: **1070005**
4. Facility Location...:
   Street Address or Other Locator: **North of CR 216; West of US 17**
   City: **Palatka** County: **Putnam** Zip Code: **32177**
5. Relocatable Facility? ☐ Yes ☒ No
6. Existing Title V Permitted Facility? ☒ Yes ☐ No

Application Contact

1. Application Contact Name: **Myra Carpenter, Superintendent of Environmental Affairs**
2. Application Contact Mailing Address...
   Organization/Firm: **Georgia-Pacific Corporation**
   Street Address: **P.O. Box 919**
   City: **Palatka** State: **FL** Zip Code: **32178-0919**
3. Application Contact Telephone Numbers...
   Telephone: **(386) 325-2001** ext. Fax: **(386) 328-0014**
4. Application Contact Email Address: **myra.carpenter@gapac.com**

Application Processing Information (DEP Use)

1. Date of Receipt of Application:	9-3-04
2. Project Number(s):	1070005-030-AC
3. PSD Number (if applicable):	PSD-FL-345
4. Siting Number (if applicable):	

Purpose of Application

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

Air Construction Permit

☒ Air construction permit.

Air Operation Permit

☐ Initial Title V air operation permit.

☐ Title V air operation permit revision.

☐ Title V air operation permit renewal.

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

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

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

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

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

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

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

Application Comment

This application is for the repair and replacement of components of the No. 4 Lime Kiln shell.

Scope of Application

Emissions Unit ID Number	Description of Emissions Unit	Air Permit Type	Air Permit Proc. Fee
017	No. 4 Lime Kiln		$7,500

Application Processing Fee

Check one: ☒ Attached - Amount: $7,500 ☐ Not Applicable

Owner/Authorized Representative Statement

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

1. Owner/Authorized Representative Name :
Theodore D. Kennedy, Vice President, Georgia-Pacific, Palatka Operations

2. Owner/Authorized Representative Mailing Address...
Organization/Firm: **Georgia-Pacific Corporation**
Street Address: **P.O. Box 919**
City: **Palatka** State: **FL** Zip Code: **32178**

3. Owner/Authorized Representative Telephone Numbers...
Telephone: **(386) 325-2001** ext. Fax: **(386) 328-0014**

4. Owner/Authorized Representative Email Address: **Ted.Kennedy@gapac.com**

5. Owner/Authorized Representative Statement:

I, the undersigned, am the owner or authorized representative of the facility addressed in this air permit application. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof and all other requirements identified in this application to which the facility is subject. I understand that a permit, if granted by the department, cannot be transferred without authorization from the department, and I will promptly notify the department upon sale or legal transfer of the facility or any permitted emissions unit.

Theodore D Kennedy
Signature

9/1/04
Date

Application Responsible Official Certification

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

1. Application Responsible Official Name:

2. Application Responsible Official Qualification (Check one or more of the following options, as applicable):

☐ For a corporation, the president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or a duly authorized representative of such person if the representative is responsible for the overall operation of one or more manufacturing, production, or operating facilities applying for or subject to a permit under Chapter 62-213, F.A.C.

☐ For a partnership or sole proprietorship, a general partner or the proprietor, respectively.

☐ For a municipality, county, state, federal, or other public agency, either a principal executive officer or ranking elected official.

☐ The designated representative at an Acid Rain source.

3. Application Responsible Official Mailing Address...
Organization/Firm:
Street Address:
City: State: Zip Code:

4. Application Responsible Official Telephone Numbers...
Telephone: ( ) - ext. Fax: ( ) -

5. Application Responsible Official Email Address:

6. Application Responsible Official Certification:

I, the undersigned, am a responsible official of the Title V source addressed in this air permit application. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof and all other applicable requirements identified in this application to which the Title V source is subject. I understand that a permit, if granted by the department, cannot be transferred without authorization from the department, and I will promptly notify the department upon sale or legal transfer of the facility or any permitted emissions unit. Finally, I certify that the facility and each emissions unit are in compliance with all applicable requirements to which they are subject, except as identified in compliance plan(s) submitted with this application.

Signature Date

Professional Engineer Certification

1. Professional Engineer Name: **Mark J. Aguilar**
   Registration Number: **52248**

2. Professional Engineer Mailing Address:
   Organization/Firm: **Georgia-Pacific Corporation**
   Street Address: **133 Peachtree St**
   City: **Atlanta** State: **GA** Zip Code: **30303**

3. Professional Engineer Telephone Numbers...
   Telephone: **(404) 652-4293** ext. Fax: **(404) 654-4706**

4. Professional Engineer Email Address: **mjaguila@gapac.com**

5. Professional Engineer Statement:

I, the undersigned, hereby certify, except as particularly noted herein, that:*

(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollution control equipment described in this application for air permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and

(2) To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.

(3) If the purpose of this application is to obtain a Title V air operation permit (check here ☐, if so), I further certify that each emissions unit described in this application for air permit, when properly operated and maintained, will comply with the applicable requirements identified in this application to which the unit is subject, except those emissions units for which a compliance plan and schedule is submitted with this application.

(4) If the purpose of this application is to obtain an air construction permit (check here ☒, if so) or concurrently process and obtain an air construction permit and a Title V air operation permit revision or renewal for one or more proposed new or modified emissions units (check here ☐, if so), I further certify that the engineering features of each such emissions unit described in this application have been designed or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application.

(5) If the purpose of this application is to obtain an initial air operation permit or operation permit revision or renewal for one or more newly constructed or modified emissions units (check here ☐, if so), I further certify that, with the exception of any changes detailed as part of this application, each such emissions unit has been constructed or modified in substantial accordance with the information given in the corresponding application for air construction permit and with all provisions contained in such permit.

Mark J. Aguilar
Signature

August 20, 2004
Date

(seal)

* Attach any exception to certification statement.

II. FACILITY INFORMATION

A. GENERAL FACILITY INFORMATION

Facility Location and Type

1. Facility UTM Coordinates... Zone **17** East (km) **434.0** North (km) **3283.4**		2. Facility Latitude/Longitude... Latitude (DD/MM/SS) **29/41/0** Longitude (DD/MM/SS) **81/40/45**	
3. Governmental Facility Code: **0**	4. Facility Status Code: **A**	5. Facility Major Group SIC Code: **26**	6. Facility SIC(s): **2611, 2621**
7. Facility Comment :			

Facility Contact

1. Facility Contact Name:
Myra Carpenter, Superintendent of Environmental Affairs

2. Facility Contact Mailing Address...
Organization/Firm: **Georgia-Pacific Corporation**
Street Address: **P.O. Box 919**
City: **Palatka** State: **FL** Zip Code: **32178-0919**

3. Facility Contact Telephone Numbers:
Telephone: **(386) 325-2001** ext. Fax: **(386) 328-0014**

4. Facility Contact Email Address: **myra.carpenter@gapac.com**

Facility Primary Responsible Official

Complete if an "application responsible official" is identified in Section I. that is not the facility "primary responsible official."

1. Facility Primary Responsible Official Name:

2. Facility Primary Responsible Official Mailing Address...
Organization/Firm:
Street Address:
City: State: Zip Code:

3. Facility Primary Responsible Official Telephone Numbers...
Telephone: ( ) - ext. Fax: ( ) -

4. Facility Primary Responsible Official Email Address:

Facility Regulatory Classifications

Check all that would apply *following* completion of all projects and implementation of all other changes proposed in this application for air permit. Refer to instructions to distinguish between a "major source" and a "synthetic minor source."

1. ☐ Small Business Stationary Source	☐ Unknown
2. ☐ Synthetic Non-Title V Source	
3. ☒ Title V Source	
4. ☒ Major Source of Air Pollutants, Other than Hazardous Air Pollutants (HAPs)	
5. ☐ Synthetic Minor Source of Air Pollutants, Other than HAPs	
6. ☒ Major Source of Hazardous Air Pollutants (HAPs)	
7. ☐ Synthetic Minor Source of HAPs	
8. ☒ One or More Emissions Units Subject to NSPS (40 CFR Part 60)	
9. ☐ One or More Emissions Units Subject to Emission Guidelines (40 CFR Part 60)	
10. ☒ One or More Emissions Units Subject to NESHAP (40 CFR Part 61 or Part 63)	
11. ☐ Title V Source Solely by EPA Designation (40 CFR 70.3(a)(5))	
12. Facility Regulatory Classifications Comment:	

List of Pollutants Emitted by Facility

1. Pollutant Emitted	2. Pollutant Classification	3. Emissions Cap [Y or N]?
PM (Particulate Matter - Total)	**A**	**N**
PM_{10} (Particulate Matter - PM)	**A**	**N**
SO_2 (Sulfur Dioxide)	**A**	**N**
NO_x (Nitrogen Oxides)	**A**	**N**
CO (Carbon Monoxide)	**A**	**N**
VOC (Volatile Organic Compounds)	**A**	**N**
SAM (Sulfuric Acid Mist)	**A**	**N**
TRS (Total Reduced Sulfur)	**A**	**N**
H001 (Acetaldehyde)	**A**	**N**
H021 (Beryllium Compounds)	**B**	**N**
H043 (Chloroform)	**A**	**N**
H095 (Formaldehyde)	**A**	**N**
H106 (Hydrochloric Acid)	**A**	**N**
H115 (Methanol)	**A**	**N**
HAPs (Total Hazardous Air Pollutants)	**A**	**N**

B. EMISSIONS CAPS

Facility-Wide or Multi-Unit Emissions Caps

1. Pollutant Subject to Emissions Cap	2. Facility Wide Cap [Y or N]? (all units)	3. Emissions Unit ID No.s Under Cap (if not all units)	4. Hourly Cap (lb/hr)	5. Annual Cap (ton/yr)	6. Basis for Emissions Cap

7. Facility-Wide or Multi-Unit Emissions Cap Comment:

C. FACILITY ADDITIONAL INFORMATION

Additional Requirements for All Applications, Except as Otherwise Stated

1.	Facility Plot Plan: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☒ Attached, Document ID:**Figure 3-2** ☐ Previously Submitted, Date:_____
2.	Process Flow Diagram(s): (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☒ Attached, Document ID:**Figure 3-3** ☐ Previously Submitted, Date:_____
3.	Precautions to Prevent Emissions of Unconfined Particulate Matter: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☒ Attached, Document ID **Application Summary** ☐ Previously Submitted, Date:_____

Additional Requirements for Air Construction Permit Applications

1.	Area Map Showing Facility Location: ☒ Attached, Document ID:**Figure 3-1** ☐ Not Applicable (existing permitted facility)
2.	Description of Proposed Construction or Modification: ☒ Attached, Document ID:**Application Summary**
3.	Rule Applicability Analysis: ☒ Attached, Document ID: **Application Summary**
4.	List of Exempt Emissions Units (Rule 62-210.300(3)(a) or (b)1., F.A.C.): ☒ Attached, Document ID: **Application Summary** ☐ Not Applicable (no exempt units at facility)
5.	Fugitive Emissions Identification (Rule 62-212.400(2), F.A.C.): ☒ Attached, Document ID: **Application Summary** ☐ Not Applicable
6.	Preconstruction Air Quality Monitoring and Analysis (Rule 62-212.400(5)(f), F.A.C.): ☒ Attached, Document ID:**Attachment C** ☐ Not Applicable
7.	Ambient Impact Analysis (Rule 62-212.400(5)(d), F.A.C.): ☒ Attached, Document ID: **Attachment C** ☐ Not Applicable
8.	Air Quality Impact since 1977 (Rule 62-212.400(5)(h)5., F.A.C.): ☒ Attached, Document ID: **Attachment C** ☐ Not Applicable
9.	Additional Impact Analyses (Rules 62-212.400(5)(e)1. and 62-212.500(4)(e), F.A.C.): ☒ Attached, Document ID: **Attachment C** ☐ Not Applicable
10.	Alternative Analysis Requirement (Rule 62-212.500(4)(g), F.A.C.): ☐ Attached, Document ID:_____ ☒ Not Applicable

Additional Requirements for FESOP Applications

1. List of Exempt Emissions Units (Rule 62-210.300(3)(a) or (b)1., F.A.C.): ☐ Attached, Document ID:_____ ☐ Not Applicable (no exempt units at facility)

Additional Requirements for Title V Air Operation Permit Applications

1. List of Insignificant Activities (Required for initial/renewal applications only): ☐ Attached, Document ID:_____ ☐ Not Applicable (revision application)
2. Identification of Applicable Requirements (Required for initial/renewal applications, and for revision applications if this information would be changed as a result of the revision being sought): ☐ Attached, Document ID:_____ ☐ Not Applicable (revision application with no change in applicable requirements)
3. Compliance Report and Plan (Required for all initial/revision/renewal applications): ☐ Attached, Document ID:_____ Note: A compliance plan must be submitted for each emissions unit that is not in compliance with all applicable requirements at the time of application and/or at any time during application processing. The department must be notified of any changes in compliance status during application processing.
4. List of Equipment/Activities Regulated under Title VI (If applicable, required for initial/renewal applications only): ☐ Attached, Document ID:_____ ☐ Equipment/Activities On site but Not Required to be Individually Listed ☐ Not Applicable
5. Verification of Risk Management Plan Submission to EPA (If applicable, required for initial/renewal applications only) : ☐ Attached, Document ID:_____ ☐ Not Applicable
6. Requested Changes to Current Title V Air Operation Permit: ☐ Attached, Document ID:_____ ☐ Not Applicable

Additional Requirements Comment

III. EMISSIONS UNIT INFORMATION

Title V Air Operation Permit Application - For Title V air operation permitting only, emissions units are classified as regulated, unregulated, or insignificant. If this is an application for Title V air operation permit, a separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each regulated and unregulated emissions unit addressed in this application for air permit. Some of the subsections comprising the Emissions Unit Information Section of the form are optional for unregulated emissions units. Each such subsection is appropriately marked. Insignificant emissions units are required to be listed at Section II, Subsection C.

Air Construction Permit or FESOP Application - For air construction permitting or federally enforceable state air operation permitting, emissions units are classified as either subject to air permitting or exempt from air permitting. The concept of an "unregulated emissions unit" does not apply. If this is an application for air construction permit or FESOP, a separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each emissions unit subject to air permitting addressed in this application for air permit. Emissions units exempt from air permitting are required to be listed at Section II, Subsection C.

Air Construction Permit and Revised/Renewal Title V Air Operation Permit Application – Where this application is used to apply for both an air construction permit and a revised/renewal Title V air operation permit, each emissions unit is classified as either subject to air permitting or exempt from air permitting for air construction permitting purposes and as regulated, unregulated, or insignificant for Title V air operation permitting purposes. **The air construction permitting classification must be used to complete the Emissions Unit Information Section of this application for air permit.** A separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each emissions unit subject to air permitting addressed in this application for air permit. Emissions units exempt from air construction permitting and insignificant emissions units are required to be listed at Section II, Subsection C.

If submitting the application form in hard copy, the number of this Emissions Unit Information Section and the total number of Emissions Unit Information Sections submitted as part of this application must be indicated in the space provided at the top of each page.

A. GENERAL EMISSIONS UNIT INFORMATION

Title V Air Operation Permit Emissions Unit Classification

1. Regulated or Unregulated Emissions Unit? (Check one, if applying for an initial, revised or renewal Title V air operation permit. Skip this item if applying for an air construction permit or FESOP only.)

☒ The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

☐ The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

Emissions Unit Description and Status

1. Type of Emissions Unit Addressed in this Section: (Check one)

☒ This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

☐ This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

☐ This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

2. Description of Emissions Unit Addressed in this Section: **No. 4 Lime Kiln**

3. Emissions Unit Identification Number: **017**

4. Emissions Unit Status Code: **A**	5. Commence Construction Date:	6. Initial Startup Date:	7. Emissions Unit Major Group SIC Code: **26**	8. Acid Rain Unit? ☐ Yes ☒ No

9. Package Unit:
Manufacturer: Model Number:

10. Generator Nameplate Rating: MW

11. Emissions Unit Comment:

Emissions Unit Control Equipment

1. Control Equipment/Method(s) Description: **Venturi scrubber**
2. Control Device or Method Code(s): **053**

B. EMISSIONS UNIT CAPACITY INFORMATION

(Optional for unregulated emissions units.)

Emissions Unit Operating Capacity and Schedule

1. Maximum Process or Throughput Rate:

2. Maximum Production Rate:

3. Maximum Heat Input Rate: **140** million Btu/hr

4. Maximum Incineration Rate: pounds/hr
tons/day

5. Requested Maximum Operating Schedule:
24 hours/day **7** days/week
52 weeks/year **8,760** hours/year

6. Operating Capacity/Schedule Comment:

Maximum Heat Input Rate based on 933 gal/hr of No. 6 fuel oil and 150,000 Btu/gal.

Maximum Process/Throughput Rate: Total Kiln Production 19.44 tons reburned lime per hour

C. EMISSION POINT (STACK/VENT) INFORMATION
(Optional for unregulated emissions units.)

Emission Point Description and Type

1. Identification of Point on Plot Plan or Flow Diagram: **017**	2. Emission Point Type Code: **1**
3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking:	
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common:	

5. Discharge Type Code: **V**	6. Stack Height: **131** feet	7. Exit Diameter: **4.4** feet
8. Exit Temperature: **164** °F	9. Actual Volumetric Flow Rate: **58,900** acfm	10. Water Vapor: **34** %

11. Maximum Dry Standard Flow Rate: **44,500 dscfm @ 10% oxygen**	12. Nonstack Emission Point Height: feet
13. Emission Point UTM Coordinates... Zone: East (km): North (km):	14. Emission Point Latitude/Longitude... Latitude (DD/MM/SS) Longitude (DD/MM/SS)

15. Emission Point Comment:

Maximum Dry Standard Flow Rate is @ 10 percent oxygen.
Actual volumetric flow rate and Exit temperature reflect observations at highest tested production rate.

D. SEGMENT (PROCESS/FUEL) INFORMATION

Segment Description and Rate: Segment 1 of 2

1. Segment Description (Process/Fuel Type): **Pulp and Paper and Wood Products, Sulfate (Kraft) Pulping, Lime Kiln: General**		
2. Source Classification Code (SCC): **3-07-001-06**	3. SCC Units: **Tons Air-dried Unbleached Pulp Produced**	
4. Maximum Hourly Rate: **118**	5. Maximum Annual Rate: **675,250**	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit:
10. Segment Comment: **Maximum annual rate is based on maximum daily rate of 1,850 tons/day ADUP (monthly average).** **Throughput is equivalent to 19.44 tons/hr CaO lime production.**		

Segment Description and Rate: Segment 2 of 2

1. Segment Description (Process/Fuel Type): **In-Process Fuel Use: Residual Oil, Lime Kiln**		
2. Source Classification Code (SCC): **3-90-004-03**	3. SCC Units: **Thousand Gallons Burned**	
4. Maximum Hourly Rate: **0.933**	5. Maximum Annual Rate: **8,173**	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur: **2.35**	8. Maximum % Ash:	9. Million Btu per SCC Unit: **150**
10. Segment Comment: **Residual oil may include No. 6 fuel oil and on spec used oil.**		

E. EMISSIONS UNIT POLLUTANTS

List of Pollutants Emitted by Emissions Unit

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
PM	053		EL
PM_{10}	053		EL
SO_2		053	EL
NO_X			EL
CO			EL
VOC			EL
TRS			EL
PB			NS
H001 (Acetaldehyde)			NS
H004 (Acetophenone)			NS
H006 (Acrolein)			NS
H015 (Arsenic)			NS
H017 (Benzene)			NS
H021 (Beryllium)			NS
H027 (Cadmium)			NS
H033 (Carbon Tetrachloride)			NS
H034 (Carbonyl Sulfide)			NS
H041 (Chlorobenzene)			NS
H043 (Chloroform)			NS
H046 (Chromium)			NS
H047 (Cobalt)			NS
H050 (o-Cresol)			NS

E. EMISSIONS UNIT POLLUTANTS

List of Pollutants Emitted by Emissions Unit (continued)

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
H051 (m-Cresol)			**NS**
H053 (Cumene)			**NS**
H085 (Ethyl Benzene)			**NS**
H089 (1,2-Dichloroethane)			**NS**
H095 (Formaldehyde)			**NS**
H100 (Hexachlorocyclopentadiene)			**NS**
H104 (n-Hexane)			**NS**
H106 (Hydrogen Chloride)			**NS**
H113 (Manganese)			**NS**
H114 (Mercury)			**NS**
H115 (Methanol)			**NS**
H118 (Chloromethane)			**NS**
H119 (1,1,1-Trichloroethane)			**NS**
H120 (Methyl Ethyl Ketone)			**NS**
H123 (Methyl Isobutyl Ketone)			**NS**
H128 (Methylene Chloride)			**NS**
H132 (Naphthalene)			**NS**
H133 (Nickel)			**NS**
H144 (Phenol)			**NS**
H162 (Selenium)			**NS**
H163 (Styrene)			**NS**
H167 (Tetrachloroethylene)			**NS**
H169 (Toluene)			**NS**
H174 (1,2,4-Trichlorobenzene)			**NS**
H175 (1,1,2-Trichloroethane)			**NS**
H176 (Trichloroethylene)			**NS**
H182 (Vinyl Acetate)			**NS**
H186 (m,p-Xylene)			**NS**
H187 (o-Xylene)			**NS**
HAPs			**NS**

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **PM**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **30.9** lb/hour **135.3** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **0.081 gr/dscf** Reference: **Existing limit**	7. Emissions Method Code: **0**

8. Calculation of Emissions:

0.081 gr/dscf x 44,500 dscf/min x 60 min/hr ÷ 7,000 gr/lb = 30.9 lb/hr

Flowrate and emission factor conditions are set to 10% oxygen

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **0.081 gr/dscf @ 10 percent O_2**	4. Equivalent Allowable Emissions: **30.9** lb/hour **135.3** tons/year
5. Method of Compliance: **Annual stack test using EPA Method 5.**	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions ____ of ____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions ____ of ____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **PM_{10}**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **30.9** lb/hour **135.3** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **0.081 gr/dscf @ 10 percent O_2** Reference: **Existing limit**	7. Emissions Method Code: **0**

8. Calculation of Emissions:

Flow rate = 44,500 dscfm (@ 10% oxygen)
Mass emission rate = 0.081 gr/dscf x 44,500 dscf/min x 60 mins/hour = 30.9 lbs/hour (135.3 tpy)

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

GP Proposes to retain the emission limit of 0.081 gr/dscf@10% oxygen. However, GP proposes to replace the 26.0 lb/hr and 113.9 tpy emission limts with 30.9 lbs/hr and 135.3 tpy.

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **0.081 gr/dscf @ 10 percent O_2**	4. Equivalent Allowable Emissions: **30.9** lb/hour **135.3** tons/year
5. Method of Compliance: **Annual stack test using EPA Method 5.**	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions __ of __

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **TRS**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **4.7** lb/hour **20.7** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **20 ppmvd** Reference: **BACT limit**	7. Emissions Method Code: **2**

8. Calculation of Emissions:

Based on 20 ppmvd at 10% oxygen (existing limit)

PV=nRT, where n=mass/molecular weight (MW)

Therefore, mass/volume (V) = P x MW/R x T

P = pressure = 1 atmosphere x 14.7 lb/in^2/atmosphere x 144 in^2/ft^2 x = 2116.8 lb/ft^2

T = temperature = 68 degrees Fahrenheit (°F) = 528 R; R = 1545.6 ft-lb$_f$/lb mole-R

Flow rate = 44,500 dscfm (@ 10% oxygen)

Corresponding mass emission limits are calculated as follows:

(20 ft^3 TRS/10^6 ft^3 air x 2116.8 lb/ft^2 x 34.1 lb/lb-mole)/(1545.6 ft-lb$_f$/lb mole-R x 528 R)
= 1.77 x 10^{-6} lb/ft^3

Mass emission rate = 1.77 x 10^{-6} lb/ft^3 x 44,500 dscf/min x 60 mins/hour = 4.7 lbs/hour (20.7 tpy)

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

GP proposes to retain the emission limit 20 ppmvd @10% oxygen. GP proposes to replace the current permit allowable of 4.0 lbs/hr and 17.5 tpy with 4.7 lbs/hr and 20.7 tpy.

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: **BACT**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **20 ppmvd**	4. Equivalent Allowable Emissions: **4.7** lb/hour **20.7** tons/year
5. Method of Compliance: **EPA Method 16 or 16A**	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **SO2**	2. Total Percent Efficiency of Control: **50%**
3. Potential Emissions: **9.1** lb/hour **40.0** tons/year	4. Synthetically Limited? ☐ Yes ☒ No

5. Range of Estimated Fugitive Emissions (as applicable):
to tons/year

6. Emission Factor: **0.47 lb / ton CaO** Reference: **NCASI Techincal Bulletin 646**	7. Emissions Method Code: **5**

8. Calculation of Emissions:

0.47 lb SO2/ton CaO represents the average of source testing results by NCASI for oil-fired kilns equipped with a wet scrubber

SO2 emissions = 0.47 lb SO2/ton CaO x 19.44 ton CaO/hr = 9.1 lbs/hour (40 tpy)

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

GP proposes to replace the current SO2 emission limits of 10.9 lb/hr and 47.7 tpy to 9.1 lbs/hr and 40 tons/yr.

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: **ESCPSD**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **9.1 lb/hr**	4. Equivalent Allowable Emissions: **9.1** lb/hour **40.0** tons/year
5. Method of Compliance: **EPA Method 8**	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **NOX**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **87.6** lb/hour **383.7** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **275 ppmvd** Reference: BACT	7. Emissions Method Code: **2**

8. Calculation of Emissions:

Based on 275 ppmvd at 10% oxygen (lowered from existing limit of 290 ppmvd)

PV=nRT, where n=mass/molecular weight (MW)

Therefore, mass/volume (V) = P x MW/R x T

P = pressure = 1 atmosphere x 14.7 lb/in^2/atmosphere x 144 in^2/ft^2 x = 2116.8 lb/ft^2

T = temperature = 68 degrees Fahrenheit (°F) = 528 R; R = 1545.6 ft-lb$_f$/lb mole-R

Flow rate = 44,500 dscfm (@ 10% oxygen)

Corresponding mass emission limits are calculated as follows:

(275 ft^3 NO$_x$/10^6 ft^3 air x 2116.8 lb/ft^2 x 46 lb/lb-mole)/(1545.6 ft-lb$_f$/lb mole-R x 528 R)

= 3.28 x 10^{-5} lb NOx /ft^3

Mass emission rate = 3.28 x 10^{-5} lb/ft^3 x 44,500 dscf/min x 60 mins/hour = 87.6 lbs/hour (383.7 tpy)

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

GP proposes to replace the current emission limit of 290 ppmvd to 275 ppmvd. GP also proposes to replace the current limits of 50.3 lb/hr and 223.3 tpy with 87.6 lb/hr and 383.7 tpy.

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: **AMBIENT**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **275 ppmvd**	4. Equivalent Allowable Emissions: **87.6** lb/hour **383.7** tons/year
5. Method of Compliance: **EPA Method 7E**	
6. Allowable Emissions Comment (Description of Operating Method): **By restricting the NOx emissions below the current permit limit of 290 ppmvd to 275 ppmvd, the net emissions increase associated with the project will cause a predicted ambient impact below the modeling significant impact level.**	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **CO**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **13.4** lb/hour **58.6** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **69 ppmvd** Reference:	7. Emissions Method Code: **2**

8. Calculation of Emissions:

Based on 69 ppmvd at 10% oxygen (existing limit)
PV=nRT, where n=mass/molecular weight (MW)
Therefore, mass/volume (V) = P x MW/R x T
P = pressure = 1 atmosphere x 14.7 lb/in^2/atmosphere x 144 in^2/ft^2 x = 2116.8 lb/ft^2
T = temperature = 68 degrees Fahrenheit (°F) = 528 R; R = 1545.6 ft-lb$_f$/lb mole-R
Flow rate = 44,500 dscfm (@ 10% oxygen)
(69 ft^3 CO/10^6 ft^3 air x 2116.8 lb/ft^2 x 28 lb/lb-mole)/(1545.6 ft-lb$_f$/lb mole-R x 528 R)
= 5.01 x 10^{-6} lb/ft^3
Mass emission rate = 5.01 x 10^{-6} lb/ft^3 x 44,500 dscf/min x 60 mins/hour = 13.4 lbs/hour (58.6 tpy)

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

GP proposes to retain the emission limit 69 ppmvd @10% oxygen. GP proposes to replace the current permit allowable of 7.3 lbs/hr and 32 tpy with 13.4 lbs/hr and 58.6 tpy.

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: **RULE**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **69 ppmvd**	4. Equivalent Allowable Emissions: **13.4** lb/hour **58.6** tons/year
5. Method of Compliance: **EPA Method 10**	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **SAM**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **0.44** lb/hour **1.9** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **4% of SO2 emissions** Reference:	7. Emissions Method Code: **2**

8. Calculation of Emissions:

Assume 4% of sulfur dioxide is sulfates

9.1 lbs/hour x 0.04 = 0.36 lb/hour (as sulfates)

SAM rate = 0.36 lb/hour x 98 lbs SAM/lb-mole SAM x lb-mole SAM/lb-mole SO_3 x lb-mole SO_3/80 lbs SO_3 = 0.44 lb/hour (1.9 tpy) SAM

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **VOC**

2. Total Percent Efficiency of Control:

3. Potential Emissions: **20.5** lb/hour **89.8** tons/year

4. Synthetically Limited? ☐ Yes ☒ No

5. Range of Estimated Fugitive Emissions (as applicable): to tons/year

6. Emission Factor: **185 ppmvd**
Reference: BACT

7. Emissions Method Code: **2**

8. Calculation of Emissions:

Based on 185 ppmvd at 10% oxygen (existing limit)

PV=nRT, where n=mass/molecular weight (MW)
Therefore, mass/volume (V) = P x MW/R x T
P = pressure = 1 atmosphere x 14.7 lb/in^2/atmosphere x 144 in^2/ft^2 x = 2116.8 lb/ft^2
T = temperature = 68 degrees Fahrenheit (°F) = 528 R; R = 1545.6 ft-lb$_f$/lb mole-R
Flow rate = 44,500 dscfm (@ 10% oxygen)

(185 ft^3 VOC/10^6 ft^3 air x 2116.8 lb/ft^2 x 16 lb/lb-mole)/(1545.6 ft-lb$_f$/lb mole-R x 528 R)
= 7.68 x 10^{-6} lb/ft^3
Mass emission rate = 7.68 x 10^{-6} lb/ft^3 x 44,500 dscf /min x 60 mins/hour = 20.5 lbs/hour (89.8 tpy)

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

GP proposes to retain the emission limit 185 ppmvd @10% oxygen. GP proposes to replace the current permit allowable of 17.2 lbs/hr and 75.3 tpy with 20.5 lbs/hr and 89.8 tpy.

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: **BACT**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **185 ppmvd**	4. Equivalent Allowable Emissions: **20.5** lb/hour **89.8** tons/year
5. Method of Compliance: **EPA Method 25A and 3Aor 3B**	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **PB**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **0.0041** lb/hour **0.018** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **0.00021 lb Pb/ton CaO** Reference: **NCASI Technical Bulletin 701, Table 14A**	7. Emissions Method Code: **5**

8. Calculation of Emissions:

Updated factors to match NCASI Technical Bulletin 701, Table 14A; details provided in attached HAP tables

19.44 tons CaO/hour x 2.1 x 10^{-4} lb Pb/ton CaO = 0.0041 lb/hour (0.018 tpy)

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H001**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **1.9E-02** lb/hour **0.082** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **9.60E-04 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**

8. Calculation of Emissions:

0.00096 lb/ton CaO x 19.44 ton CaO/hr = 0.019 lb/hr (0.082 tons/yr)

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H004**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **0.11** lb/hour **0.47** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **5.50E-03 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.0055 lb/ton CaO x 19.44 ton CaO/hr = 0.11 lb/hr (0.47 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H006**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **4.08E-02** lb/hour **0.18** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **2.10E-03 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.0021 lb/ton CaO x 19.44 ton CaO/hr = 0.0408 lb/hr (0.18 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H015**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **2.33E-03** lb/hour **1.0E-02** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **1.20E-04 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.00012 lb/ton CaO x 19.44 ton CaO/hr = 0.00233 lb/hr (0.01 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H017**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **0.13** lb/hour **0.56** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **6.60E-03 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**

8. Calculation of Emissions:

0.0066 lb/ton CaO x 19.44 ton CaO/hr = 0.13 lb/hr (0.56 tons/yr)

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H021**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **1.94E-04** lb/hour **8.5 E-04** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **1.00E-05 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.00001 lb/ton CaO x 19.44 ton CaO/hr = 0.000194 lb/hr (0.00085 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H027**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **1.13E-04** lb/hour **4.94E-04** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **5.80E-06 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.0000058 lb/ton CaO x 19.44 ton CaO/hr = 0.00011 lb/hr (0.00049 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H033**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **2.9E-02** lb/hour **0.13** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **1.50E-03 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.0015 lb/ton CaO x 19.44 ton CaO/hr = 0.029 lb/hr (0.13 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H034**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **7.6 E-02** lb/hour **0.33** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: 3.90E-03 lb/ton air dried unbleached pulp Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**

8. Calculation of Emissions:

0.0039 lb/ton CaO x 19.44 ton CaO/hr = 0.076 lb/hr (0.33 tons/yr)

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H041**
2. Total Percent Efficiency of Control:
3. Potential Emissions: **8.9E-03** lb/hour **0.039** tons/year
4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year
6. Emission Factor: **4.60E-04 lb/ton air dried unbleached pulp**

Reference: **NCASI Technical Bulletin # 701**

7. Emissions Method Code: **5**
8. Calculation of Emissions:

0.00046 lb/ton CaO x 19.44 ton CaO/hr = 0.0089 lb/hr (0.039 tons/yr)

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H043**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **4.1 E-03** lb/hour **0.018** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **2.10E-04 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.00021 lb/ton CaO x 19.44 ton CaO/hr = 0.0041 lb/hr (0.018 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H046**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **3.9E-03** lb/hour **1.70E-02** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **2.00E-04 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.0002 lb/ton CaO x 19.44 ton CaO/hr = 0.0039 lb/hr (0.017 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H047**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **4.5 E-05** lb/hour **2.0 E-04** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **2.30E-06 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.0000023 lb/ton CaO x 19.44 ton CaO/hr = 0.000045 lb/hr (0.0002 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions
Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H050**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **9.1 E-02** lb/hour **0.40** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **4.70E-03 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**

8. Calculation of Emissions:

0.0047 lb/ton CaO x 19.44 ton CaO/hr = 0.091 lb/hr (0.4 tons/yr)

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: H051	2. Total Percent Efficiency of Control:
3. Potential Emissions: **1.85E-01** lb/hour **0.81** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **9.50E-03 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.0095 lb/ton CaO x 19.44 ton CaO/hr = 0.185 lb/hr (0.81 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H053**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **0.11** lb/hour **0.47** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **5.50E-03 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.0055 lb/ton CaO x 19.44 ton CaO/hr = 0.11 lb/hr (0.47 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H085**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **2.92E-02** lb/hour **0.13** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **1.50E-03 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.0015 lb/ton CaO x 19.44 ton CaO/hr = 0.029 lb/hr (0.128 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H089**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **7.2E-03** lb/hr **0.032** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **3.70E-04 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.00037 lb/ton CaO x 19.44 ton CaO/hr = 0.0072 lb/hr (0.032 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H095**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **2.33E-01** lb/hour **1.02** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **1.20E-02 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.012 lb/ton CaO x 19.44 ton CaO/hr = 0.233 lb/hr (1.02 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H100**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **1.94E-01** lb/hour **0.85** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **1.00E-02 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.01 lb/ton CaO x 19.44 ton CaO/hr = 0.194 lb/hr (0.85 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H104**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **9.33E-03** lb/hour **0.041** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **4.80E-04 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.00048 lb/ton CaO x 19.44 ton CaO/hr = 0.0093 lb/hr (0.041 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H106**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **3.7E-02** lb/hour **0.16** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **1.90E-03 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: 0.0019 lb/ton CaO x 19.44 ton CaO/hr = 0.037 lb/hr (0.16 tons/yr)	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H113**

2. Total Percent Efficiency of Control:

3. Potential Emissions: **5.83E-03** lb/hour **2.6 E-02** tons/year

4. Synthetically Limited? ☐ Yes ☒ No

5. Range of Estimated Fugitive Emissions (as applicable): to tons/year

6. Emission Factor: **3.00E-04 lb/ton air dried unbleached pulp**

Reference: **NCASI Technical Bulletin # 701**

7. Emissions Method Code: **5**

8. Calculation of Emissions:

0.0003 lb/ton CaO x 19.44 ton CaO/hr = 0.0058 lb/hr (0.026 tons/yr)

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H114**

2. Total Percent Efficiency of Control:

3. Potential Emissions: **1.2E-05** lb/hour **5.3 E-05** tons/year

4. Synthetically Limited? ☐ Yes ☒ No

5. Range of Estimated Fugitive Emissions (as applicable):
to tons/year

6. Emission Factor: **6.20E-07 lb/ton air dried unbleached pulp**
Reference: **NCASI Technical Bulletin # 701**

7. Emissions Method Code: **5**

8. Calculation of Emissions:

0.00000062 lb/ton CaO x 19.44 ton CaO/hr = 0.000012 lb/hr (0.000053 tons/yr)

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H115**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **1.6E-01** lb/hour **0.68** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **8.00E-03 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.008 lb/ton CaO x 19.44 ton CaO/hr = 0.16 lb/hr (0.68 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H118**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **3.30E-02** lb/hour **0.145** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **1.70E-03 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.0017 lb/ton CaO x 19.44 ton CaO/hr = 0.033 lb/hr (0.145 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H119**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **1.56E-03** lb/hour **0.007** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **8.00E-05 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.00008 lb/ton CaO x 19.44 ton CaO/hr = 0.002 lb/hr (0.007 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H120**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **3.38** lb/hour **14.8** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **1.74E-01 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.174 lb/ton CaO x 19.44 ton CaO/hr = 3.38 lb/hr (14.8 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H123**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **2.5 E-02** lb/hour **0.11** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **1.30E-03 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.0013 lb/ton CaO x 19.44 ton CaO/hr = 0.025 lb/hr (0.111 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H128**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **4.5E-03** lb/hour **0.020** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **2.30E-04 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.00023 lb/ton CaO x 19.44 ton CaO/hr = 0.0045 lb/hr (0.02 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H132**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **2.5E-01** lb/hour **1.11** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **1.30E-02 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.013 lb/ton CaO x 19.44 ton CaO/hr = 0.25 lb/hr (1.11 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H133**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **1.9 E-03** lb/hour **8.0E-03** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **9.50E-05 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: 5
8. Calculation of Emissions: **0.000095 lb/ton CaO x 19.44 ton CaO/hr = 0.0019 lb/hr (0.008 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H144**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **3.11E-01** lb/hour **1.36** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **1.60E-02 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.016 lb/ton CaO x 19.44 ton CaO/hr = 0.311 lb/hr (1.36 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H162**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **5.1E-05** lb/hour **2.2E-04** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **2.60E-06 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.0000026 lb/ton CaO x 19.44 ton CaO/hr = 0.000051 lb/hr (0.00022 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H163**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **3.1 E-02** lb/hour **0.14** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: 1.60E-03 lb/ton air dried unbleached pulp Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.0016 lb/ton CaO x 19.44 ton CaO/hr = 0.031 lb/hr (0.14 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H167**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **1.03E-01** lb/hour **0.45** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **5.30E-03 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.0053 lb/ton CaO x 19.44 ton CaO/hr = 0.103 lb/hr (0.45 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H169**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **4.7E-01** lb/hour **2.04** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **2.04E-02 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.024 lb/ton CaO x 19.44 ton CaO/hr = 0.47 lb/hr (2.04 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H174**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **9.14E-01** lb/hour **4.00** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **4.70E-02 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.047 lb/ton CaO x 19.44 ton CaO/hr = 0.914 lb/hr (4.0 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H175**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **7.4 E-03** lb/hour **0.032** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: 3.80E-04 lb/ton air dried unbleached pulp Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.00038 lb/ton CaO x 19.44 ton CaO/hr = 0.0074 lb/hr (0.032 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H176**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **7.2 E-03** lb/hour **0.032** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **3.70E-04 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.00037 lb/ton CaO x 19.44 ton CaO/hr = 0.0072 lb/hr (0.032 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H182**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **1.6E-03** lb/hour **0.007** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **8.00E-05 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**

8. Calculation of Emissions:

0.00008 lb/ton CaO x 19.44 ton CaO/hr = 0.0016 lb/hr (0.007 tons/yr)

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H186**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **1.11E-01** lb/hour **0.49** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **5.70E-03 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.0057 lb/ton CaO x 19.44 ton CaO/hr = 0.111 lb/hr (0.49 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **H187**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **2.6** lb/hour **11.2** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **1.32E-01 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **0.132 lb/ton CaO x 19.44 ton CaO/hr = 2.6 lb/hr (11.2 tons/yr)**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **HAPS**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **9.69** lb/hour **42.5** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **4.99 E-01 lb/ton air dried unbleached pulp** Reference: **NCASI Technical Bulletin # 701**	7. Emissions Method Code: **5**
8. Calculation of Emissions: **Note emission factor for total HAPs is the sum of individual HAP emission factors.** 0.499 lb/ton CaO x 19.44 ton CaO/hr = 9.69 lb/hr (42.5 tons/yr)	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

G. VISIBLE EMISSIONS INFORMATION

Complete if this emissions unit is or would be subject to a unit-specific visible emissions limitation.

Visible Emissions Limitation: Visible Emissions Limitation 1 of 1

1. Visible Emissions Subtype: **VE20**	2. Basis for Allowable Opacity: ☒ Rule ☐ Other
3. Allowable Opacity: Normal Conditions: **20** % Exceptional Conditions: % Maximum Period of Excess Opacity Allowed: min/hour	
4. Method of Compliance: **DEP Method 9**	
5. Visible Emissions Comment: **Due to moisture interference, the visible emission limiting standard pursuant to F.A.C. Rule 62-296.320(4) is not applicable and is deferred to F.A.C. Rule 62-296.404(2)(b).**	

Visible Emissions Limitation: Visible Emissions Limitation _____ of _____

1. Visible Emissions Subtype:	2. Basis for Allowable Opacity: ☐ Rule ☐ Other
3. Allowable Opacity: Normal Conditions: % Exceptional Conditions: % Maximum Period of Excess Opacity Allowed: min/hour	
4. Method of Compliance:	
5. Visible Emissions Comment:	

H. CONTINUOUS MONITOR INFORMATION

Complete if this emissions unit is or would be subject to continuous monitoring.

Continuous Monitoring System: Continuous Monitor 1 of 2

1. Parameter Code: **EM**	2. Pollutant(s): **TRS**	
3. CMS Requirement:	☒ Rule	☐ Other
4. Monitor Information... Manufacturer: **Thermal Environmental Instrument, Inc** Model Number: **Not Applicable**	Serial Number: **Not Applicable**	
5. Installation Date: **Dec 2000**	6. Performance Specification Test Date:	
7. Continuous Monitor Comment: **Monitor information describes equipment in operation. GP reserves the right to replace this equipment as maintenance,**		

Continuous Monitoring System: Continuous Monitor 2 of 2

1. Parameter Code: **O_2**	2. Pollutant(s):	
3. CMS Requirement:	☒ Rule	☐ Other
4. Monitor Information... Manufacturer: **Thermal Environmental Instrument, Inc** Model Number: **320B**	Serial Number: **Not available**	
5. Installation Date: **Dec 2000**	6. Performance Specification Test Date:	
7. Continuous Monitor Comment: **Rule 62-296.404(5)(a). Monitor information describes equipment in operation. G-P reserves the right to replace this equipment as maintenance may require.**		

I. EMISSIONS UNIT ADDITIONAL INFORMATION

Additional Requirements for All Applications, Except as Otherwise Stated

1. Process Flow Diagram (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
☒ Attached, Document ID: **Figure 3-3** ☐ Previously Submitted, Date _____

2. Fuel Analysis or Specification (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
☐ Attached, Document ID: _____ ☒ Previously Submitted, Date _____

3. Detailed Description of Control Equipment (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
☐ Attached, Document ID: _____ ☒ Previously Submitted, Date **April 2003**

4. Procedures for Startup and Shutdown (Required for all operation permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
☐ Attached, Document ID: _____ ☐ Previously Submitted, Date _____
☒ Not Applicable (construction application)

5. Operation and Maintenance Plan (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
☐ Attached, Document ID: _____ ☐ Previously Submitted, Date _____
☒ Not Applicable

6. Compliance Demonstration Reports/Records
☐ Attached, Document ID: _____
Test Date(s)/Pollutant(s) Tested: _____

☐ Previously Submitted, Date: _____
Test Date(s)/Pollutant(s) Tested: _____

☐ To be Submitted, Date (if known): _____
Test Date(s)/Pollutant(s) Tested: _____

☒ Not Applicable

Note: For FESOP applications, all required compliance demonstration records/reports must be submitted at the time of application. For Title V air operation permit applications, all required compliance demonstration reports/records must be submitted at the time of application, or a compliance plan must be submitted at the time of application.

7. Other Information Required by Rule or Statute
☒ Attached, Document ID: **Application Summary** ☐ Not Applicable

Additional Requirements for Air Construction Permit Applications

1. Control Technology Review and Analysis (Rules 62-212.400(6) and 62-212.500(7), F.A.C.; 40 CFR 63.43(d) and (e))
   ☒ Attached, Document ID: **Attachment D** ☐ Not Applicable
2. Good Engineering Practice Stack Height Analysis (Rule 62-212.400(5)(h)6., F.A.C., and Rule 62-212.500(4)(f), F.A.C.)
   ☒ Attached, Document ID: **Attachment C** ☐ Not Applicable
3. Description of Stack Sampling Facilities (Required for proposed new stack sampling facilities only)
   ☐ Attached, Document ID: _____ ☒ Not Applicable

Additional Requirements for Title V Air Operation Permit Applications

1. Identification of Applicable Requirements
   ☒ Attached, Document ID: **Application Summary** ☐ Not Applicable
2. Compliance Assurance Monitoring
   ☐ Attached, Document ID: _____ ☒ Not Applicable
3. Alternative Methods of Operation
   ☐ Attached, Document ID: _____ ☒ Not Applicable
4. Alternative Modes of Operation (Emissions Trading)
   ☐ Attached, Document ID: _____ ☒ Not Applicable
5. Acid Rain Part Application
   - ☐ Certificate of Representation (EPA Form No. 7610-1)
     - ☐ Copy Attached, Document ID: _____
   - ☐ Acid Rain Part (Form No. 62-210.900(1)(a))
     - ☐ Attached, Document ID: _____
     - ☐ Previously Submitted, Date: _____
   - ☐ Repowering Extension Plan (Form No. 62-210.900(1)(a)1.)
     - ☐ Attached, Document ID: _____
     - ☐ Previously Submitted, Date: _____
   - ☐ New Unit Exemption (Form No. 62-210.900(1)(a)2.)
     - ☐ Attached, Document ID: _____
     - ☐ Previously Submitted, Date: _____
   - ☐ Retired Unit Exemption (Form No. 62-210.900(1)(a)3.)
     - ☐ Attached, Document ID: _____
     - ☐ Previously Submitted, Date: _____
   - ☐ Phase II NOx Compliance Plan (Form No. 62-210.900(1)(a)4.)
     - ☐ Attached, Document ID: _____
     - ☐ Previously Submitted, Date: _____
   - ☐ Phase II NOx Averaging Plan (Form No. 62-210.900(1)(a)5.)
     - ☐ Attached, Document ID: _____
     - ☐ Previously Submitted, Date: _____
   - ☒ Not Applicable

Additional Requirements Comment

Attachment B
Emission Rate Calculations

Attachment B
Emission Rate Calculations
Palatka Mill, Lime Kiln – Shell Replacement

Emission Rate Calculations for Lime Kiln

Recent Stack Test Results

Pollutant	**Test Results (lbs/hour)**	
	2002	**2003**
Total Reduced Sulfur (TRS)	0.606	0.556
Sulfur Dioxide (SO_2)	1.06	4.3
Particulate Matter (PM)	9.51	11.94
Fine Particulate Matter (PM_{10})	8.18[1]	10.27[1]
Nitrogen Oxides (NO_x)	18.88	32.0
Carbon Monoxide (CO)	1.04	1.8
Volatile Organic Compounds (VOCs)	0.58	0.609

[1] PM_{10} assumed to be 86% of PM (from annual emissions reports).

Operating Hours:	2002	8,145 hours/year
	2003	7,763 hours/year
CaO Throughput	2002	107,017 tons/year
	2003	111,329 tons/year
	Maximum	170,294 tons/year (19.44 tons/hour)

Baseline Emissions (average 2002/2003 and based on average of recent stack tests and emission factors)

Total Reduced Sulfur (based on stack tests)

2002 0.606 lb/hour x 8,145 hours/year x ton/2000 lbs = 2.5 tpy
2003 0.556 lb/hour x 7,763 hours/year x ton/2000 lbs = 2.2 tpy

Average 2.3 tpy

Sulfur Dioxide

2002 1.06 lbs/hour x 8,145 hours/year x ton/2000 lbs = 4.3 tpy
2003 4.3 lbs/hour x 7,763 hours/year x ton/2000 lbs = 16.7 tpy

Average 10.5 tpy

Particulate Matter (total)

2002 9.51 lbs/hour x 8,145 hours/year x ton/2000 lbs = 38.7 tpy
2003 11.94 lbs/hour x 7,763 hours/year x ton/2000 lbs = 46.3 tpy

Average 42.5 tpy

Particulate Matter (PM_{10})

2002 8.18 lbs/hour x 8,145 hours/year x ton/2000 lbs = 33.3 tpy
2003 10.27 lbs/hour x 7,763 hours/year x ton/2000 lbs = 39.9 tpy

Average 36.6 tpy

Nitrogen Oxides

2002 18.88 lbs/hour x 8,145 hours/year x ton/2000 lbs = 76.9 tpy
2003 32.0 lbs/hour x 7,763 hours/year x ton/2000 lbs = 124.2 tpy

Average 100.6 tpy

Carbon Monoxide

2002 1.04 lbs/hour x 8,145 hours/year x ton/2000 lbs = 4.2 tpy
2003 1.8 lbs/hour x 7,763 hours/year x ton/2000 lbs = 7.0 tpy

Average 5.6 tpy

Volatile Organic Compounds

2002 0.58 lb/hour x 8,145 hours/year x ton/2000 lbs = 2.4 tpy
2003 0.609 lb/hour x 7 ,763 hours/year x ton/2000 lbs = 2.4 tpy

Average 2.4 tpy

Sulfuric Acid Mist

Calculated based on basis of 4% of sulfur dioxide being sulfates and then correcting the molecular weight for sulfuric acid mist

10.5 tpy (average) x 0.04 (4%) x 98/80 (ratio of molecular weights for H_2SO_4 and SO_3) = 0.51 tpy

Average = 0.51 tpy

Lead

Calculated based on current NCASI factor from Technical Bulletin 701 – see attached HAP spreadsheet for detailed explanation of emission factor

2002	107,017 tons CaO/year x 2.1 x 10^{-4} lbs/ton CaO x ton/2000 lbs = 0.011 tpy
2003	111,329 tons CaO/year x 2.1 x 10^{-4} lbs/ton CaO x ton/2000 lbs = 0.012 tpy
Average	*0.011 tpy*

Future Potential Emissions

For conversions from parts per million (ppm) to mass emission rates (lbs/hour), the following formula and factors are used:

PV=nRT, where n=mass/molecular weight (MW)

Therefore, mass/volume (V) = P x MW/R x T

P = pressure = 1 atmosphere x 14.7 lb/in^2/atmosphere x 144 in^2/ft^2 x = 2116.8 lb/ft^2
T = temperature = 68 degrees Fahrenheit (°F) = 528 R
R = 1545.6 ft-lb$_f$/lb mole-R
Flow rate (from testing; see discussion in Section 4 of main text) = 44,500 dscfm (@ 10% oxygen)

Total Reduced Sulfur

Based on 20 ppmvd at 10% oxygen (existing limit)

Corresponding mass emission limits are calculated as follows:

(20 ft^3 TRS/10^6 ft^3 air x 2116.8 lb/ft^2 x 34.1 lb/lb-mole)/(1545.6 ft-lb$_f$/lb mole-R x 528 R)
= 1.77 x 10^{-6} lb/ft^3

Mass emission rate = 1.77 x 10^{-6} lb/ft^3 x 44,500 dscf/min x 60 mins/hour = 4.7 lbs/hour (20.7 tpy)

Sulfur Dioxide

Based on 0.47 lb/ton CaO (NCASI TB 646, February 1993 – from Table 13, average of all of the oil-fired values – 0.18, 0.02, 0.45, 0.07, and 1.63 – average = 0.47 lb/ton CaO)

19.44 ton CaO/hour x 0.47 lb/ton CaO = 9.1 lbs/hour (40.0 tpy)

Particulate Matter (total)

Based on 0.081 gr/dscf at 10% oxygen (existing limit)

Corresponding mass emission limits are calculated as follows:

0.081 gr/dscf x 44,500 dscf/min x 60 mins/hour x lb/7000 grains = 30.9 lbs/hour (135.3 tpy)

Particulate Matter (PM$_{10}$)

Based on 0.081 gr/dscf at 10% oxygen (existing limit)

Corresponding mass emission limits are calculated as follows:

0.081 gr/dscf x 44,500 dscf/min x 60 mins/hour x lb/7000 grains = 30.9 lbs/hour (135.3 tpy)

Nitrogen Oxides

Based on 275 ppmvd at 10% oxygen (lowered from existing limit of 290 ppmvd)

Corresponding mass emission limits are calculated as follows:

(275 ft^3 NO_x/10^6 ft^3 air x 2116.8 lb/ft^2 x 46 lb/lb-mole)/(1545.6 ft-lb_f/lb mole-R x 528 R)
= 3.28 x 10^{-5} lb/ft^3

Mass emission rate = 3.28 x 10^{-5} lb/ft^3 x 44,500 dscf/min x 60 mins/hour = 87.6 lbs/hour (383.7 tpy)

Carbon Monoxide

Based on 69 ppmvd at 10% oxygen (existing limit)

(69 ft^3 CO/10^6 ft^3 air x 2116.8 lb/ft^2 x 28 lb/lb-mole)/(1545.6 ft-lb_f/lb mole-R x 528 R)
= 5.01 x 10^{-6} lb/ft^3

Mass emission rate = 5.01 x 10^{-6} lb/ft^3 x 44,500 dscf/min x 60 mins/hour = 13.4 lbs/hour (58.6 tpy)

Volatile Organic Compounds

Based on 185 ppmvd at 10% oxygen (existing limit); used molecular weight for methane (CH_4)

(185 ft^3 VOC/10^6 ft^3 air x 2116.8 lb/ft^2 x 16 lb/lb-mole)/(1545.6 ft-lb_f/lb mole-R x 528 R)
= 7.68 x 10^{-6} lb/ft^3

Mass emission rate = 7.68 x 10^{-6} lb/ft^3 x 44,500 dscf/min x 60 mins/hour = 20.5 lbs/hour (89.8 tpy)

Sulfuric Acid Mist

Assume 4% of sulfur dioxide is sulfates

9.1 lbs/hour x 0.04 = 0.36 lb/hour (as sulfates)

SAM rate = 0.36 lb/hour x 98 lbs SAM/lb-mole SAM x lb-mole SAM/lb-mole SO_3
x lb-mole SO_3/80 lbs SO_3 = 0.45 lb/hour (2.0 tpy) as SAM

Lead

Updated factors to match NCASI Technical Bulletin 701, Table 14A; details provided in attached HAP tables

19.44 tons CaO/hour x 2.1×10^{-4} lb Pb/ton CaO = 0.0041 lb/hour (0.018 tpy)

Summary – Emission Rate Calculations and Changes

Annual Emission Rates and Changes (tons per year)

	TRS	SO_2	PM/PM_{10}	NO_x	CO	SAM	VOCs	Pb
Potential	20.7	40.0	135.3	383.7	58.6	2.0	89.8	0.018
Baseline	2.3	10.5	42.5/36.6	100.6	5.6	0.51	2.4	0.011
Change	18.4	29.5	92.8/98.7	283.1	53.0	1.5	87.4	0.007
PSD Significance Level	10	40	25/15	40	100	7	40	0.6
PSD Triggered?	Yes	No	Yes	Yes	No	No	Yes	No

TRS – total reduced sulfur compounds
SO_2 – sulfur dioxide
PM – total particulate matter
PM_{10} – particulate matter less than 10 microns in aerodynamic diameter
CO – carbon monoxide
SAM – sulfuric acid mist
VOCs – volatile organic compounds
Pb – lead

NCAS TB 646

TABLE 13 LIME KILN SULFUR DIOXIDE EMISSIONS

MILL CODE	TEST DATE	CONTROL DEVICE	PULP ADTPD	LIME TPD	FUEL & PERCENT S	BURN NCG Y/N	INPUT NCG S[1] lb/ton CaO	INPUT tot S[2] lb/ton CaO	OUTPUT SO_2, ppm @ 10% O_2	OUTPUT lb SO_2/ton CaO	OUTPUT lb/SO_2[3] 10^6 Btu	ESTIMATE OF % SULFUR CAPTURED
LIME KILNS WITH SCRUBBERS												
LA	1986-87	VEN SCBR	1375	344	NATURAL GAS	Y	4.4 to 14.0	4.4 to 14.0	13 to 15	0.33	0.037	96.3 to 98.8
LB	1988	VEN SCBR	800	220	OIL, 2.5% S	Y	5.8 to 20.0	16.4 to 30.5	10.0	0.18[6]	0.023	98.9 to 99.7
LC	1986	VEN SCBR	1090	300	OIL, 1.0% S	N	0.0	1.17	1.3	0.02	0.003	99.8
LE	1979	SCRUBBER[4]	495	136	OIL, 1.3% S	Y	18.5	28.7[5]	-	0.45	0.057	99.2
LF	1984	VEN SCBR	290	80	NATURAL GAS	NA	NA	NA	3.9[6]	0.07	0.009	-
LG	1984	VEN SCBR	240	60	NATURAL GAS	Y	NA	NA	<2.0[6]	<0.04	<0.005	-
LH1	1987	VEN SCBR	717	180	NATURAL GAS	N	0.0	small	0.4[6]	0.01	0.001	-
LH2	1987	VEN SCBR	717	180	COKE/GAS	N	0.0	18.8	4.8[6]	0.10	0.011	99.7
LJ	1977	SCRUBBER[4]	267	73	OIL, 2.8% S	NA	NA	12.0	1 to 7	0.07[6]	0.009	99.7
LK	-	SCRUBBER	400	110	NATURAL GAS	N	0.0	small	0 to 6	0.09	0.011	-
LL	1984	VEN SCBR	740	221	NATURAL GAS	N	0.0	small	26.0[6]	0.47	0.059	-
LO1	1991	VEN SCBR	422	155	NATURAL GAS	N	0.0	small	<1.0	<0.02	<0.003	-
LO2	1991	VEN SCBR	1056	260	NATURAL GAS	N	0.0	small	<1.0	<0.02	<0.002	-
LP1	1990	VEN SCBR	820	225	OIL, 1.8% S	Y	NA	7.73	37 to 61	1.63	0.204	87.3 to 92.1
LT	1991	VEN SCBR	830	311	NATURAL GAS	N	0.0	small	0.5 to 1	0.01	0.002	-
LU	1992	VEN SCBR	890	306	NATURAL GAS	Y	NA	NA	4 to 16	0.13	0.020	-
									Average of 16 Kilns	0.23	0.028	

Range - 0.01 to 1.63 lb/ton CaO or ≤0.002 to 0.204 lb/10^6 Btu

MILL CODE	TEST DATE	CONTROL DEVICE	PULP ADTPD	LIME TPD	FUEL & PERCENT S	BURN NCG Y/N	INPUT NCG S[1] lb/ton CaO	INPUT tot S[2] lb/ton CaO	OUTPUT SO_2, ppm @ 10% O_2	OUTPUT lb SO_2/ton CaO	OUTPUT lb/SO_2[3] 10^6 Btu	ESTIMATE OF % SULFUR CAPTURED
LIME KILNS WITH ESPs												
LD	1988	ESP	1700	468	OIL, 2.5% S	N	0.0	8.15[7]	1.03	0.02[6]	0.002	>99.9
LM	1989	ESP	840	230	NATURAL GAS	N	0.0	small	1.80	0.03[6]	0.004	-
LN	1990	ESP	1375	330	OIL/COKE/NG	Y	2.2	14.04[8]	10 to 100	1.00[6]	0.125	88.8 to 98.9
LP2	1991	ESP	2050	565	OIL, 1.8% S	NA	NA	7.69	72 to 237	2.98	0.373	93.0
									Average of 4 Kilns	1.00	0.126	

range - 0.02 to 2.98 lb/ton CaO or 0.002 to 0.373 lb/10^6 Btu

Notes

NA - not available or not known; [1] estimated from NCASI Technical Bulletin No. 469; [2] sulfur input from oil firing estimated assuming 8.0 x 10^6 Btu/ton CaO and 18,750 Btu/lb oil; [3] lb/ton CaO converted to lb/10^6 Btu using conversion factor of 8.0 x 10^6 Btu/ton CaO; [4] dust chamber followed by Peabody scrubber; [5] sulfur input from oil, lime mud and NCG were 31.8, 26.7 and 104.3 lb/hr, respectively; [6] assumed 5.5 ppm SO_2 in vent equals 0.1 lb SO_2/ton CaO; [7] sulfur input from oil firing for this kiln estimated using 6.2 x 10^6 Btu/ton CaO and 18,750 Btu/lb oil; [8] 2 lime kilns firing gas/coke with NCG and fuel oil/coke with NCG; NCGs are first scrubbed with white liquor or NaOH.

$$\text{Average Oil-Fired Kilns} = \left.\begin{matrix} 0.18 \\ 0.02 \\ 0.45 \\ 0.07 \\ 1.63 \end{matrix}\right\} \rightarrow 2.35/5 = 0.47 \text{ lb/ton CaO}$$

Emission Factors and Emission Rates for Organic Hazardous Air Pollutants, Lime Kiln

		Available Emission Factors (lb/ton CaO)							
	Test Result	Est. mean		ND as 0	ND as 1/2 DL			Selected Factor	
Compound	Range	>50% NDs		Median[1]	Median[2]	Mean[2]		(lb/ton CaO)	PTE(tpy)
1,1,1-Trichloroethane	--	--		8.00E-05	8.00E-05	8.00E-05	d	8.00E-05	0.0068
1,1,2-Trichloroethane	--	--		3.80E-04	3.80E-04	3.80E-04	d	3.80E-04	0.032
1,2,4-Trichlorobenzene	ND to 4.7E-02	1.30E-04	c					4.70E-02	4.00
1,2-Dichloroethane	--	--		3.70E-04	3.70E-04	3.70E-04	d	3.70E-04	0.032
Acetaldehyde	ND to 1.2E-02			9.60E-04	5.50E-03	5.10E-03	a	9.60E-04	0.082
Acetophenone	--	--		5.50E-03	5.50E-03	5.50E-03	d	5.50E-03	0.47
Acrolein	ND to 2.1E-03	2.10E-05	b					2.10E-03	0.18
Benzene	ND to 6.6E-03	3.30E-04	b					6.60E-03	0.56
Carbon Tetrachloride	--	--		1.50E-03	1.50E-03	1.50E-03	d	1.50E-03	0.13
Carbonyl Sulfide	--	--		3.90E-03	3.90E-03	3.90E-03	d	3.90E-03	0.33
Chlorobenzene	ND to 4.6E-04	1.10E-05	c					4.60E-04	0.039
Chloroform	ND to 2.1E-04	3.60E-06	c					2.10E-04	0.018
Chloromethane	27 to 187 ppb	--		1.70E-03	1.70E-03	1.70E-03		1.70E-03	0.14
m-Cresol	--	--		9.50E-03	9.50E-03	9.50E-03	d	9.50E-03	0.81
o-Cresol	--	--		4.70E-03	4.70E-03	4.70E-03	d	4.70E-03	0.40
Cumene	--	--		5.50E-03	5.50E-03	5.50E-03	d	5.50E-03	0.47
Ethyl Benzene	--	--		1.50E-03	5.50E-03	8.50E-03	a	1.50E-03	0.13
Formaldehyde	ND to 4.2E-02			1.20E-02	1.20E-02	1.20E-02	d	1.20E-02	1.02
Hexachlorocyclopentadiene	--	--		1.00E-02	1.00E-02	1.00E-02	d	1.00E-02	0.85
n-Hexane	ND to 4.8E-04	2.10E-05	c	--	--	--		4.80E-04	0.041
Hydrogen Chloride	ND to 1.9E-03	2.10E-04	c	--	--	--		1.90E-03	0.16
Methanol	ND to 0.98	--		8.00E-03	1.20E-02	3.10E-02	a	8.00E-03	0.68
Methyl Ethyl Ketone	ND to 0.174	4.30E-05	b	--	--	--		1.74E-01	14.8
Methyl Isobutyl Ketone	ND to 1.3E-03	2.00E-04	b	--	--	--		1.30E-03	0.11
Methylene Chloride	ND to 2.3E-04	4.20E-06	c	--	--	--		2.30E-04	0.020
Naphthalene	ND to 4.8E-03	--		1.30E-02	1.30E-02	1.30E-02		1.30E-02	1.11
Phenol	ND to 0.016	2.70E-04	c	--	--	--		1.60E-02	1.36
Styrene	ND to 1.6E-03	5.70E-05	c	--	--	--		1.60E-03	0.14
Tetrachloroethylene	ND to 5.3E-03	2.60E-04	c	--	--	--		5.30E-03	0.45
Toluene	ND to 2.4E-02	1.50E-05	b	--	--	--		2.40E-02	2.04
Trichloroethylene	--	--		3.70E-04	3.70E-04	3.70E-04	d	3.70E-04	0.032
Vinyl Acetate	--	--		8.00E-05	8.00E-05	8.00E-05	d	8.00E-05	0.0068
m,p-Xylene	ND to 5.7E-03	6.80E-06	b	--	--	--		5.70E-03	0.49
o-Xylene	ND to 0.132	2.10E-04	b	--	--	--		1.32E-01	11.2

Emission Factors and Emission Rates for Organic Hazardous Air Pollutants, Lime Kiln

		Available Emission Factors (lb/ton CaO)					
Compound	Test Result Range	Est. mean >50% NDs	ND as 0 Median[1]	ND as 1/2 DL Median[2]	Mean[2]	Selected Factor (lb/ton CaO)	PTE(tpy)

Notes:

ND = Not detected; DL = Detection Limit
This sheet compiles the most current NCASI emission factors and selects the most appropriate factor using the following priority:
First - ND as 0 Median values. Second - For compounds which do not have at least >50% detects, then select the max from all tests.
NCASI tested but found no detection of hexachloroethane, iodomethane, and isooctane.

1. Median based upon assuming all non-detects (NDs) = 0 as in NCASI Technical Bulletin No. 701 (1995)
2. Median/mean based upon assuming ND = ½ detection limit (DL)
3. From NCASI Technical Bull. No. 849 – all NDs were assumed at ½ the DL when estimating averages

a. Trimmed Mean for data sets with 15 to 50% NDs;
b. NOR-PLOT Average;
c. SDln Average; The "NOR-PLOT Average"
d "SDln Average" are statistically derived sample averages applicable to all data sets with greater than 50% NDs; when more than 1 source is tested and all observations are ND, averages shown correspond to ½ of the lowest detection limit.

Emission Factors and Emission Rates for Metal Hazardous Air Pollutants, Lime Kiln

	Computed Factor (lb/ton CaO) Scrubber						
		Est. Mean	ND as 0	ND as 1/2 DL			
	Max	>50% NDs	Median [1]	Median [2]	Mean [2]		PTE(tpy)
As	1.20E-04	6.10E-07					0.010
Be	1.00E-05	2.40E-08					0.00085
Cd	3.30E-05		5.80E-06	1.30E-05	1.40E-05		0.00049
Cr	9.60E-04		2.00E-04	2.00E-04	2.70E-04		0.017
Co	3.60E-05		2.30E-06	1.00E-05	1.00E-05	a	0.00020
Pb	1.70E-02		2.10E-04	1.60E-04	3.20E-03		0.018
Mn	8.30E-03		3.00E-04	3.00E-04	1.70E-03		0.026
Hg	5.20E-06	6.20E-07					0.000053
Ni	1.30E-03		9.50E-05	9.50E-05	3.10E-04		0.0081
Se	1.20E-04	2.60E-06					0.00022
Cr+6	7.60E-05	1.80E-05					0.0065

ND= Not detected DL= Detection Limit

This sheet compiles the most current NCASI emission factors and selects the most appropriate factor using the following priority:

First - ND as 0 Median values.

Second - For compounds which do not have at least >50% detects, then select the max from all tests.

[1] Median based upon assuming all non-detects (NDs) = 0 as in NCASI Technical Bulletin No. 701 (1995)

[2] Median/mean based upon assuming ND = ½ detection limit (DL)

[a] Trimmed Mean for data sets with 15 to 50% NDs

Attachment C
Air Quality Analysis

ATTACHMENT C
AIR QUALITY ANALYSIS
PALATKA, FL OPERATIONS

C.1 INTRODUCTION

United States Environmental Protection Agency (EPA) and Florida Department of Environmental Protection (FDEP) rules require major new facilities and major modifications of existing facilities to undergo several analyses for emission increases subject to Prevention of Significant Deterioration (PSD) review. These analyses determine whether significant air quality deterioration will result from the new or modified facility. As described elsewhere in the application, the modifications at the GP Palatka Mill will result in emissions increases above the significant emission rate for:

- ozone (based on the increase in volatile organic compound (VOC) emissions),
- particulate matter less than 10 microns in diameter (PM_{10}),
- nitrogen oxides (NO_x),
- total suspended particulate matter (TSP) and
- total reduced sulfur (TRS).

Therefore, the project is subject to PSD review for these pollutants. In addition to an analysis of control technology discussed in other attachments, PSD review requires GP to conduct the following analyses:

- Source impact analysis,
- Good engineering practice stack height (GEP),
- Air quality analysis (monitoring),
- Additional impact analyses.

EPA regulations (40 CFR 52.21(k)) require that an applicant perform a source impact analysis for each applicable pollutant. The PSD regulations specifically provide for the use of atmospheric dispersion models in performing impact analyses, estimating baseline and future air quality levels, and determining compliance with National Ambient Air Quality Standards (NAAQS) and allowable PSD increments. Section C.2 of this attachment presents the Source Impact Analysis.

In addition to the source impact analysis, PSD review requires that any emission limit must be applied in a source impact analysis with a stack height that does not exceed GEP (refer to 40 CFR 52.21(h)).

To demonstrate this, GP performed an analysis of the physical arrangement of stacks and solid physical structures that may affect dispersion and computed GEP stack heights. The lime kiln stack is existing and not affected by building downwash (see results below).

The third analysis is specified by EPA regulation 40 CFR 52.21(m). In addition to predicting a source impact, a PSD permit application must contain an analysis of continuous ambient air quality data in the area affected by the project. The regulation presents the conditions that require pre-construction and post-construction monitoring of ambient air. Section C.3 of this attachment presents the Ambient Air Quality Analysis.

Lastly, EPA regulations (40 CFR 52.21(o)) require an analysis of additional impacts. Section C.4 presents an analysis of the impacts on soils and vegetation, growth, and impairment to visibility that would occur as a result of the project in the vicinity of the Mill. Section C.5 presents an analysis of the impact on visibility and deposition in the Class I areas.

C.2. SOURCE IMPACT ANALYSIS

GP conducted the Source Impact Analysis in two phases: 1) impact of the project, and 2) full impact analysis. The first phase determines the impact from the change in emissions associated with the project alone. GP compared these impacts to EPA thresholds for significance and ambient monitoring criteria. If the project impacts exceed the Significant Impact Levels (SILs), then GP conducts a full impact analysis. A full impact analysis predicts impacts from the sources across the entire Mill. GP compares these impacts to state and national ambient air quality standards. The following sections discuss the methodology, data inputs, and techniques for the Source Impact Analysis.

C.2.1 AIR MODELING METHODOLOGY

The general modeling approach follows EPA and FDEP modeling guidelines for determining compliance with the state AAQS and PSD Increments. In general, current policies stipulate that the highest annual average and highest, second-highest short-term (*i.e.,* 24 hours or less) concentrations be compared to the applicable standard when 5 years of meteorological data are used. The highest, second-highest concentration (HSH) is calculated for a receptor field by:

1. Eliminating the highest concentration predicted at each receptor,

2. Identifying the second-highest concentration at each receptor, and
3. Selecting the highest concentration among these second-highest concentrations.

This approach is consistent with the air quality standards, which permit a short-term average concentration to be exceeded once per year at each receptor.

To develop the maximum short-term impacts for the GP Palatka Mill, the general modeling approach was to first perform a screening analysis with a coarse receptor grid spacing to determine the critical impact locations. First, GP predicted impacts for the screening analysis using a 5-year meteorological data record. Then, a refined analysis was performed if the receptor spacing at the location of maximum impact is greater than 100 meters (m) and the screening grid result exceeded 75% of the applicable criteria. The refined analyses used a denser receptor grid centered on the receptor at which the identified in the screening phase. GP then executed the air dispersion model for the entire year.

C.2.2 MODEL SELECTION

GP selected an air dispersion model based on the model's ability to simulate air quality impacts in areas surrounding the Palatka Mill. The area surrounding the Mill is mostly rural and flat. The Mill is located on the western side of the St. John's River. Figure C-1 presents a topographic map of the GP Palatka Mill vicinity. Based on these features, GP has selected the Industrial Source Complex Short-Term (ISCST3) model (Version 02035) to predict maximum concentrations in all areas in the vicinity of the plant site.

In this analysis, the US EPA regulatory default options are utilized in the ISCST3 model to predict all maximum impacts. These options include:

- Final plume rise at all receptor locations
- Stack-tip downwash
- Buoyancy-induced dispersion
- Default wind speed profile coefficients
- Default vertical potential temperature gradients
- Calm wind processing

C.2.3 LAND USE CLASSIFICATION

Dispersion coefficients are set in the model by selecting the land-use mode as urban or rural. The land use in the vicinity of the source is the criteria used to determine the setting. Auer developed a land-use procedure in 1978 to determine the model setting. The procedure involves classifying land areas within a 3-kilometer (km) radius circle centered on the Mill. GP selected the land-use mode to reflect the majority of the classified area. The urban mode is selected if more than 50 percent of the land-use consists of one or more of the following land-use classifications:

- heavy industrial
- light-moderate industrial
- commercial, or
- compact residential

The USGS map indicates that there are no other significant commercial or industrial properties within 3 km. GP estimates that the urban classifications constitute less than 50% of the total area. Therefore, GP set the ISCST3 model in the rural mode is used for the ISCST3 modeling.

C.2.4 METEOROLOGICAL DATA

GP predicted impacts using hourly meteorological data for the five-year period 1984-1988. The nearest site for surface observations to the Palatka Mill is located approximately 57 km to the west in Gainesville. However, FDEP has routinely recommended analyses for Palatka apply surface observations from Jacksonville International Airport (JAX). While the distance between GP and JAX is approximately 92 km, GP and FDEP consider JAX to be more representative than Gainesville surface observations. While both JAX and GP are less than 40 km from the Atlantic coastline, Gainesville is over 95 km from the coastline. The analysis applied meteorological data was comprised of hourly surface data from JAX and upper air data collected in Waycross, Georgia.

The surface observations include wind direction, wind speed, temperature, cloud cover, and cloud ceiling. The wind speed, cloud cover, and cloud ceiling values were used in the ISCST meteorological preprocessor program to determine atmospheric stability using the Turner stability scheme. Based on the temperature measurements at morning and afternoon, mixing heights were calculated with the radiosonde data using the Holzworth (1972) approach. Hourly mixing heights were derived from the morning and afternoon mixing heights using the interpolation method developed by EPA (Holzworth, 1972). USEPA provided the dataset in an ISCST-ready format. GP did not perform any additional processing of the meteorological files.

C.2.5 BACKGROUND CONCENTRATIONS

Background concentrations are necessary to determine total ambient air quality impacts to demonstrate compliance with the NAAQS. "Background concentrations" are defined as concentrations due to sources other than those specifically included in the modeling analysis. For example, background concentration would account for other small point sources not included in the modeling, fugitive emission sources, and natural background sources (*e.g.,* mobile sources).

To select a background concentration, GP has analyzed FDEP and EPA ambient air quality observations. GP collected information on monitor locations, their proximity to the Palatka Mill, data quality, and how recent the data was collected. Preliminary dispersion modeling concluded that no full analyses are required. Table C-1 presents the values for background concentrations in micrograms per cubic meter ($\mu g/m^3$) and represent current ambient air quality.

Table C-1. Summary of Background Concentrations for NOx, PM10, and Ozone

Pollutant	Monitor Description	Averaging Period	Background Concentration ($\mu g/m^3$)
Ozone	12-001-3011 Alachua County, 200 Savannah – 2003	1-hour	175 [a]
		8-hour	145 [b]
NOx	12-031-0032 Duval County, 2900 Bennett St – 2003	Annual	27
PM10	12-107-1008 Putnam County, Palatka – 2003	24-hour	52
		Annual	23.2

Notes
[a] High-Second-Highest
[b] 3-year average
Source: Florida Department of Environmental Protection. Quick Look Report. June 2004.

These values reflect the most current year of data by a representative monitor.

C.2.6 BUILDING DOWNWASH

In accordance with current EPA policy, GP evaluated the effect of building downwash on predicted air quality concentration levels in the modeling analysis. For this analysis, GP used the US EPA-developed Building Profile Input Program (BPIP, Version 95086) to determine the appropriate direction-specific building dimensions for all modeled sources at the Mill. The building height, length, and width for all significant building structures are input to the program. For short stacks (*i.e.,* physical stack height is less than $H_b + 0.5\ L_b$, where H_b is the building height and L_b is the lesser of the building height or projected width), BPIP applies the Schulman and Scire (1980) algorithm. For cases where the physical stack is greater than $H_b + 0.5\ L_b$, but less than GEP, BPIP applies the Huber-Snyder (1976) algorithm. For both downwash methods, the ISCST3 model uses direction-specific building dimensions for H_b and L_b for 36 radial directions, with each direction representing a 10-degree sector. Table C-2 presents a summary of the horizontal and vertical structure dimensions at the Mill that are considered in the BPIP analysis. Table C-3 summarizes dimensions for tank structures included in the BPIP analysis. Inspection of the ISCST3 model output indicates that no cavity effects are occurring at the model receptors.

Table C-2. Summary of Building Dimensions, Georgia-Pacific, Palatka

Structure	Height		Length		Width	
	(ft)	(m)	(ft)	(m)	(ft)	(m)
RB4 Precipitator	85	25.9	123	37.5	58	17.6
RB4 Boiler Building	193.7	59.0	104	31.7	90	27.4
Power Plant Building	107.6	32.8	101	30.8	92	28.0
Pulp Dryer No. 3	84.5	25.8	275	83.7	157	47.9
Pulp Dryer No. 5	70.5	21.5	328	99.9	99	30.3
Pulp Dryer No. 4	73	22.3	265	80.7	125	38.2
Warehouse Complex 1	62.67	19.1	1,394	424.9	377	114.8
Warehouse Complex 2	46.8	14.3	924	281.5	425	129.5
Nos. 1 and 2 Machines, Storage	71.16	21.7	225	68.6	407	124.2
Kraft Converting & Storing	60.75	18.5	310	94.4	524	159.9
Kraft Warehouse and Multi Wall	56.7	17.3	290	88.4	521	158.7
Digester	62.2	19.0	264	80.4	33	10.1

Figure 3-1 presents a plot plan section identifying the lime kiln stack.

C.2.7 SIGNIFICANT IMPACT ANALYSIS

Purpose and Methodology

The significant impact analysis is the first phase of the Source Impact Analysis and determines two results: 1) the maximum impacts from the project emissions and 2) the location of predicted impacts greater than significant impact levels (SILs). The area of these impacts defines the impact area of the project and the significant impact distance (SID).

GP performed a significant impact analysis to determine whether the emissions increase result in maximum predicted impacts greater than the PSD modeling SILs or the EPA monitoring deminimis concentrations. Current EPA and FDEP policies stipulate that GP compare the highest predicted short-term impacts to these levels. Table C-4 presents the SILs and deminimis concentrations.

Table C-4. Significant Impact Levels and De Minimis Concentrations for Modeled Pollutants

Pollutant	Averaging Time	Significant Impact Levels ($\mu g/m^3$)	De Minimis Concentration ($\mu g/m^3$)
PM_{10}	24-hour	5	10
	Annual	1	--
NO_x	Annual	1	14

Model Inventory

For the significant impact analysis, the model inventory only includes sources that will experience an increase or decrease in emissions due to the project. The emission increase represents the difference between the potential emissions and the actual emissions during the baseline period. The baseline must reflect conditions prior to any modifications or physical changes. GP selected the average of 2002 and 2003 operations to represent the baseline. Table C-5 presents the potential short-term maximum emission rates for the project source.

Table C-5. Summary of Emissions Increases due to Project, GP

			Emission Rates			
			Baseline	Potential	Project	
Pollutant	Model ID	Source Description	(tons/yr)	(tons/yr)	(tons/yr)	(gram/sec)
PM10	LK4	No. 4 Lime Kiln (EU17)	36.6	135.3	98.7	2.84
NOx	LK4	No. 4 Lime Kiln (EU17)	100.6	383.7	283.1	8.14

Point Source Modeling Parameters

GP developed modeling parameters for the Lime Kiln using physical data for stack height, stack diameter, and observation data for exit temperature and exit velocity. Table C-6 presents these modeling parameters.

Table C-6. Modeling Parameters for Significant Impact Analysis

Parameter	Units	Lime Kiln
Stack Height	(ft)	131
Stack Height	(m)	39.9
Stack Exit Temp	K	346.5
Stack Exit Temp	Deg F	164
Stack Exit Flow	(acfm)	58,900
Stack Exit Velocity	(ft/s)	63.7
Stack Exit Velocity	(m/s)	19.42
Stack Diameter	(ft)	4.42
Stack Diameter	(m)	1.35

Receptor Locations

All analyses used refined Cartesian receptor grids in addition to discrete receptors along the Mill fenceline. The analyses applied receptor spacing as follows:

- 100-m intervals along the fenceline
- 100-m intervals within 8 km of the Mill

Model coordinates are local and refer to the relative position from the original TRS Incinerator stack. The use of the TRS stack as the origin is consistent with air modeling reviewed by the Department for several PSD analyses.

To determine the maximum impact from the project, GP reviewed the distribution of predicted impacts and the location of the maximum impact. Because the model settings include the FLAT option, the predicted impacts from the single model source will decrease with distance beyond the location of the maximum impact. Thus, if the predicted impacts decrease at the receptor edges, then no additional receptors at greater distances is necessary. If the predicting impacts indicate that the maximum impact may be further than 8 km from the source, then GP performed additional modeling using a 100m refined grid to identify the maximum impact out to further distances.

C.2.8 SOURCE IMPACT ANALYSIS RESULTS

Significant Impact Analysis

Because the model inventory is a single source, GP analyzed potential air impacts by using a generic source in the model. When modeling a single source with an emission rate of 1 gram/second, the analysis can produce pollutant-specific impacts by multiplying the generic impact by the associated emission rate. Table C-7 presents the maximum predicted impacts from the generic analysis.

Table C-7. Maximum Predicted Impact for Generic Impact Analysis (1 gram per second)

Averaging Period	Maximum Predicted Impact (μg/m^3)	Period Ending (YYMMDDHH)	Receptor Location East (m)	Receptor Location North (m)
24-hour High 1st High	1.75	86082424	500	-400
Annual	0.1196	--	800	-600

YY =Year, MM=Month, DD=Day, HH=Hour

Table C-8 presents the pollutant specific predicted impacts and compares the significant impact levels.

Table C-8. Significant Impact Analysis Summary for PM and NOx, GP Palatka

Pollutant	Averaging Time	Generic Impact (ug/m^3)	Project Emissions Increase (gram/sec)	Pollutant-Specific Project Impact (ug/m3)	SIL (ug/m^3)
PM	Annual	0.1196	2.84	0.340	1
	24-hour	1.75	2.84	4.97	5
NOx	Annual	0.1196	8.14	0.97	1

For example, the annual NOx impact is calculated as follows:

Annual impact for 1 gram/sec = 0.1196 ug/m^3
Project NOx emissions = 8.14 gram/sec
Annual impact for NOx = 8.14 x 0.1196 = 0.97 ug/m^3

The maximum predicted impact locations are well inside the receptor grid analyzed. As shown in the above table, the project will not cause a significant impact of NOx or PM10. Thus, no further analyses or refinements in the Class II area are required. Figure C-2 presents the maximum predicted impact locations.

The maximum predicted impacts are also below the monitoring deminimis values. Thus, no preconstruction monitoring is necessary for this project.

C.3. AMBIENT AIR QUALITY ANALYSIS

Rule 40 CFR 52.21(m) describes the analyses of ambient air quality data required in a PSD review. These requirements include pre-application and post-application analyses. Both of these requirements are exempted by Rule 40 CFR 52.21(i)(8) if the source impact analysis demonstrates that the emissions increase from the modification would cause air quality impacts less than the deminimis monitoring concentrations in all areas. The source impact analysis (Section C.2) for the project at GP Palatka concluded that the maximum impacts from the project for NOx and PM_{10} would not exceed this concentration. Therefore, the rule exemption is applicable.

C.4 ADDITIONAL IMPACT ANALYSIS – CLASS II AREAS

C.4.1 IMPACTS UPON SOILS AND VEGETATION

Soils

Air contaminants can affect soils through fumigation by gaseous forms, accumulation of compounds transformed from the gaseous state, or by the direct deposition of PM or PM to which certain contaminants are absorbed. According to the Putnam County Soil Survey (1990), the soils in the vicinity of the GP Palatka Mill are dominated by Terra Ceia muck, with Cassia fine sand and Pamona fine sand also present.

The dominant soil in the vicinity of the GP facility, Terra Ceia muck, is a highly organic wetland soil and has an extremely high buffering capacity based on the cation exchange capacity, base saturation, and bulk density. Therefore, this soil would be relatively insensitive to atmospheric inputs. The maximum predicted NO_2, PM_{10}, and CO concentrations in the vicinity of the site as a result of the proposed project are below the significant impact levels. The maximum predicted SO_2 concentrations in the vicinity of the site are below the AAQS. Since the AAQS are designed to protect the public welfare, including effects on soils and vegetation, no detrimental effects on soils should occur in the vicinity of the GP Palatka Mill due to the proposed project.

Vegetation

In general, the effects of air pollutants on vegetation occur from NO_2, O_3, and PM. The effects of air pollutants are dependent both on the concentration of the contaminant and the duration of the exposure. The term "injury," as opposed to damage, is commonly used to describe all plant responses to air contaminants and will be used in the context of this analysis. Air contaminants are thought to interact primarily with plant foliage that is considered to be the major pathway of exposure. For purposes of this analysis, it was assumed that 100 percent of each air contaminant of concern is accessible to the plants.

Injury to vegetation from exposure to various levels or air contaminants can be termed acute, physiological, or chronic. Acute injury occurs as a result of a short-term exposure to a high contaminant concentration and is typically manifested by visible injury symptoms ranging from chlorosis (discoloration) to necrosis (dead areas). Physiological or latent injury occurs as the result of a long-term exposure to contaminant concentrations below that which results in acute injury symptoms. Chronic injury results from repeated exposure to low concentrations over extended periods of time, often without any visible symptoms, but with some effect on the overall growth and productivity of the plant. In this assessment, 100 percent of the particular air pollutant in the ambient air was assumed to interact with the vegetation. This is a conservative approach. The following paragraphs address the NO_2, PM, and ozone effects.

A review of the literature indicates great variability in NO_2 dose-response relationship in vegetation. Acute NO_2 injury symptoms are manifested as water-soaked lesions, which first appear on the upper surface, followed by rapid tissue collapse. Low-concentration, long-term exposures as frequently encountered in polluted atmospheres often do not induce the lesions associated with acute exposures but may still result in some growth suppression. Citrus trees exposed to 470 $\mu g/m^3$ of NO_2 for 290 days showed injury (Thompson *et al.*, 1970). Sphagnum exposed for 18 months at an average concentration of 11.7 $\mu g/m^3$ showed reduced growth (Press *et al.*, 1986)

The maximum increase in ground-level annual average NO_2 concentrations predicted to occur in the vicinity of the plant during the operation of the proposed project well below reported effects levels.

Although information pertaining to the effects of particulate matter on plants is scarce, some threshold concentrations are available. Mandoli and Dubey (1998) exposed ten species of native Indian plants to levels of particulate matter ranging from 210 to 366 $\mu g/m^3$ for an 8-hour averaging period. Damage in the form of a higher leaf area/dry weight ratio was observed at varying degrees for most plants tested. Concentrations of particulate matter lower than 163 $\mu g/m^3$ did not appear to be injurious to the tested plants. The maximum predicted 24-hour and annual average PM_{10} concentrations due to the proposed project are well below the injury thresholds reported in the literature.

It is difficult to predict what effect the proposed project's emissions of VOC will have on ambient O_3 concentrations from either a local or regional scale. VOC and NO_x emissions are precursors to the formation of O_3. O_3 is formed down-wind from emission sources when VOC, and NO_x emissions from the facility react in the presence of sunlight.

O_3 can cause various damage to broad-leaved plants including: tissue collapse, interveinal necrosis and markings on the upper surface of leaves known as stippling (pigmented yellow, light tan, red brown, dark brown, red, or purple), flecking (silver or bleached straw white), mottling, chlorosis or bronzing, and bleaching. O_3 can also stunt plant growth and bud formation. On certain plants such as citrus, grape, and tobacco, it is common for leaves to wither and drop early. A literature review suggests that exposure for 4 hours at levels of 0.04 to 11.0 ppm of O_3 will result in plant injury for sensitive plants. The extent of the injury depends on the plant species and environmental conditions prior to and during exposure.

Given that the O_3 measurements in the region comply with the NAAQS and the increase in VOC emissions for the project represents less than a 1-percent change in regional VOC emissions, no adverse effects on vegetation due to the project's VOC emissions are expected.

In summary, GP expects that the project increase in emissions will not adversely impact the soils or vegetation in areas adjacent to the Palatka Mill.

C.4.2 IMPACTS DUE TO ADDITIONAL GROWTH

The proposed project is to repair components of the existing lime kiln. Upon completion of the project, the lime kiln will continue to operate in the same way it currently operates. While the repair is to maintain the integrity and safety of the kiln, the kiln uptime is very high, and will not be significantly changed by the proposed project. Thus, because the project will not increase actual operations or increase personnel, GP expects no air quality impacts due to associated commercial and industrial growth from the proposed project.

C.4.3 IMPACTS ON VISIBILITY

The proposed project only affects and modifies the existing No. 4 Lime Kiln. The application does not request an increase in permitted emissions (on a ppmvd basis), while it does request a reduced maximum permit limit for both NO_2 and SO_2 emissions. The Lime Kiln is in compliance with opacity regulations and should remain in compliance after the modification. As a result of the visibility-affecting emission rates being lowered, and no change in opacity, GP does not expect any adverse impacts upon visibility.

C.5 ADDITIONAL IMPACT ANALYSIS – CLASS I AREAS

C.5.1. INTRODUCTION

Generally, if the facility undergoing the modification is within 200 kilometers of a PSD Class I area, then a significant impact analysis is also performed to evaluate the impact due to the project alone at the PSD Class I area. The three PSD Class I areas located within 200 km of the Mill are:

- Okefenokee National Wilderness Area (NWA) at 108 km north of the Mill;
- Wolf Island NWA 186 km north of the Mill; and
- Chassahowitzka NWA located 137 km southwest of the Mill.

The maximum predicted impacts due to the project at the Okefenokee and Chassahowitzka NWAs are compared to EPA's proposed significant impact levels for PSD Class I areas. This application does not address impacts at the Wolf Island PSD Class I area because the maximum impacts are expected to occur at the Okefenokee NWA. These recommended significant impact levels have never been promulgated as rules, but are the currently accepted criteria for determining whether a proposed project will incur a significant impact on a PSD Class I area.

If the project-only impacts at the PSD Class I area are above the proposed EPA PSD Class I significant impact levels, then an analysis is performed to demonstrate compliance with allowable PSD Class I impacts at the PSD Class I area. The proposed project's maximum emission increases are also evaluated at the PSD Class I area to support the air quality related values (AQRV) analysis, which includes an evaluation of regional haze degradation.

For predicting maximum impacts at the Okefenokee and Chassahowitzka NWA PSD Class I areas, the California Puff (CALPUFF) modeling system was used. CALPUFF, Version 5.5 (EPA, 2002), is a Lagrangian puff model that is recommended by the FDEP, in coordination with the Federal Land Manager (FLM) for the NWA, for predicting pollutant impacts at PSD Class I areas that are beyond 50 km from a project site. The following sections present a description of the CALPUFF model methodology.

C.5.2 GENERAL AIR MODELING APPROACH

The general modeling approach was based on using the long-range transport model, California Puff model (CALPUFF, Version 5.7). The methods and assumptions used in the CALPUFF model were based on the latest recommendations for a refined analysis as presented in the IWAQM Phase 2 Summary Report and the FLAG document.

The following sections present the methods and assumptions used to assess the impacts of the proposed project. The analysis is consistent with a "refined analysis" since it was performed using the detailed weather data from multiple surface and upper air stations as well as the MM4/MM5 prognostic with fields.

Model Selection And Settings

The California Puff (CALPUFF, version 5.7) air modeling system was used to model to assess the proposed project's impacts at the PSD Class I area for comparison to the PSD Class I significant impact levels. 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 CALPUFF meteorological and geophysical data preprocessor (CALMET, Version 5.4), 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. 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 was input to CALPUFF to assess the pollutant specific impact. Both CALMET and CALPUFF were used in a manner that is recommended by the IWAQM Phase 2 and FLAG reports.

CALPUFF Model Approaches And Settings

The IWAQM has recommended approaches for performing a Phase 2 refined modeling analyses that are presented in Table C-9. These approaches involve use of meteorological data, selection of receptors and dispersion conditions, and processing of model output.

Table C-9. Refined Modeling Analyses Recommendations[a]

Model Input/Output	Description
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 sources being modeled; terrain elevation and land-use data is resolved for the situation.
Receptors	Within Class I area(s) of concern; obtain regulatory concurrence on coverage.
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	1. For PSD increments: use highest, second highest 3-hour and 24-hour average SO_2 concentrations; highest, second highest 24-hour average PM10 concentrations; and highest annual average SO_2, PM_{10}, and NO_x concentrations. 2. For haze: process, on a 24-hour basis, compute the source extinction from the maximum increase in emissions of SO_2, NO_x, and PM_{10}; compute the daily relative humidity factor [f(RH)], provided from an external disk file; and compute the maximum percent change in extinction using the FLM supplied background extinction data in the FLAG document. 3. For significant impact analysis: use highest annual and highest short-term averaging time concentrations for SO_2, PM_{10}, and NOx.

[a] IWAQM Phase II report (December, 1998) and FLAG document (December, 2000)

The specific settings used in the CALPUFF model are presented in Table C-10.

Table C-10. CALPUFF Model Settings

Parameter	Setting
Pollutant Species	SO_2, SO_4, NO_x, HNO_3, NO_3, PM_{10}
Chemical Transformation	MESOPUFF II scheme including hourly ozone data
Deposition	Include both dry and wet deposition, plume depletion
Meteorological/Land Use Input	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 file including output species for SO_4, NO_3, PM_{10}, SO_2, and NO_x; process for visibility change using Method 2 and FLAG background extinctions
Model Processing	For haze: highest predicted 24-hour extinction change (%) for the year For significant impact analysis: highest predicted annual and highest short-term averaging time concentrations for SO_2, NO_x, and PM_{10}.
Background Values	Ozone: 50 ppb; Ammonia: 1 ppb

Emission Inventory and Building Wake Effects

The CALPUFF model included the facility's emission, stack, and operating data as well as building dimensions to account for the effects of building-induced downwash on the emission sources. Dimensions for all significant building structures were processed with the Building Profile Input Program modified to process additional direction-specific building information, and were included in the CALPUFF model input. The modeling presents a listing of the facility's emissions and structures included in the analysis.

Receptor Locations

For the refined analyses, pollutant concentrations were predicted in an array of 161 discrete receptors located at the Okefenokee NWA and 13 discrete receptors at Chassahowitzka NWA.

Meteorological Data

Two wind field domains were developed to model the two PSD Class I areas that are described in the following sections. Figure C-3 presents the arrangement of the extents of the two wind field domains.

C.5.3 OKEFENOKEE NWA WIND FIELD DOMAINS

CALMET was used to develop the grid pattern for the parameter fields required for the refined modeling analyses for the Okefenokee NWA. The following sections discuss the specific data used and processed in the CALMET model.

Modeling Domain

A rectangular modeling domain extending 316 km in the east-west (x) direction and 412 km in the north-south (y) direction was used for the refined modeling analysis. The southwest corner of the domain is the origin and is located at 29.25 degrees north latitude and 84.0 degrees west longitude (east and north UTM coordinates of 208.0 and 3239.0 km, respectively, zone 17). This location is in the Gulf of Mexico approximately 110 km west of Cedar Key, Florida. For the processing of meteorological and geophysical data, the domain contains 80 grid cells in the x-direction and 104 grid cells in the y-direction. The domain grid resolution is 4 km. The air modeling analysis was performed in the UTM coordinate system.

Mesoscale Model – Generations 4 and 5 (MM4 and MM5) Data

Pennsylvania State University in conjunction with the NCAR Assessment Laboratory developed the MM4 and MM5 data set, a prognostic wind field or "guess" field, for the United States. The hourly meteorological variables used to create this data set (wind, temperature, dew point depression, and geopotential height for eight standard levels and up to 15 significant levels) are extensive and are available for 1990, 1992, and 1996. The analysis used the MM4 and MM5 data to initialize the CALMET wind field. The MM4 and MM5 data available for 1990 and 1992, respectively, have a horizontal spacing of 80 km and are used to simulate atmospheric variables within the modeling domain. The MM5 data are also available for 1996 and have a horizontal spacing of 36 km.

The MM4 and MM5 data used in the CALMET, although advanced, lacks the fine detail of specific temporal and spatial meteorological variables and geophysical data. These variables were processed into the appropriate format and introduced into the CALMET model through the additional data files obtained from the following sources.

Surface Data Stations and processing

The surface station data processed for the CALPUFF analyses consisted of data from ten NWS stations or Federal Aviation Administration (FAA) Flight Service stations for Columbus, Macon, Savannah, Augusta, Athens, and Atlanta in Georgia; and Tampa, Jacksonville, Daytona Beach, Tallahassee, and Gainesville in Florida. A summary of the surface station information and locations are presented in Table C-4. 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 surface station data were processed into a SURF.DAT file format for CALMET input.

Because the modeling domain extends over water, three sea surface stations were used. Data were obtained from two C-Man stations from Folly Island, South Carolina, and Savannah Light, Georgia, and one buoy identified NOAA Buoy 41008. These data were processed into an over-water surface station format (i.e., SEA*.DAT) for input to CALMET. The over-water station data include wind direction, wind speed and air temperature.

Upper Air Data Stations and Processing

Upper air data from the following NWS stations, based on the availability of the upper air data, were used in the modeling analysis:

- Waycross, Georgia (1990, 1992);
- Athens, Georgia (1990, 1992);
- Charleston, South Carolina (1990, 1992, 1996);
- Apalachicola, Florida (1990);
- Ruskin, Florida (1990, 1992, 1996);
- Tallahassee, Florida (1992, 1996);
- Jacksonville, Florida (1996); and
- Peachtree City, Georgia (1996).

Table C-11 presents the data and locations for the surface and upper air stations.

Table C-11. Surface and Upper Air Stations Used in the CALPUFF Analysis, Okefenokee NWA PSD Class I Area

			UTM Coordinates			
Station Name	**Station Symbol**	**WBAN Number**	**Easting (km)**	**Northing (km)**	**Zone**	**Anemometer Height (m)**
Surface Stations						
Tampa, FL	TPA	12842	349.17	3094.25	17	6.7
Jacksonville, FL	JAX	13889	432.82	3374.19	17	6.1
Daytona Beach, FL	DAB	12834	495.14	3228.09	17	9.1
Tallahassee, FL	TLH	93805	173.04[a]	3363.99	16	7.6
Columbus, GA	COL	93842	112.57[a]	3599.35	16	9.1
Macon, GA	MCN	3813	251.58	3620.93	17	7.0
Savannah, GA	SAV	3822	481.13	3555.03	17	9.1
Gainesville, FL	GNV	12816	377.43	3284.16	17	6.7
Augusta, GA	AGS	3820	410.25	3692.49	17	6.1
Athens, GA	AHN	13873	284.98	3758.67	17	7.6
Atlanta, GA	ATL	13874	158.65[a]	3725.04	16	6.1
Sea Surface Stations						
NOAA Buoy 41008	41008	-	490.42	3396.12	17	4.0
Folly Island (SC) C- Man	FBIS1	-	603.15	3618.33	17	6.7
Savannah Light (GA) C-Man	SVLS1	-	528.37	3540.27	17	10.0
Upper Air Stations						
Ruskin, FL	TBW	12842	361.95	3064.55	17	NA
Waycross, GA	AYS	13861	366.68	3457.95	17	NA
Athens, GA	AHN	13873	285.91	3758.83	17	NA
Charleston, SC	CHS	13880	590.42	3640.42	17	NA
Apalachicola, FL	AQQ	12832	110.22[a]	3290.65	16	NA
Tallahassee, FL	TLH	93805	173.04[2]	3363.99	17	NA
Jacksonville, FL	JAX	13889	459.61	3351.92	17	NA
Peachtree, GA	FFC	53819	188.65[2]	3679.35	16	NA

[a] Equivalent coordinate for Zone 17.

Precipitation Data Stations and Processing

Precipitation data were processed from a network of hourly precipitation data files collected from primary and secondary NWS precipitation-recording stations located within the latitude and longitudinal limits of the modeling domain. Data for 19 stations in Georgia and 22 stations in Florida were obtained in NCDC TD-3240 variable format and converted into a fixed-length format. The utility programs PXTRACT and PMERGE were then used to process the data into the format for the

PRECIP.DAT file that is used by CALMET. A listing of the precipitation stations used for the modeling analysis is presented in Table C-12.

Table C-12. Hourly Precipitation Stations Used in the Okefenokee NWA CALPUFF Analysis

Station Name	Station Number	UTM Coordinate Easting (km)	UTM Coordinate Northing (km)	UTM Coordinate Zone
Florida				
Branford	80975	315.61	3315.96	17
Bristol	81020	113.72[a]	3366.47	16
Brooksville 7 SSW	81048	358.03	3149.55	17
Cross city 2 WNW	82008	290.27	3281.75	17
Daytona Beach WSO AP	82158	495.14	3228.09	17
Deland 1 SSE	82229	470.78	3209.66	17
Dowling Park 1 W	82391	283.51	3348.42	17
Gainesville 11 WNW	83322	354.85	3284.43	17
Inglis 3 E	84273	342.63	3211.65	17
Jacksonville WSO AP	84358	434.27	3372.40	17
Lakeland	84797	409.87	3099.18	17
Lisbon	85076	423.59	3193.26	17
Lynne	85237	409.26	3230.30	17
Marineland	85391	479.19	3282.03	17
Melbourne WSO	85612	534.38	3109.97	17
Monticello 3 W	85879	220.17	3381.29	17
Orlando WSO McCoy	86628	468.99	3146.88	17
Panacea 3 s	86828	172.45[a]	3319.61	16
Raiford State Prison	87440	385.93	3326.55	17
Saint Leo	87851	376.48	3135.09	17
Tallahassee WSO AP	88758	173.04[a]	3363.99	16
Woodruff Dam	89795	124.29[a]	3399.94	16
Georgia				
Abbeville 4 S	90010	281.84	3535.69	17
Bainbridge Intl Paper Co	90586	144.85[a]	3409.59	16
Brunswick	91340	452.34	3447.98	17
Coolidge	92238	226.34	3434.77	17
Doles	92728	226.73	3510.59	17
Edison	93028	135.13[a]	3494.43	16
Fargo	93312	349.92	3395.35	17
Folkston 3 SW	93460	401.13	3407.69	17
Hazlehurst	94204	348.49	3526.08	17
Jesup	94671	416.21	3498.08	17
Pearson	96879	325.50	3464.09	17
Richmond Hill	97468	468.92	3535.69	17
Valdosta 4 NW	98974	276.90	3416.95	17
Claxton	91973	415.05	3559.19	17
Dublin 2	92844	321.61	3603.71	17
Lizella	95249	235.94	3633.39	17
Macon Middle Ga Regional	95443	251.13	3619.58	17

Table C-12. Hourly Precipitation Stations Used in the Okefenokee NWA CALPUFF Analysis

Station Name	Station Number	UTM Coordinate Easting (km)	 Northing (km)	 Zone
(continued)				
Savannah WSO Airport	97847	480.92	3553.43	17
Sylvania 2 SSE	98517	442.11	3621.57	17

[a] Equivalent coordinate for Zone 17.

Geophysical Data Processing

Terrain elevations for each grid cell of the modeling domain were obtained from 1-degree Digital Elevation Model (DEM) files obtained from the U.S. Geographical Survey (USGS) Internet website. The DEM data was extracted for the modeling domain grid using the utility program TERREL. Land-use data were also extracted from 1-degree USGS files and processed using utility programs CTGCOMP and CTGPROC. Both the terrain and land use files were combined into a GEO.DAT file for input to CALMET with the MAKEGEO utility program.

C.5.4 CHASSAHOWITZKA NWA WIND FIELD DOMAINS

CALMET was used to develop the grid pattern for parameter fields required for the refined modeling analyses for the Chassahowitzka NWA. The follow sections discuss the specific data used and processed in the CALMET model.

Modeling Domain

A rectangular modeling domain extending 348 km in the east-west (x) direction and 372 km in the north-south (y) direction was used for the refined modeling analysis. The southwest corner of the domain is the origin and is located at 27 degrees north latitude and 83.5 degrees west longitude (east and north UTM coordinates of 270.0 and 2990.0 km, respectively, zone 17). This location is in the Gulf of Mexico approximately 110 km west of Venice, Florida. For the processing of meteorological and geophysical data, the domain contains 88 grid cells in the x-direction and 94 grid cells in the y-direction. The domain grid resolution is 4 km. The air modeling analysis was performed in the UTM coordinate system.

Mesoscale Model – Generations 4 and 5 (MM4 and MM5) Data

Pennsylvania State University in conjunction with the NCAR Assessment Laboratory developed the MM4 and MM5 data set, a prognostic wind field or "guess" field, for the United States. The hourly meteorological variables used to create this data set (wind, temperature, dew point depression, and geopotential height for eight standard levels and up to 15 significant levels) are extensive and are available for 1990, 1992, and 1996. The analysis used the MM4 and MM5 data to initialize the CALMET wind field. The MM4 and MM5 data available for 1990 and 1992, respectively, have a horizontal spacing of 80 km and are used to simulate atmospheric variables within the modeling domain. The MM5 data are also available for 1996 and have a horizontal spacing of 36 km.

The MM4 and MM5 data used in the CALMET, although advanced, lacks the fine detail of specific temporal and spatial meteorological variables and geophysical data. These variables were processed into the appropriate format and introduced into the CALMET model through the additional data files obtained from the following sources.

Surface Data Stations and Processing

The surface station data processed for the CALPUFF analyses consisted of data from six NWS stations or Federal Aviation Administration (FAA) Flight Service stations for Gainesville, Tampa, Daytona Beach, Vero Beach, Fort Myers and Orlando. A summary of the surface station information and locations are presented in Table C-13. 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 surface station data were processed by FDEP into a SURF.DAT file format for CALMET input.

Because the modeling domain extends largely over water, C-Man station data from Venice was obtained. Florida DEP processed these data into an over-water surface station format (i.e., SEA*.DAT) for input to CALMET. The over-water station data include wind direction, wind speed and air temperature.

Upper Air Data Stations and Processing

Upper air data from the following NWS stations, based on the availability of the upper air data, were used in the modeling analysis:

- Ruskin, Florida (1990, 1992, 1996);

- West Palm Beach, Florida (1990, 1992);
- Apalachicola, Florida (1990);
- Tallahassee, Florida (1992, 1996);
- Jacksonville, Florida (1996); and
- Ft. Lauderdale, Florida (1996).

Table C-13 presents the data and locations for the surface and upper air stations.

Table C-13. Surface and Upper Air Stations Used in the CALPUFF Analysis, Chassahowitzka NWA PSD Class I Area

			UTM Coordinates			
Station Name	**Station Symbol**	**WBAN Number**	**Easting (km)**	**Northing (km)**	**Zone**	**Anemometer Height (m)**
Surface Stations						
Tampa	TPA	12842	349.20	3094.25	17	6.7
Daytona Beach	DAB	12834	495.14	3228.05	17	9.1
Orlando	ORL	12815	468.96	3146.88	17	10.1
Gainesville	GNV	12816	377.40	3284.12	17	6.7
Vero Beach	VER	12843	557.52	3058.36	17	6.7
Fort Myers	FMY	12835	413.65	2940.38	17	6.1
Venice Sea Surface	VENF1	--	356.2[a]	2994.8[a]	17	6.1
Upper Air Stations						
Ruskin	TBW	12842	349.20	3094.28	17	NA
West Palm Beach	PBI	12844	587.87	2951.42	17	NA
Apalachicola	AQQ	12832	110.00[a]	3296.00	16	NA
Tallahassee	TLH	93805	173.04[a]	3363.99	17	NA
Jacksonville	JAX	13809	459.61	3351.92	17	NA
Ft. Lauderdale	MFL	92803	562.18	2847.98	17	NA

[a] Equivalent coordinate for Zone 17; Zone 16 coordinate is 690.22 km.

Precipitation Data stations and Processing

Precipitation data were processed from a network of hourly precipitation data files collected from primary and secondary NWS precipitation-recording stations located within the latitude and longitudinal limits of the modeling domain. Data for 14 stations were obtained in NCDC TD-3240 variable format and converted into a fixed-length format. The utility programs PXTRACT and PMERGE were then used to process the data into the format for the PRECIP.DAT file that is used by CALMET. A listing of the precipitation stations used for the modeling analysis is presented in Table C-14.

Table C-14. Hourly Precipitation Stations Used in the Chassahowitzka NWA CALPUFF Analysis

Station Name	Station Number	UTM Coordinate		
		Easting (km)	Northing (km)	Zone
Belle Glade Hrcn Gt 4	80616	528.190	2953.034	17
Branford	80975	315.606	3315.955	17
Brooksville 7 SSW	81048	358.029	3149.545	17
Canal Point Gate 5	81271	536.428	2971.514	17
Daytona Beach WSO AP	82158	494.165	3227.413	17
Deland 1 SSE	82229	470.780	3209.660	17
Fort Myers FAA/AP	83186	413.992	2940.710	17
Gainesville 11 WNW	83322	355.411	3284.205	17
Inglis 3 E	84273	342.631	3211.652	17
Lakeland	84797	409.871	3099.178	17
Lisbon	85076	423.594	3193.256	17
Lynne	85237	409.255	3230.295	17
Marineland	85391	479.193	3282.030	17
Melbourne WSO	85612	534.381	3109.967	17
Moore Haven Lock 1	85895	491.608	2967.803	17
Orlando Wso Mccoy	86628	468.169	3145.102	17
Ortona Lock 2	86657	470.174	2962.267	17
Parrish	86880	366.986	3054.394	17
Port Mayaca S L Canal	87293	538.044	2984.440	17
Saint Leo	87851	376.483	3135.086	17
St Lucie New Lock 1	87859	571.042	2999.353	17
St Petersburg	87886	339.608	3071.991	17
Tampa Wscmo AP	88788	348.478	3093.670	17
Venice	89176	357.593	2998.178	17
Venus	89184	467.266	3001.224	17
Vero Beach 4 W	89219	554.268	3056.498	17
West Palm Beach Int AP	89525	589.611	2951.627	17

Geophysical Data Processing

Terrain elevations for each grid cell of the modeling domain were derived from 1-degree Digital Elevation Model (DEM) files obtained from the U.S. Geographical Survey (USGS) Internet website. The DEM data were extracted for the modeling domain grid using the utility program TERREL. Land-use data were also extracted from 1-degree USGS files and processed using utility programs CTGCOMP and CTGPROC. Both the terrain and land use files were combined into a GEO.DAT file for input to CALMET with the MAKEGEO utility program.

C.5.5 METHODOLOGY AND MODEL RESULTS

The following paragraphs summarize the processing methods for deposition, visibility.

Deposition

As part of the AQRV analyses, total nitrogen (N) and sulfur (S) deposition rates were predicted for the proposed project at the Okefenokee and Chassahowitzka NWAs. The deposition analysis criterion is based on the annual averaging period. The total N and S deposition is estimated in units of kilogram per hectare per year (kg/ha/yr). The CALPUFF model is used to predict wet and dry deposition fluxes of various oxides of these elements.

For N deposition, the species include:

- Particulate ammonium nitrate (from species NO_3), wet and dry deposition;
- Nitric acid (species HNO_3), wet and dry deposition;
- NO_x dry deposition; and
- Ammonium sulfate (species SO_4), wet and dry deposition.

For S deposition, the species include:

- SO_2 wet and dry deposition, and
- SO_4 wet and dry deposition.

The CALPUFF model produces results in units of micrograms per square meter per second ($\mu g/m^2/s$). The modeled deposition rates are then converted to N and S deposition in kilograms per hectare, respectively, by using a multiplier equal to the ratio of the molecular weights of the substances (refer to the IWAQM Phase 2 report, Section 3.3).

The deposition analysis threshold (DAT) for N of 0.01 kg/ha/yr was provided by the USFWS (January 2002). A DAT is the additional amount of N or S deposition within a Class I area, below which estimated impacts from a proposed new or modified source are considered insignificant. The maximum N and S deposition predicted for the proposed GP project is, therefore, compared to these DAT or significant impact levels.

Visibility

Based on the FLAG document, current regional haze guidelines characterize a change in visibility by the change in the light-extinction coefficient (b_{ext}). The b_{ext} is the attenuation of light per unit distance due to the scattering and absorption by gases and particles in the atmosphere. A change in the extinction coefficient produces a perceived visual change. An index that simply quantifies the percent change in visibility due to the operation of a source is calculated as:

$$\Delta\% = (b_{exts} / b_{extb}) \text{ x } 100$$

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

The purpose of the visibility analysis is to calculate the extinction at each receptor for each day (24-hour period) of the year due to the proposed project. The criteria to determine if the project's impacts are potentially significant are based on a change in extinction of 5 percent or greater for any day of the year.

The analysis processing of visibility impairment for this study was performed with the CALPUFF model and the CALPUFF post-processing program CALPOST. The analysis was conducted in accordance with the most recent guidance from the FLAG report (December 2000). The CALPUFF postprocessor model CALPOST is used to calculate the combined visibility effects from the different pollutants that are emitted from the proposed project. Daily background extinction coefficients are calculated on an hour-by-hour basis using hourly relative humidity data from CALMET and hygroscopic and non-hygroscopic extinction components specified in the FLAG document. For the Okefenokee NWA, the hygroscopic and non-hygroscopic components are 0.9 and 8.5 inverse megameter (Mm^{-1}). CALPOST then calculates the percent extinction change for each day of the year. Impacts for the proposed project only were compared to both the proposed EPA PSD Class I significance levels for SO_2 and NO_2, the regional haze degradation criteria of 5 percent, and the S and N deposition criteria of 0.01 kilograms per hectare per year (kg/ha/yr).

Table C-15 compares the maximum SO_2, PM_{10}, and NO_x concentrations predicted for the proposed project only at the Okefenokee and Chassahowitzka PSD Class I areas are compared with the EPA's proposed PSD Class I significance levels. The maximum SO_2, PM_{10}, and NO_2 concentrations were predicted to be below the significant impact levels at the PSD Class I areas. Therefore, a full PSD Class I increment analysis was not required for these pollutants.

Table C-15. Summary of Maximum Pollutant Concentrations Predicted for the Project at the Okefenokee and Chassahowitzka NWA PSD Class I Areas

		Concentrations [a] (ug/m^3)						EPA Class I Significant Impact Levels
		Okefenokee NWA			Chassahowitzka NWA			
Pollutant	Averaging Time	1990	1992	1996	1990	1992	1996	(µg/m3)
SO_2	Annual	0.0003	0.0002	0.0004	0.0002	0.0002	0.0002	0.1
	24-Hour	0.006	0.005	0.008	0.004	0.004	0.005	0.2
	3-Hour	0.021	0.021	0.025	0.012	0.020	0.018	1.0
PM_{10}	Annual	0.0012	0.0009	0.0015	0.0009	0.0009	0.0008	0.2
	24-Hour	0.027	0.018	0.034	0.016	0.018	0.019	0.3
NO_2	Annual	0.0013	0.0009	0.0023	0.0008	0.0010	0.0010	0.1

[a] Concentrations are the highest impacts predicted with the CALPUFF model and 1990, 1992, and 1996 CALMET Wind Fields.

Table C-16 compares the maximum visibility impairment predicted for the proposed project only at the Okefenokee and Chassahowitzka PSD Class I areas. The predicted impacts are less than the criteria.

Table C-16. Maximum 24-hour Average Visibility Impairment Predicted for the Project at the Okefenokee and Chassahowitzka NWA PSD Class I Areas

	Visibility Impairment (%) [a]			Visibility Impairment Criteria (%)
Area	1990	1992	1996	
Okefenokee NWA	1.23	1.08	1.70	5.0
Chassahowitzka NWA	0.54	0.84	1.38	5.0

[a] Concentrations are highest predicted using CALPUFF model and CALMET wind fields for central and north Florida, 1990, 1992 and 1996.

Background extinctions calculated using FLAG Document (December 2000) values and hourly relative humidity data.

Table C-17 compares the maximum deposition predicted for the proposed project only at the Okefenokee and Chassahowitzka PSD Class I areas. The predicted impacts are less than the criteria.

Table C-17. Maximum Sulfur and Nitrogen Annual Deposition Predicted for the Project at the Okefenokee and Chassahowitzka NWA PSD Class I Areas

	Total Deposition (Wet & Dry)						Deposition Analysis Threshold[b]
	1990		1992		1996		
Area/Species	(g/m2/s)	(kg/ha/yr)	(g/m2/s)	(kg/ha/yr)	(g/m2/s)	(kg/ha/yr)	(kg/ha/yr)
Okefenokee NWA							
Nitrogen Deposition	2.858E-12	0.0009	3.318E-12	0.0010	3.570E-12	0.0011	0.01
Sulfur Deposition	8.419E-13	0.0003	1.116E-12	0.0004	9.745E-13	0.0003	0.01
Chassahowitzka NWA							
Nitrogen Deposition	1.227E-12	0.0004	1.384E-12	0.0004	1.121E-12	0.0004	0.01
Sulfur Deposition	4.063E-13	0.0001	3.983E-13	0.0001	4.044E-13	0.0001	0.01

[a] Conversion factor is used to convert $g/m^2/s$ to kg/hectare (ha)/yr

g/m2/s x 0.001 kg/g
x 3600 sec/hr
x 8760 hr/yr =kg/ha/yr
or
$g/m^2/s$ x 3.1536E+= kg/ha/yr

[b] Deposition analysis thresholds (DAT) for nitrogen and sulfur deposition provided by the U.S. Fish and Wildlife Service, January 2002.
A DAT is the additional amount of N or S deposition within a Class I area, below which estimated impacts from a proposed new or modified source are considered insignificant.

C.5.6. ADDITIONAL IMPACTS ANALYSIS FOR NATIONAL WILDLIFE AREAS

The analysis addresses the potential impacts on vegetation, soils, and wildlife of the Okefenokee and Chassahowitzka NWAs Class I area due to the proposed project. In addition, potential impacts upon visibility resulting from the proposed project are assessed. The Okefenokee NWA Class I area is located approximately 108 km north of the GP Palatka Mill. Although the Wolf Island NWA Class I area is located approximately 186 km north of the GP Palatka Mill, only the Okefenokee NWA Class I area was evaluated since it is much closer to the Mill than Wolf Island, and both have similar AQRVs.

Ambient Impact

The maximum pollutant concentrations predicted for the project in the NWAs are presented above. These results were compared with effect threshold limits for both vegetation and wildlife as reported in the scientific literature. While the literature search focused on such species as cabbage palm, eastern red cedar, lichens, and species of the hardwood swamplands and mangrove forest, no specific citations that addressed these species were found. Threshold information is not available for all species found in the Class I area, although studies have been performed on a few of the common species and on other similar species that can be used as indicators of effects. All predicted impacts were far below thresholds.

Impacts to soils

For soils, the potential and hypothesized effects of atmospheric deposition include:

- Increased soil acidification,
- Alteration in cation exchange,
- Loss of base cations, and
- Mobilization of trace metals.

The potential sensitivity of specific soils to atmospheric inputs is related to two factors. First, the physical ability of a soil to conduct water vertically through the soil profile is important in influencing the interaction with deposition. Second, the ability of the soil to resist chemical changes, as measured in terms of pH and soil cation exchange capacity (CEC), is important in determining how a soil responds to atmospheric inputs.

The soils of the Okefenokee NWA are generally classified as histosols. Histosols (peat soils) are organic and have extremely high buffering capacities based on their CEC, base saturation, and bulk density. Therefore, they would be relatively insensitive to atmospheric inputs.

The soils of the Chassahowitzka NWA are also generally classified as histosols. According to the U.S. Department of Agriculture (USDA) Soil Surveys of Citrus and Hernando Counties, nine soil complexes are found in the Chassahowitzka NWA. These include Aripeka fine sand, Aripeka-Okeelanta-Lauderhill, Hallendale-Rock outcrop, Homosassa mucky fine sandy loam, Lacooche, Okeelanta mucks, Okeelanta-Lauderdale-Terra Ceia mucks, Rock outcrop-Homosassa-Lacoochee, and Weekiwachee-Durbin mucks (Porter, 1996). The majority of the soil complexes found in the Chassahowitzka NWA is inundated by tidal waters, contain a relatively high organic matter content, and have high buffering capacities based on their CEC, base saturation, and bulk density. The regular flooding of these soils by the Gulf of Mexico regulates the pH and any change in acidity in the soil would be buffered by this activity. Therefore, they would be relatively insensitive to atmospheric inputs. However, Terra Ceia, Okeelanta, and Lauderdale freshwater mucks are present along the eastern border of the Chassahowitzka NWA, and may be more sensitive to atmospheric sulfur deposition (Porter, 1996). Although not tidally influenced, these freshwater mucks are highly organic and, therefore, have a relatively high intrinsic buffering capacity.

The relatively low sensitivity of the soils to atmospheric inputs coupled with the extremely low ground-level pollutant concentrations due to the project for the Okefenokee and Chassahowitzka NWAs precludes any significant impact on soils.

Impacts to Vegetation

In summary, the phytotoxic effects from the project's emissions are minimal. It is important to note that the elements were conservatively modeled with the assumption that 100 percent was available for plant uptake. This is rarely the case in a natural ecosystem.

Impacts To Wildlife

The major air quality risk to wildlife in the United States is from continuous exposure to pollutants above the National AAQS. This occurs in non-attainment areas (*e.g.,* Atlanta). Risks to wildlife also may occur for wildlife living in the vicinity of an emission source that experiences frequent upsets or episodic conditions resulting from malfunctioning equipment, unique meteorological conditions, or startup operations (Newman and Schreiber, 1988). Under these conditions, chronic effects (*e.g.*, particulate contamination) and acute effects (*e.g.*, injury to health) have been observed (Newman, 1981).

A wide range of physiological and ecological effects to fauna has been reported for gaseous and particulate pollutants (Newman, 1981; Newman and Schreiber, 1988). The most severe of these effects have been observed at concentrations above the secondary AAQS. Physiological and behavioral effects have been observed in experimental animals at or below these standards.

Based on the very low level of impacts, GP does not expect any effects on wildlife AQRVs from SO_2, NO_2, and particulates. The proposed project's contribution to cumulative impacts is expected to be negligible.

Research with primates shows that O_3 penetrates deeper into non-ciliated peripheral pathways and can cause lesions in the respiratory bronchioles and alveolar ducts as concentrations increase from 0.2 to 0.8 ppm (Paterson, 1997). These bronchioles are the most common site for severe damage. In rats, the Type I cells in the proximal alveoli (where gas exchange occurs) were the primary site of action at concentrations between 0.5 and 0.9 ppm (Paterson, 1997). Work with rats and rabbits suggest that the mucus layer that lines the large airways does not protect completely against the effects of O_3, and desquamated cells were found from acute exposures at 0.25, 0.5, and 1.0 ppm. In animal research, O_3 has been found to increase the susceptibility to bacterial pneumonia (Paterson, 1997). During the last decade, there has also been growing concern with the possibility that repeated or long-term exposure to elevated O_3 concentrations may be causing or contributing to irreversible chronic lung injury.

The project's contribution to ground level O_3 is expected to be very low and dispersed over a large area. Coupled with the historical ambient data, mobility of wildlife, the potential for exposure of wildlife to the facility's impacts that lead to high concentration is extremely unlikely.

C.5.7 SUMMARY

The analysis demonstrates that the increase in impacts due to the proposed project is extremely low. Regardless of the existing conditions in the vicinity of the Class I area, the proposed project will not cause any significant adverse effects due to the predicted low impacts upon that area.

SELECTED REFERENCES

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Newman, J.R. 1981. Effects of Air Pollution on Animals at Concentrations at or Below Ambient Air Standards. Performed for Denver Air Quality Office, National Park Service, U.S. Department of the Interior. Denver, Colorado.

Newman, J.R. and R.K. Schreiber. 1988. Air Pollution and Wildlife Toxicology. Environmental Toxicology and Chemistry. 7:381-390.

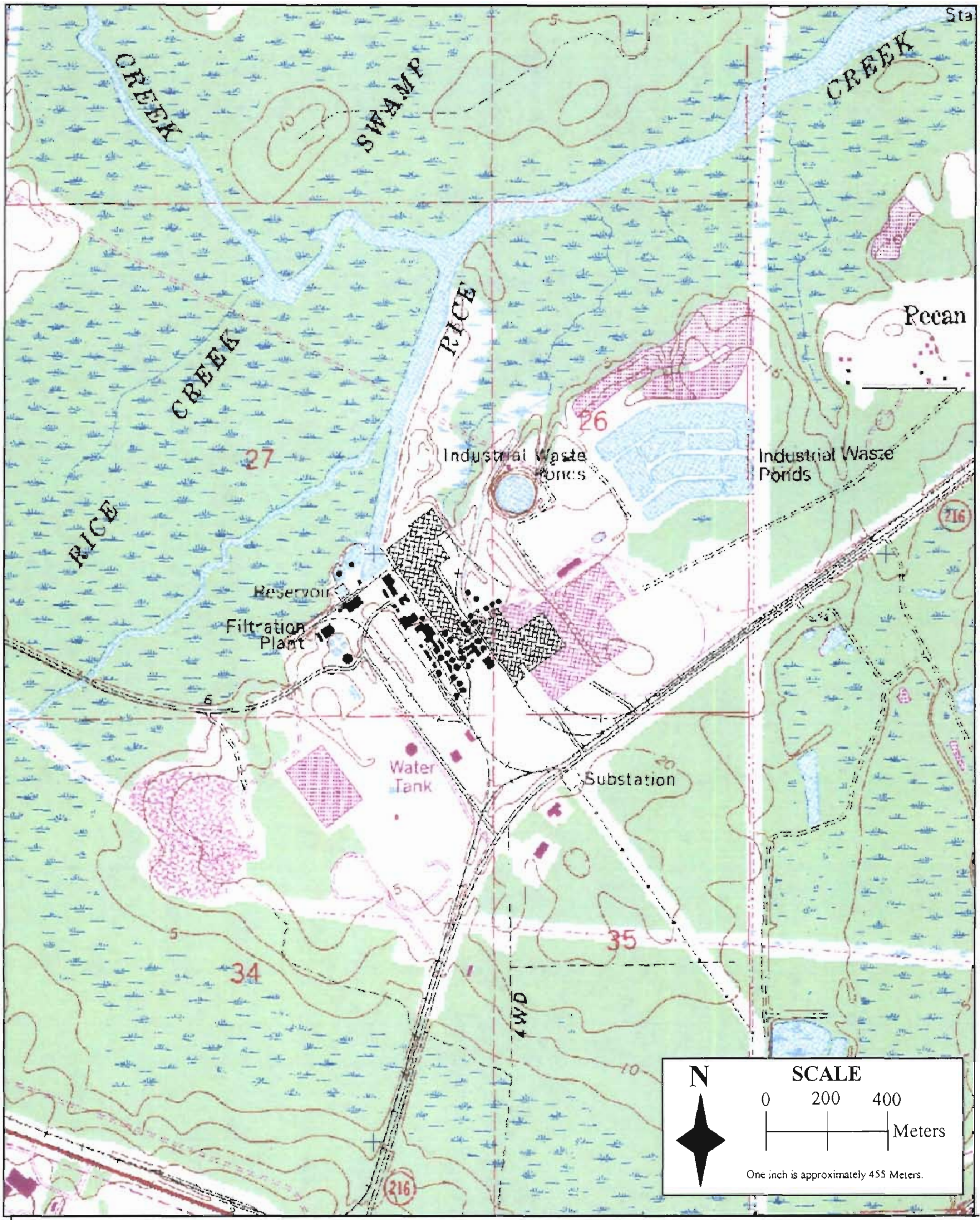
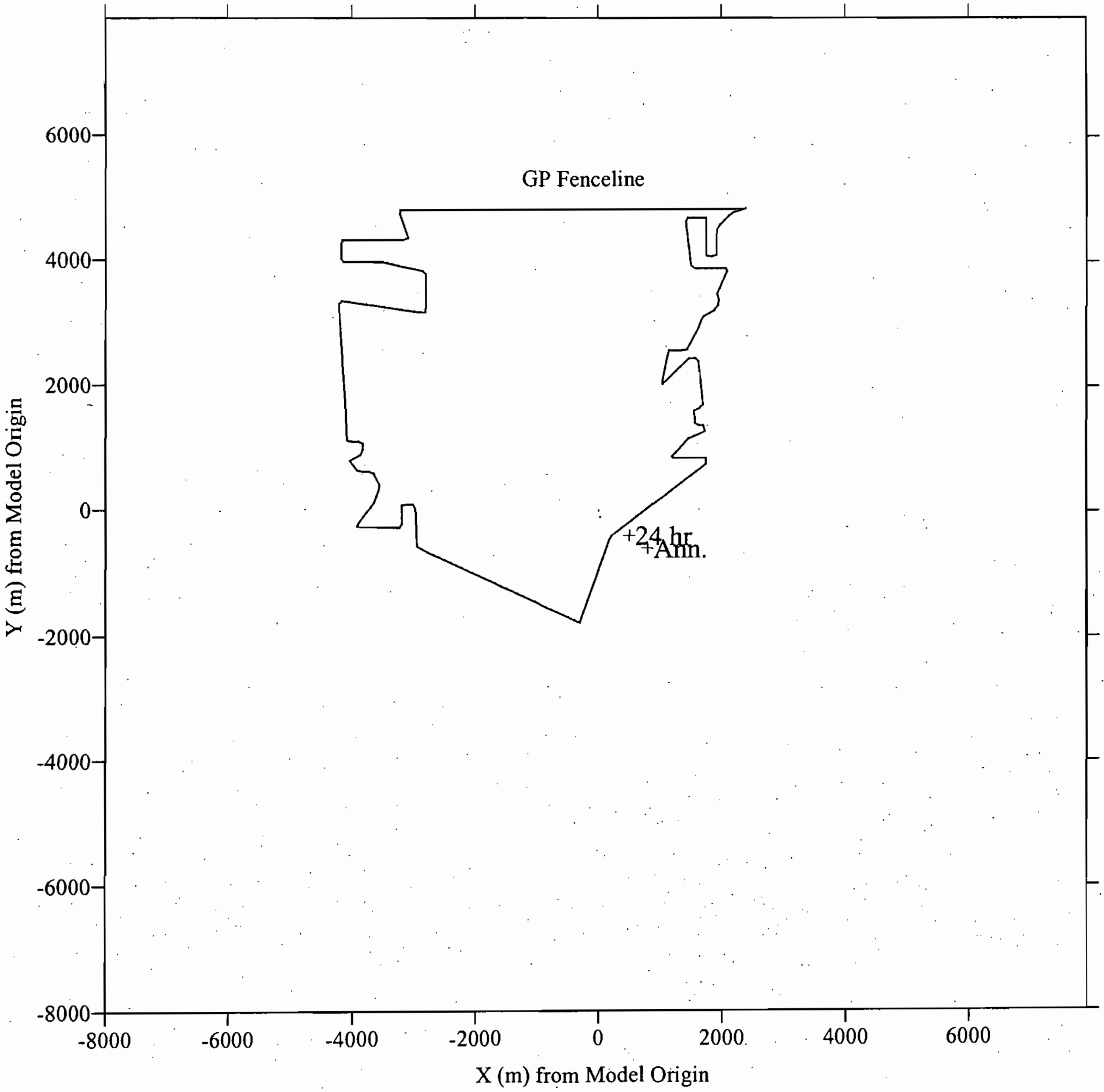


Figure C-1
Area Map
Georgia-Pacific Corporation, Palatka Mill

Source: Golder, 2004.

Figure C-2. Locations of Maximum Predicted Impacts, GP Palatka Kiln Project



Note: Model Extents of Screening receptors is -8,000m, -8,000m to +8,000m, +8,000 m

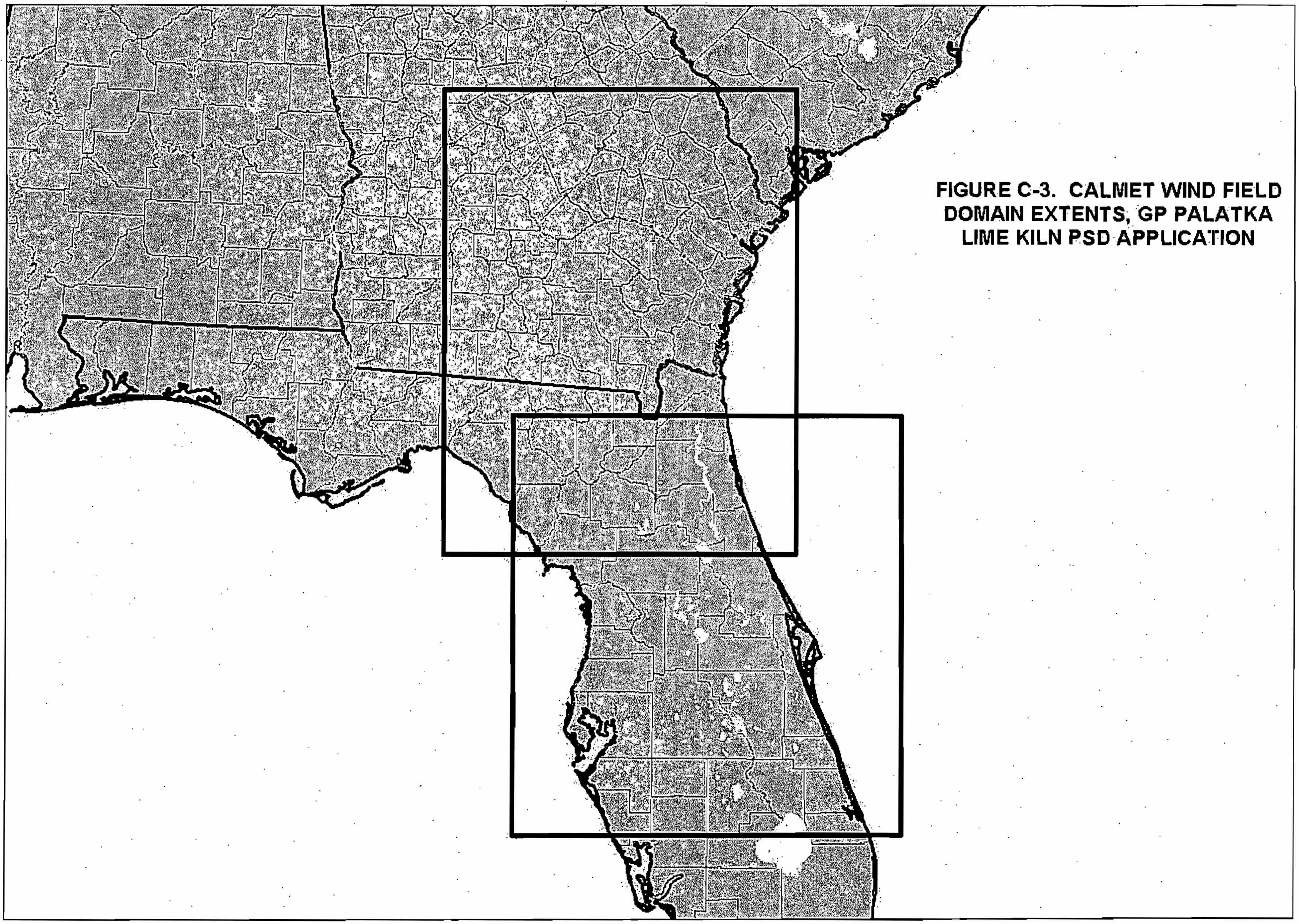


FIGURE C-3. CALMET WIND FIELD DOMAIN EXTENTS, GP PALATKA LIME KILN PSD APPLICATION

Attachment D
BACT Analysis

ATTACHMENT D
BACT Analysis
Georgia-Pacific, Palatka Mill, Lime Kiln Shell Replacement

D.1. INTRODUCTION TO BEST AVAILABLE CONTROL TECHNOLOGY ANALYSIS

Both the U. S. Environmental Protection Agency (EPA) and the Florida Department of Environmental Protection (FDEP) require that Best Available Control Technology (BACT) be applied to control emissions from a proposed new or modified source that triggers review under the federal Prevention of Significant Deterioration (PSD) regulations. Since the proposed project will install new equipment and modify an existing emissions unit, the BACT analysis must address all of this equipment. The project triggers PSD review and the requirement for a BACT analysis for emissions of particulate matter (both total suspended particulate matter (PM) and particulate matter less than 10 microns in aerodynamic diameter (PM_{10})), nitrogen oxides (NO_x), total reduced sulfur (TRS) compounds (including hydrogen sulfide (H_2S)), and ozone (based on a significant increase in volatile organic compounds (VOCs)).

With regard to the federal PSD rules, BACT is defined in 40 CFR 52.21as follows:

> *"Best Available Control Technology means an emission limitation (including a visible emission standard)based on the maximum degree of reduction for each pollutant subject to regulation under the Act which would be emitted from any proposed major stationary source or major modification which the Administrator, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant. In no event shall application of best available control technology result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under 40 CFR parts 60 and 61. If the Administrator determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emissions standard infeasible, a design, equipment, work practice, operational standard, or combination thereof, may be prescribed instead to satisfy the requirement for the application of best available control technology. Such standard shall, to the degree possible, set forth the emissions reduction achievable by implementation of such design, equipment, work practice or operation, and shall provide for compliance by means which achieve equivalent results."*

The requirements for BACT were promulgated within the framework of the PSD regulations in the 1977 Amendments to the Clean Air Act (CAA) [Public Law 95-95; Part C, Section 165(a)(4)]. The primary purpose of BACT is to optimize consumption of PSD air quality increments and thereby enlarge the potential for future economic growth without significantly degrading air quality (EPA, 1978; 1980). Guidelines for the evaluation of BACT can be found in the EPA's Guidelines for Determining Best Available Control Technology (BACT) (EPA, 1978) and in the PSD Workshop Manual (EPA, 1980 and 1990 draft). EPA promulgated these guidelines to provide a consistent approach to BACT and to ensure that the impacts of alternative emission control systems are measured by the same set of parameters. In addition, through implementation of these guidelines, BACT in one area may not be identical to BACT in another area.

According to EPA (1980), BACT analyses for the same types of emissions unit and the same pollutants in different locations or situations may determine that different control strategies should be applied to the different sites, depending on site-specific factors. Therefore, BACT analyses must be conducted on a case-by-case basis.

The BACT requirements are intended to ensure that the control systems incorporated in the design of a proposed or modified facility reflect the latest in control technologies used in a particular industry and take into consideration existing and future air quality in the vicinity of the facility. BACT must, as a minimum, demonstrate compliance with the New Source Performance Standards (NSPS) for a source (if applicable). An evaluation of the air pollution control techniques and systems, including a cost-benefit analysis of alternative control technologies capable of achieving a higher degree of emission reduction than the proposed control technology, is required. The cost-benefit analysis requires the documentation of the materials, energy, and economic penalties associated with the proposed and alternative control systems, as well as the environmental benefits derived from these systems. A decision on BACT is to be based on sound judgment, balancing environmental benefits with energy, economic, and other impacts (EPA, 1978).

D.2 FACILITY DESCRIPTION

Georgia-Pacific Corporation (GP) operates an unbleached and bleached Kraft pulp and paper Mill in Palatka, Florida (Putnam County). Processes and systems at the Mill include a batch digester system, multiple effect evaporator (MEE) system, condensate stripper system, recovery boiler and smelt dissolving tanks, lime kiln, tall oil plant, utilities, bleach plant, chlorine dioxide plant, and other equipment to produce finished paper products from virgin wood.

Putnam County has been designated by EPA as in attainment or unclassified for all criteria pollutants. The existing Mill is classified as a major stationary source under PSD and Clean Air Act Title V definitions since it has the potential-to-emit more than 100 tons per year (tpy) of at least one regulated air pollutant.

D.3 PROCESS AND PROJECT DESCRIPTION

As explained more fully in the main text of this document, the Palatka Mill is proposing to complete a maintenance project on the existing Lime Kiln (Emission Unit 017). In late 2003, the Mill experienced a failure of the Lime Kiln shell. The Kiln had cracks all the way through the shell in several different areas of the "hot end". This outage alone resulted in unbudgeted expenditures of $1.5 million for maintenance repairs and purchased chemicals. An equipment vendor has recommended that the Mill replace 62 feet of the hot end Kiln shell and all ten (10) coolers. The existing coolers are causing excessive stress on the Kiln shell. The new coolers will have an improved mounting bracket design that will eliminate future stress cracking underneath the coolers.

Presently, the Lime Kiln dries and processes lime mud from the causticizing system by burning fuel oil with a sulfur content no greater than 2.35%. The main function of the recausticizing area is to causticize green liquor with reburned lime or fresh lime to form white liquor for use in the digesters. In the recausticizing area, sodium carbonate (Na_2CO_3) is converted into active sodium hydroxide (NaOH) and various impurities introduced from the furnace and Lime Kiln are removed. Green liquor (formed by dissolving smelt from the recovery furnace) is first stabilized then clarified to remove dregs. Clarified green liquor and reburned lime from the lime storage silo are continuously mixed in a lime slaker to convert quick lime (CaO) into milk-of-lime (slaked lime). The liquor from the slaker continuously flows to the causticizers. In the causticizers, lime and Na_2CO_3 are converted into white liquor (sodium hydroxide and $CaCO_3$) by the following reaction steps.

1. $CaO + H_2O \rightarrow Ca(OH)_2 + \text{Heat}$
2. $Ca(OH)_2 + Na_2CO_3 \rightarrow 2NaOH + CaCO_3$

The white liquor from the causticizers flows through a clarifier where precipitated lime mud ($CaCO_3$) settles, and is then ready to recycle and re-use in the digesters. The $CaCO_3$ is then washed and calcined in a lime kiln to produce CaO for re-use in the causticizing process. The following reaction takes place in the Lime Kiln:

$$CaCO_3 \text{ (lime mud)} + \text{Heat} \rightarrow CaO + CO_2$$

Lime dust is captured by a dust collector (cyclone) and recycled back to the process. The exhaust gases from the Lime Kiln are then treated by a venturi scrubber.

D.4 SCOPE OF BACT ANALYSIS

For this permit application, a BACT analysis is required for particulate matter (both PM and PM_{10}), NO_x, TRS compounds (including H_2S), and VOCs. Attachment B of this permit application presents the emission inventory for the project. The following sections present the BACT analysis for the Lime Kiln.

D.5 TECHNICAL APPROACH

Historically, a bottom-up approach, consistent with the BACT Guidelines and PSD Workshop Manual, has been used. With this approach, an initial control level, which is usually NSPS, is evaluated against successively more stringent controls until a BACT level is selected. However, EPA developed a concern that the bottom-up approach was not providing the level of BACT decisions originally intended. As a result, in December 1987, the EPA Assistant Administrator for Air and Radiation mandated changes in the implementation of the PSD program, including the adoption of a new "top-down" approach to BACT decision-making.

The EPA issued a draft guidance document on the top-down approach entitled Top-Down Best Available Control Technology Guidance Document (EPA, 1990). However, to date, EPA has not promulgated the top-down approach for determining BACT. According to the guidance, the BACT analysis shall include the following steps:

> (1) Identify all potential control strategies.
>
> (2) Eliminate technically infeasible options. The demonstration of technical infeasibility should be clearly documented and should show, based on physical, chemical, and engineering principles, that the technical difficulties would preclude the successful use of the control option on the emission unit under review.
>
> (3) Rank remaining control technologies by control effectiveness. The ranking should include relevant information such as:
>
> (a) control effectiveness
> (b) expected emission rate
> (c) expected emission reduction
> (d) energy impacts
> (e) environmental impacts
> (f) economic impacts
>
> (4) Evaluate most effective controls and document results. The evaluation should include case-by-case consideration of energy, environmental and economic impacts. If the top option is not selected as BACT, the evaluation should consider the next most effective control option.
>
> (5) Select BACT. BACT is the most effective option not rejected in Step 4.

D.6. BACT ANALYSIS FOR LIME KILN

D.6.1 Step 1 – Identification of Control Technologies

GP conducted a comprehensive review of potential control technologies, utilizing the following:

- The BLIS database (the RACT/BACT/LAER Clearinghouse) (RBLC),
- Pollution control technology vendors;
- US EPA control technology documents;
- GP experience with similar pollution control technologies in pulp and paper manufacturing

To identify the current technologies in use today, GP considered RBLC entries dated January 1990 or later for pulp and paper lime kilns. The following table summarizes the findings.

Table D-1. Summary of BACT Determinations for Pulp Mill Lime Kilns Listed by EPA

Pollutant	Control Technology
NO_x	No Controls
NO_x	Low-NO_x Burners
NO_x	Efficient Operation
NO_x	Good Combustion Control
NO_x	Preventative Maintenance
PM/PM_{10}	Electrostatic Precipitator (ESP)
PM/PM_{10}	Wet Scrubber (venturi and other)
PM/PM_{10}	Venturi Scrubber
PM/PM_{10}	Fabric Filter[1]
VOC	Venturi Scrubber Using Fresh Water
VOC	Good Combustion Control
VOC	Kiln Design and Operation
TRS	Venturi Scrubber
TRS	Use of Low Sulfur Fuels
TRS	No Controls
TRS	Wet Scrubber and Optimal Mud Washing
TRS	Good Combustion Control

[1] According to the West Virginia Department of Environmental Protection (DEP), the equipment was never constructed and the permit has expired.

Appendix 1 presents the individual query results for each pollutant.

As the listed technologies are all conventional and demonstrated (with the exception of the fabric filter for PM control) on pulp and paper mill lime kilns, this BACT analysis presents a detailed description of the individual technologies in Step 2. The RBLC only contained a single record for H_2S. This record was for a Gulf States Paper facility located in Demopolis, Alabama. The entry states that there were no controls in place. Thus, this step did not identify any control technologies for H_2S.

In addition to the listed technologies, several additional technologies for NO_x control are available for external combustion sources, although these have never been "demonstrated" on a lime kiln. These technologies include Flue Gas Recirculation (FGR), Oxidation/Reduction Scrubbing (O/R), Selective Catalytic Reduction (SCR), Selective Non-Catalytic Reduction (SNCR) and Non-Selective Catalytic Reduction (NSCR).

D.6.2 Step 2 – Technical Feasibility Analysis

This step of the BACT review process discusses the technical feasibility or infeasibility of each of the technologies identified in prior steps. Table D-2 addresses the technical feasibility of the various technologies specifically applied to the Lime Kiln at the Palatka Mill.

Table D-2. Technical Feasibility of the Control Technologies for a Lime Kiln

Pollutant	Control Technology	Typical Control Efficiency Range (% reduction)	Technically Feasible for Palatka Lime Kiln?
NO_x	Oxidation/Reduction Scrubbing	90%	No
NO_x	Selective Catalytic Reduction	60-90%	No
NO_x	Selective Non-Catalytic Reduction	30-50%	No
NO_x	Low-NO_x Burners	20-30%	No
NO_x	Flue Gas Recirculation	Varies (15%-25%)	No
NO_x	Non-Selective Catalytic Reduction	Varies	No
NO_x	Good Combustion Control/ Preventative Maintenance/Efficient Operation	Varies	Yes
PM/PM_{10}	Venturi Scrubber and ESP[1]	99%+	Yes
PM/PM_{10}	Fabric Filter[2]	99%+	No
PM/PM_{10}	ESP	95-99%	Yes
PM/PM_{10}	Venturi Scrubber	95-99%	Yes
PM/PM_{10}	Wet Scrubber (other)	95+%	Yes
PM/PM_{10}	Cyclonic Separators	25-95%	Yes
VOC	Venturi Scrubber Using Fresh Water	Varies	Yes
VOC	Good Combustion Control	Varies	Yes
VOC	Kiln Design and Operation	Varies	Yes
TRS	Wet Scrubber and Optimal Mud Washing	90%-95%	Yes
TRS	Gas Absorption with a Caustic Scrubber	90%-95%	Yes
TRS	Good Combustion Control	Varies	Yes
TRS	Use of Low Sulfur Fuels	[3]	Yes[3]

[1] Control technology currently in place at Koch Cellulose Mills in Leaf River, MS and Brunswick, GA; also in place on one of two lime kilns at a Georgia-Pacific Mill in Port Hudson, LA and on a lime kiln at a Georgia-Pacific Mill in Naheola, AL. Although not otherwise reported in the RBLC, GP is aware of the technology as a prior (in the case of the two Koch Cellulose Mills) or current owner (Port Hudson and Naheola) of these facilities.

[2] According to the West Virginia Department of Environmental Protection (DEP), the equipment was never constructed and the permit has expired.

[3] The TRS gases are generated as a result of the calcining process, as opposed to being generated as a result of fuel combustion. As such, the use of low sulfur fuels would lead to little, if any, reduction in emissions of TRS.

Nitrogen Oxides

Table D-2 identifies seven (7) possible technologies for the control of NO_x emissions from a lime kiln. GP believes that only one of these is technically feasible. The following paragraphs discuss the technical feasibility or infeasibility of each technology. A significant portion of the following information, including feasibility for a lime kiln, was obtained from the BACT Determination for Weyerhaeuser – Flint River Operations, Georgia SIP Permit Application No. 14050, March 2003. A copy of the determination is included in Appendix 2.

Oxidation/Reduction Scrubbing (O/R)

Several proprietary NO_x removal processes are commercially available, such as Tri-Mer Corporation's TRI-NO_X and BOC's LoTO_X System. It has been reported that O/R scrubbing has a theoretical NO_x removal efficiency of 90 percent. The basic elements of the system are:

1) Cooling of the gas stream to its dew point temperature (150 degrees Fahrenheit (°F) to 250 °F) which condenses a portion of the water vapor in the gas and generates condensate that requires disposal,
2) Low temperature oxidation of the NO_x, CO and SO_2 to higher oxides through controlled injection of ozone or sodium chlorite in a static mixer or reaction duct (the ozone/NO_x ratios required to produce the desired NO_x oxidation are reported to be less than stoichiometric amounts),
3) Absorption of higher vapor forms of nitrogen and sulfur oxides in a wet scrubber that produces nitric, sulfuric, and carbonic acid solution. These acids must be recovered and neutralized by the use of sodium hydroxide in the scrubber water (caustic scrubbing) as follows:

$$2\ NaOH + 2\ NO_2 + 1/2\ O_2 \rightarrow 2\ NaNO_3 + H_2O$$

$$N_2O_5 + H_2O \rightarrow 2\ HNO_3$$

4) Once neutralized, the resultant scrubber water, containing nitrate solution, can be discharged to a sanitary sewer system.

Saturated flue gas from the scrubber requires heating before exiting through the flue stack to prevent in-stack condensation of acid gases and other adverse ambient impacts. Further, bleed air or a water spray cooling tower could be required to cool the gases, thus increasing the size of the ID fan and its power consumption. When using bleed air, cooling the gases to the dew point temperature will condense a portion of the water vapor and acid vapor. This condensate must be properly disposed of since it cannot be used in other portions of the lime kiln process. Also, oxygen must be supplied to cells that generate the ozone. This requires installation of very large liquid oxygen tanks. The liquid oxygen is withdrawn from the tank, sent through a vaporizer, and then to the generating cells. Considerable safety practices must be exercised when dealing with handling and vaporizing liquid oxygen. Finally, the ability of the O/R Scrubbing System to perform on a lime kiln or a similar source has never been demonstrated, particularly in the presence of carbon dioxide (CO_2) from both calcination and combustion. Furthermore, the technology is not listed for lime kilns in the RBLC. For all of the reasons listed above, O/R Scrubbing is considered technically infeasible for the Lime Kiln.

Selective Catalytic Reduction (SCR)

SCR is an exhaust gas treatment process in which ammonia (NH_3) or urea is injected into the exhaust gas upstream of a catalyst bed. The NH_3 reacts to form nitrogen (N_2) and water on the surface of the catalyst. The overall chemical reaction is represented by the following equation:

$$NH_3 + NO + 1/4\ O_2 \rightarrow N_2 + 3/2\ H_2O$$

In the SCR process, urea or NH_3 from a liquid storage tank is vaporized and injected into the exhaust prior to the catalyst. The exhaust gas/ammonia mixture passes over the catalyst. The function of the catalyst is to lower the activation energy of the NO decomposition reaction, therefore, lowering the temperature necessary to carry out the reaction. Several technical and operational difficulties exist with SCR technology. The SCR process is temperature sensitive. Efficient operation requires constant exhaust temperatures within a defined range; usually ± 50°F. Any load fluctuation resulting in exhaust gas temperature fluctuations reduces removal efficiency and upsets the NH_3/NO_x molar ratio. A low temperature results in slow reaction rates, which leads to low nitrogen oxides conversion, and unreacted NH_3 passing through the reactor bed (ammonia slip). A high temperature results in shortened catalyst life and can lead to the oxidation of NH_3 and the formation of additional NO_x. Under ideal conditions the catalytic reaction can result in NO_x removal efficiencies between 60 and 90 percent. SCR technology has not been applied to lime kilns due to the variable exhaust temperatures associated with the process. Further, the optimum temperature range for the catalytic reaction is 575 °F to 750 °F. A lime kiln typically operates in the 1,600 – 2,700 °F range.

Additional concerns with using a SCR system include the hazards involved with storing large quantities of NH_3 and with disposal of spent catalyst that has been contaminated by SO_2 and chlorine (Cl_2). Most of the time, the spent catalyst is returned to the supplier who regenerates the catalyst and sends it back to the user. The NH_3 also causes potential corrosion problems. Another operating condition that has a major impact on SCR performance is the NH_3/NO_x molar ratio. Ammonia is typically injected to produce an NH_3/NO_x molar ratio of 1.05-1.1/1 to achieve NO_x conversions of 80 to 90 percent with an ammonia slip of about 10 parts per million (ppm). Increasing this ratio would significantly increase the ammonia slip, with little change in conversion, and decreasing the ratio would result in lower conversion. The ammonia may also react with sulfur to form ammonium bisulfate, which has the potential to create a visible and/or detached plume. The lime may also react with the sulfur to form calcium sulfate. Ammonium bisulfate and calcium sulfate coatings, along with other dusts, will block the catalyst pores, thereby reducing the catalyst effectiveness.

The SCR unit could be placed downstream of the wet scrubber to alleviate the catalyst blockage problem; however, the flue gas is approximately 170 °F and would require a heat exchanger (*i.e.*, an additional gas-fired duct burner) system to achieve the desired reaction temperature of greater than 575 °F. The necessary equipment includes a catalytic reactor, heat exchanger, and blower. This technology is not listed for lime kilns in the RBLC. For all of the reasons listed above, SCR is not considered to be technically feasible for controlling NO_x emissions from lime kilns.

Selective Non-Catalytic Reduction (SNCR)

SNCR is an exhaust gas treatment process in which urea or ammonia is injected into the exhaust gas. High temperatures, normally between 1,600 °F and 2,100 °F, promote the reaction between NH_3 and NO_x to form N_2 and water. The overall chemical reaction is represented by the following equation.

$$NH_3 + NO + 1/4\ O_2 \rightarrow N_2 + 3/2\ H_2O$$

In this process, NH_3 from a liquid storage tank is vaporized and injected into the exhaust. The system is temperature dependent.

Several difficulties preclude use of an SNCR system for control of NO_x emissions from a lime kiln. If burner temperatures exceed 2,100 °F, the NH_3 injected with the SNCR system will begin to oxidize, forming additional NO_x. Another difficulty involves maintaining the correct NH_3/NO_x ratio during any load fluctuations. Any excess NH_3 would be released into the atmosphere, creating ammonia slip. Not only does ammonia slip result in direct emissions to the atmosphere, it also leads to the formation of ammonium salts. These salts can result in a visible plume. In addition, the NH_3 injection, storage, and waste by-product collection system must be properly designed for spill containment and waste removal. Use of this control technology in a lime kiln would cause several concerns. Due to load and exhaust gas temperature fluctuations, optimum NH_3/NO_x molar ratio, as well as correct reaction temperatures, would be extremely difficult to monitor and maintain, and release of NH_3 into the atmosphere can occur. Further, it is likely that formation of NH_3 salts would occur, which could result in an increase in process downtime due to "ringing" effects on the kiln interior. In addition, the hazards involved with the storage of NH_3 and the increased emissions from ammonia slip cause environmental and safety concerns.

The correct temperature window of 1,600 °F to 2,100 °F occurs inside the rotating body of the kiln. Locating injection nozzles in such an area is not technically feasible at the present time and has not been attempted on any lime kiln. SNCR has never been demonstrated on a lime kiln and is not listed in the RBLC. For all of the above reasons, SNCR is considered a technically infeasible control technology for the Lime Kiln.

Low-NO_x Burners (LNB)

Traditional burner design introduces both the fuel and air into a single combustion zone. To obtain optimal flames, large amounts of excess air must be combined with the fuel. This relatively "uncontrolled" combustion creates high flame temperatures. To control the generation of thermal NO_x, LNB technology stages combustion in the high temperature zone of the flame. The first stage is a fuel-rich, oxygen-lean atmosphere where little oxygen is available for NO_x formation and which reduces peak flame temperatures by delaying the completion of the combustion process. Combustion is then completed downstream in the second stage where excess air is available, but temperatures are lower than at the hottest portion of the flame core. Although LNBs have been extensively tested and used in utility boilers and industrial furnaces, the transfer of this technology to lime processing has been met with difficulties. Burner flame properties are critical to the quality control and calcining process to convert a high percentage of mud to reburnt lime in the lime kiln. The burner flame shape and properties have a dramatic effect on calcining efficiency. Poor efficiency increases energy usage and decreases the calcining capacity of the kiln. Due to these technical complexities, the conversion of a standard lime kiln burner to low NO_x design is not yet technically feasible. Further, the State of Georgia BACT determination for the Weyerhaeuser Mill stated that there are no commercially available LNBs on the market for a lime kiln application. Due to such technical and operational difficulties, in addition to the unavailability, LNBs are not a technically feasible control option for NO_x emissions from the Palatka Lime Kiln.

Flue Gas Recirculation (FGR)

FGR redirects the post-combustion exhaust gas back to the primary combustion chamber to create a lower oxygen (O_2) content atmosphere. This oxygen-lean atmosphere provides less O_2 available for NO_x formation. Due to increased mass flow, peak flame temperature is lowered. Therefore, FGR reduces both fuel and thermal NO_x.

Major barriers to using FGR include the following: 1) it would reduce the peak flame temperature below the temperature necessary for proper lime formation, and 2) a long and lazy flame will be produced, which is not acceptable for ensuring fully calcined lime. FGR would also require an excessive amount of ducting from the stack to the Kiln inlet. Finally, FGR has never been demonstrated on a lime kiln and is considered a technically infeasible control technology for lime kilns.

Non-Selective Catalytic Reduction (NSCR)

NSCR is an exhaust gas treatment technique for NO_x reduction. It is the type of catalyst control used to treat automobile exhaust and typically uses a platinum/rhodium catalyst. Use of NSCR reduces emissions of NO_x, CO, and VOC simultaneously across the catalyst bed, but it is only effective in fuel rich combustion air. To achieve a fuel-rich environment, excess combustion air must be kept to a minimum, resulting in an exhaust gas with less than three percent O_2 by volume ideally (the O_2 content should be less than half a percent by volume for proper operation).

The Palatka Lime Kiln normally operates with stack exhaust gas O_2 concentrations in the 4 to 6 percent range (by volume). Decreasing the excess air, and thus the O_2 concentrations, would result in increased CO emissions – an unacceptable compromise. In addition to the operational incompatibility of the control strategy, various problems will arise from the fuel-borne contaminants causing catalyst fouling (dust, SO_2, and Cl_2 in the flue gas can poison the catalyst), excessive backpressure, plugging of the catalyst, and efficiency reduction. For all of the reasons mentioned above, NSCR is technically infeasible for lime kiln NO_x emissions control.

Good Combustion Practices

The formation of NO_x is minimized by proper kiln design and operation. Generally, emissions are minimized when the lime kiln temperature is kept at the lower end of the desired range and when the distribution of air at the air and fuel injection zones is controlled. Ideally, maintaining a low-oxygen condition near fuel injection points approaches an off-stoichiometric staged combustion process. A high thermal efficiency would lead to less consumption of heat and fuel and would produce less NO_x emissions. General improvement in thermal efficiency is one design method of reducing NO_x formation, since less fuel is used. This control option is technically feasible.

Particulate Matter

As indicated in Table D-2, G-P has identified 5 technologies. GP believes each of these technologies is technically feasible. The following paragraphs discuss the technical feasibility of each technology.

Fabric Filters

A baghouse, or fabric filter, is one of the most efficient devices for removing particulate matter (including lead). Baghouses have the capability of maintaining collection efficiencies at or above 99 % for particles down to 0.3 micrometers (μm). The basic components of a fabric filter unit consist of woven or felted fabric, usually in the form of bags that are suspended in a housing structure (baghouse), an induced draft or forced draft fan; and a blow-back or reverse air fan, pulse-jet fan, or mechanical shaking mechanism. The emission stream is distributed by means of specially designed entry and exit plenum chambers, providing equal gas flow through the filtration medium. The particle collection mechanism for fabric filters includes inertial impaction, Brownian diffusion, gravity settling, and electrostatic attraction. The particles are collected in dry form on a cake of dust supported by the fabric or on the fabric itself. The process occurs with a relatively low pressure drop requirement (usually within the range of 2-6 inches water column pressure). Periodically, most of the cake dust is removed for disposal. Shaking or a "rapping" system removes cake dust, with the use of reverse air or with the use of a pulsejet of air. Dust is collected in a hopper at the bottom of the baghouse and is removed through a valve and dumped into a storage container. Usually, the dust is disposed of at an industrial landfill.

There is a single entry for a fabric filter in the RBLC, from eight (8) years ago, for a facility located in West Virginia (Apple Grove Pulp and Paper Company). GP spoke to the West Virginia Department of Environmental Protection on June 18, 2004 and obtained information that this equipment was never constructed and the permit has subsequently expired. GP made this call as a result of strong concerns regarding the use of this technology on a lime kiln. The moisture content of the gas stream is in the range of 35% leaving the Lime Kiln. The temperature of the stream is approximately 600 °F (range of 550 to 700 °F). In order for a fabric filter to operate properly, and within the range designed, condensation would have to be totally prevented. In order to prevent condensation, the temperature of the stream would have to maintained above the dew point temperature, which would be extremely difficult, if not impossible. A fabric filter would have to be fully insulated with no air leaks.

Furthermore, it would have to be assured that the insulation was put back on exactly as originally installed anytime that maintenance took place on the unit. If any condensation at all occurred within the fabric filter, the bags would plug and the collection efficiency would drop rapidly. A fabric filter is much more appropriate for "dry" air streams. For these reasons, this technology is rejected for the lime kiln application on the basis of technical infeasibility.

Electrostatic Precipitator (ESP)

ESPs use electrical energy to charge and collect particles with very high removal efficiency. The classification of ESPs may be as wet or dry systems and single-stage or two-stage systems. Dry systems are the predominant type used in industrial applications. Wet systems are gaining in popularity today since they eliminate the possibility of fires, which can sometimes occur in dry systems.

The principal components of a dry ESP (DESP) include the housing, discharge and collection electrodes, power source, cleaning mechanism, and solids handling systems. The housing is gas-tight, weatherproof, and grounded for safety. Dust particles entering the housing are charged by ions from the discharge electrodes. Dust is collected on the collection electrodes. The collection electrodes are also referred to as plates. The system voltage and the distance between the discharge and collection electrodes governs the electric field strength and the amount of charge on the particles. DESPs are most effective at collecting coarse, larger particles above the 1.0 μm size. Particles smaller than this are difficult to remove because they can inhibit the generation of the charging corona in the inlet field, thereby reducing collection efficiency. Rappers serve as the cleaning mechanisms for DESPs. Dust hoppers collect the precipitated particles from a DESP. Dust is removed continuously or periodically from the hopper and stored in a container until final disposition.

Wet ESPs operate a wet wall on the back of an ESP, with either continuous or intermittent water flow. The water flow is collected into a sump. The advantage to a wet ESP is that it has no back coronas and there is a reduced risk of fire. Collection efficiencies for both types of systems (dry or wet) are usually at or above 95-99%.

Both dry and wet ESPs are technically feasible for the Palatka Lime Kiln.

Wet Scrubbers

Wet scrubbers are collection devices that trap wet particles in order to remove them from a gas stream. They utilize inertial impaction and/or Brownian diffusion as the particle collection mechanism. Wet scrubbers generally use water as the cleaning liquid. Water usage and wastewater disposal requirements are important factors in the evaluation of a scrubber alternative. Types of scrubbers include spray scrubbers, cyclone scrubbers, packed-bed scrubbers, plate scrubbers, and venturi scrubbers. The most common particulate matter removal scrubber is the venturi scrubber because of its simplicity (no moving parts) and high collection efficiency. In this type of scrubber, a gas stream is passed through a venturi section, before which, a low-pressure liquid (usually water) is added to the throat. The liquid is atomized by the turbulence in the throat and begins to collect particles impacting the liquid as a result of differing velocities for the gas stream and atomized droplets. A separator is used to remove the particles or liquid from the gas stream. The most important design consideration is the pressure drop across the venturi. Generally, the higher the pressure drop, the higher the collection efficiency. Venturi scrubbers with a pressure drop greater than 15 inches of water usually have collection efficiencies near 85%. Venturi scrubbers with higher pressure drops can result in collection efficiencies up to 98%. Wet scrubbers are technically feasible for the Lime Kiln.

<u>Cyclonic Separators</u>

Cyclonic separators are devices that utilize centrifugal forces and low pressure caused by spinning motion to separate materials of different density, size and shape. Gas cyclones are used to separate particulate matter from dust-laden air streams. Cyclones are popular because they are simple to operate, inexpensive to manufacture, require little maintenance, have no moving parts, and operate at high temperatures and pressures. There are two types of separators available, tangential and axial. Both types operate on the same principle; however, in axial flow cyclones, the gas stream enters from the top of the unit and is forced to move tangentially by a grate in the top of the cyclone. In tangential cyclones, the gas stream enters from an inlet on the side that is positioned tangentially to the body of the unit. Multi-stage cyclones can increase the amount of particulate matter that is removed by connecting a number of single stage cyclones in series. The first stage of a multi-stage cyclone removes the larger particles while the remaining stages remove progressively smaller particles. The collection efficiency of cyclones varies anywhere from 25 to 95%, depending on whether the system is comprised of a single-stage cyclone or a multi-stage cyclone system. Cyclonic separators are technically feasible for the Lime Kiln.

Volatile Organic Compounds

As indicated in Table D-2, GP has identified one (1) add-on control technology and two pollution prevention techniques. The terms “good combustion practices” and “proper kiln design and operation” are really two labels for the same set of efficient combustion practices. As such, the same principles apply and there is no need to discuss these separately. The technical feasibility of each of these control approaches is discussed in the following paragraphs.

<u>Venturi Scrubber Using Fresh Water</u>

A single entry in the RBLC, for a facility in Louisiana, indicates the use of a “venturi scrubber using fresh water” as a control alternative for VOCs. Almost all of the water used in the Lime Kiln scrubber at the Palatka Mill is fresh water. If any condensates were used as scrubber “make-up”, they would be “clean” condensates with extremely low quantities of methanol.

National Council for Air and Stream Improvement, Inc. (NCASI) Technical Bulletin No. 676 discusses the impact of a scrubber in controlling VOC emissions:

> *“At Mill M the lime kiln vent gases entering and exiting the wet scrubber were tested. The results...show a very small decrease in total...VOC emissions across the wet scrubber, primarily due to a slight decrease in methanol emissions from the scrubber. These differences do not appear to be significant.”*

This same Technical Bulletin states the following:

> *"These observations...support the conclusion that methanol in the scrubber make-up water is the major source of...VOC emissions from lime kilns with wet scrubbers."*

The conclusion from these excerpts is that a scrubber using fresh water and "clean" condensates will have little to no impact on VOC emissions. Since these scrubbers are primarily in place for the control of particulate matter and sulfur compounds, the RBLC entry, when viewed in light of the excerpts from the NCASI document, indicates that, as long as the water being used in the scrubber is essentially "clean", no additional VOCs would be expected to be generated by the use of the scrubber. However, there is little control of the VOCs actually provided by the scrubber. This technology is in use at the Palatka Mill and is, therefore, technically feasible.

Good Combustion Practices/Proper Design and Operation

The formation of VOCs in a lime kiln is minimized by ensuring efficient combustion of the fuel in the burner. Efficient combustion is a function of several parameters, including the quantity of oxygen supplied in the burner to support combustion of the fuel and the temperature and residence time inside the kiln to which the products of fuel combustion are exposed.

Another factor that must be considered for efficient combustion of fuel oil is atomization in the burner. To burn fuel oil efficiently, the burner must be atomized correctly, with the oil sprayed into the kiln in a controlled manner. Droplet size is critical in determining the mixing rate of fuel oil and air. If the droplet size is too coarse, the larger drops take longer to burn, which affects combustion efficiency.

Since lime kilns operate at relatively high temperatures and have long residence times (due to their length), volatile organic matter, generated from the combustion of fuel, will be efficiently destroyed. Lime kilns typically operate at temperatures well above 1,400 ^{o}F and have residence times greater than 1 second. The values for these two parameters will ensure complete destruction of essentially all VOCs generated from the combustion of fuel oil. Recent stack testing conducted for the Palatka Lime Kiln in 2002 and 2003 (see Attachment B), indicated an average VOC emission rate of less than 1 pound per hour. This is an extremely low emission rate, which verifies that the Mill's Kiln is combusting fuel very efficiently. Therefore, this is a technically feasible manner in which to control emissions of VOCs.

Total Reduced Sulfur

As indicated in Table D-2, GP has identified three (3) control technologies and one pollution prevention technique. The following paragraphs discuss the technical feasibility of each of the technologies identified in Table D-2.

Wet Scrubber and Optimal Mud Washing
As indicated above, the RBLC also contains entries showing optimal mud washing in addition to a wet scrubber. Lime mud washing is important for efficient process operation, as well as to reduce emissions. By washing soluble sodium and sulfur compounds from the lime mud, ball and ring formation is minimized in the Lime Kiln and SO_2 and TRS emissions are also minimized. The mud washing cycle begins at the mud washer mix tank. Dilution washing is achieved in the mud washer to ensure that the mud is thoroughly washed before it settles in the clarifier and is sent to the mud storage tank. The lime mud is then pumped from this tank to the precoat filter where the final stage of washing occurs. The precoat filter removes sodium and sulfur compounds by displacement washing. This technology is technically feasible.

Gas Absorption with Caustic Scrubber
Gas absorption systems are designed to maximize contact between the gas and liquid solvent in order to permit interphase diffusion. Absorbers found to adequately disperse the liquid include packed towers, plate or tray towers, and spray chambers. When water is the liquid solvent, absorbers are analogous to wet scrubbers used for the reduction of particulate matter emissions (see discussion above). Thus, this type of equipment can be used to reduce both types of contaminants. TRS emission reductions of 90-95% can be expected using gas absorption systems. Packed tower absorbers may achieve efficiencies as high as 99.9%. However, if the pollutant concentration entering the absorber is relatively low, then the TRS removal efficiency will not be as high. Most often, the effluent from an absorber is discharged to a wastewater treatment plant.

Gas absorption systems usually have significant pressure drops, in the range of 6 to 12 inches of water column. This may require additional costs for a new fan that is designed to handle the added pressure drop. These systems also require routine maintenance to clean-out and/or replace the packing material. This technology is technically feasible for the Palatka Lime Kiln.

Good Combustion Control
Good combustion practices manage the process to maintain a consistent level of conversion of reduced sulfur compounds to SO_2 that is typically scrubbed with a post-scrubber. This technology is technically feasible.

Use of Low Sulfur Fuels
Lower sulfur fuels would include lower sulfur content fuel oils and natural gas. However the TRS gases are generated as a result of the calcining process, as opposed to being generated as a result of fuel combustion. As such, the use of low sulfur fuels would lead to little, if any, reduction in emissions of TRS. While this is a technically feasible alternative, it would likely not lead to any reduction in TRS emissions.

D.6.3 Step 3 – Ranking the Technically Feasible Alternatives to Establish a Control Hierarchy

The following sections discuss the control technology hierarchy for the technically feasible alternatives discussed in Step 2 above for each pollutant.

Nitrogen Oxides

Step 2 of the analysis determined that oxidation/reduction scrubbing, SCR, SNCR, LNB burners, flue gas recirculation, and NSCR are technically infeasible. Technically feasible control technologies for NO_x are limited to "efficient operation", "good combustion practices", and "preventative maintenance". It is difficult to assign a control efficiency to these practices. For this step of the BACT analysis, GP has assigned an equal ranking for these control techniques.

Particulate Matter

Step 2 of the analysis determined that all of the listed PM control technologies, with the exception of a fabric filter, are feasible. These technically feasible control technologies include cyclonic separators, venturi scrubbers, other wet scrubbers, ESPs, and a combination of a venturi scrubber and ESP. The following table ranks these technologies based on top control efficiency values and lists the associated emission rates reported in the RBLC:

Table D-3. Ranking of PM Control Technologies for Existing Lime Kilns

Control Technology	Removal Efficiency	Emission Rate (gr/dscf)
Venturi Scrubber and ESP	99.9%+	<0.064
Venturi Scrubber	98-99%	--
Dry/Wet ESP	98-99%	0.033-0.067[1]
Packed Bed Wet Scrubber	85+%	--
Cyclone Separators	25-95%	--

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[1] Emission rate ranges reflects natural gas-fired kilns at 0.033 gr/dscf and oil-fired kilns at 0.067 gr/dscf on existing lime kilns. In addition, the RBLC reports an emission standard of 0.01 gr/dscf for a completely new lime kiln under construction in Georgia. The limit of 0.01 gr/dscf is defined by National Emission Standards for Hazardous Air Pollutants (40 CFR 63, Subpart MM) for new kilns.

Volatile Organic Compounds

The technically feasible technologies for controlling VOC emissions include a venturi scrubber using fresh water and "good combustion practices"/"proper design and operation". While both of these techniques are in place on the Lime Kiln at the Palatka Mill, per the discussion above, it is likely that the scrubber is doing very little, if anything, to control VOC emissions. However, the use of "clean" make-up water ensures that additional VOCs are not generated through the use of that device in controlling other emissions (*i.e.*, PM and sulfur compound emissions).

Total Reduced Sulfur

The three technically feasible technologies include a wet scrubber with optimal mud washing, gas absorption with a caustic scrubber and "good combustion control". GP believes that the two scrubber technologies are approximately equivalent in terms of control effectiveness and these two controls rank higher than "good combustion control".

D.6.4 Step 4-Cost Effectiveness Evaluation

In addition to considering emission reduction efficiency, control effectiveness may consider economic, energy and environmental impacts. This step of the BACT process determines the cost effectiveness of the technically feasible control options listed in Step 3.

Nitrogen Oxides

As discussed in Step 3, the only technically feasible controls for NO_x from a lime kiln are "efficient operation", "good combustion practices", and "preventative maintenance". Since these are the only technically feasible control strategies for this pollutant, a cost effectiveness evaluation is not required.

Particulate Matter

The Lime Kiln at the Palatka Mill is currently equipped with a cyclonic dust collector followed by a venturi scrubber. The venturi scrubber primarily uses fresh water as the scrubbing media. In Step 3, there were two control configurations identified that would potentially have a higher control efficiency for particulate matter. These included, (1) the combination of a scrubber and an ESP, and (2) a fabric filter. Following those two options, a stand-alone scrubber and stand-alone ESP are essentially equivalent in terms of control efficiency for particulate matter. This equivalency is reflected in the RBLC entries – in some cases, scrubber installations are shown to have higher control efficiencies, while in others, ESPs are shown to be more effective in controlling particulate matter.

As stated in the EPA *New Source Review Workshop Manual* (draft, October 1990), "...for control alternatives that have been effectively employed in the same source category, the economic impact of such alternatives on the particular source under review should be not nearly as pertinent to the BACT decision making process as the average, and, where appropriate, incremental cost effectiveness of the control alternative". In order to understand the relevance of this language to the Lime Kiln at the Palatka Mill, it is important to document the facts surrounding the installations of an ESP/scrubber combination at the Koch Cellulose Mills in Leaf River, Mississippi and Brunswick, Georgia and the GP Mills in Port Hudson, Louisiana and Naheola, Alabama. The two Koch Cellulose Mills were owned by GP until May 2004. When the Leaf River Mill was originally constructed in the mid-1980s, BACT was determined to be a stand-alone scrubber. It was only as a result of subsequent operational issues following initial start-up that seemed to necessitate the addition of the ESP. It is GP's understanding (the Mill was not owned by GP at the time of construction) that the Mill had an issue in meeting the original permitted particulate matter emission limit with the scrubber in place. As a result, the ESP was added for that purpose (*i.e.,* to meet the permitted emission limit), as opposed to being required as part of a BACT assessment. At any rate, the Mill subsequently determined that the issues that existed were a result of "engineering" problems, as opposed to having anything to do with the operation and/or performance of the control equipment. However, once that determination was made, the Mill had already committed to install the ESP. It is worth noting that, when the Leaf River Mill experienced a catastrophic fire in the ESP a few years ago, they were able to demonstrate compliance with their emissions limit(s) with the use of the scrubber. Given these facts, it is highly unlikely that a cost effectiveness calculation was ever performed for the ESP/scrubber combination in place at the Leaf River Mill.

In the case of the Brunswick and Port Hudson Mills, the scrubbers that were originally installed with the two kilns were of the low energy, low pressure drop variety, whereas the scrubbers in place at Palatka and other GP Mills are high energy with high pressure drops. For the Port Hudson Mill, the ESP was added as part of a retroactive PSD permitting exercise that took place approximately five years ago. As part of that exercise, it was determined that the No. 2 Lime Kiln should have been subjected to NSPS. With the low energy scrubber, GP had concerns that the Mill would be able to meet the NSPS limit for PM on a continual basis. As such, the decision was made to add the ESP. The No. 1 Lime Kiln at the Port Hudson Mill continues to operate with a scrubber. Although the Brunswick Mill did not undergo a retroactive PSD analysis, it was determined, shortly after the kiln was installed in the mid-1980s, that there would be issues with that type of scrubber (*i.e.,* low energy, low pressure drop) maintaining compliance on a continual basis. As such, that ESP was added in the late-1980s, shortly after initial installation of the lime kiln. Similarly, for the Naheola Mill, although GP did not own the Mill at the time, it is reported that the ESP was added for compliance purposes and not as the result of a BACT assessment.

Again, the scrubbers in place at Palatka and other GP Mills are of the high energy, high pressure drop variety. As such, these scrubbers are already highly effective in the removal of PM, SAM, and to some degree, other sulfur compounds. Also, as discussed further above, in the context of a PSD application, one of the components of the BACT analysis is an economical evaluation. Since the ESPs that were added at the other mills were primarily for immediate compliance purposes, the economics were not necessarily given detailed consideration and they certainly were not evaluated in the context of a BACT-type economic analysis (*i.e.,* cost per ton of pollutant removed).

Since GP is aware that the ESP/scrubber combination exists at these mills and that this combination is technically feasible, a cost analysis is prepared for the Lime Kiln at the Palatka Mill as part of this BACT assessment. These costs, prepared utilizing spreadsheets from EPA's Cost Control Manual, are presented in Appendix 3. Referring to the spreadsheet, the annualized cost is calculated as $679,716 for an ESP. As shown in Attachment B, baseline emissions are 42.5 and 36.6 tons per year (tpy) for PM and PM_{10}, respectively. Assuming a 99% control efficiency for the ESP, the pollutant tons removed are calculated as 42.1 and 36.2 tons for PM and PM_{10}, respectively. This yields a cost effectiveness of more than $16,000 per ton of pollutant removed ($679,716/42.1 tons removed based on total PM = $16,145). GP feels that it is appropriate, based on EPA guidance, to consider the scrubber as the "base case" in calculating the cost effectiveness. The scrubber is required by federally enforceable permit conditions in both the existing Title V and PSD permits. Furthermore, it is not feasible to simply replace the scrubber with an ESP since the scrubber is in place for the control of both particulate matter and sulfur compounds. Another way to conduct the cost effectiveness assessment is to perform the calculations in terms of incremental cost effectiveness. As stated in the New Source Review Workshop Manual, "The incremental cost effectiveness should be examined in combination with the average cost effectiveness in order to justify elimination of a control option. The annualized costs for a scrubber, based on EPA's Cost Control Manual, are calculated and presented in Appendix 3. Referring to the spreadsheet, the annualized cost is calculated as $359,034. Adding this to the annualized cost of the ESP to get the total annualized cost for the control combination, yields a total annualized cost of $1,038,750. The formula to be utilized in calculating incremental cost effectiveness is as follows:

$$\frac{\text{Total Costs (annualized) of Control Option} - \text{Total Costs (annualized) of Next Control Option}}{\text{Next Control Option Emission Rate} - \text{Control Option Emission Rate}}$$

As presented in Table D-3, the estimated control efficiency for the ESP/scrubber combination is 99.9+ %. The estimated control efficiency for the scrubber alone is up to 99%. If it is assumed that the baseline emission rate of 42.5 tpy is a controlled emission rate based on 99% control, then the controlled emission rate at 99.9% efficiency would be (42.5 tpy/0.01 x 0.001 = 4.2 tpy).

$$\frac{\$1{,}038{,}750 - \$359{,}034}{42.5\text{ tpy} - 4.2\text{ tpy}} = \$17{,}747/\text{ton}$$

As shown, the cost effectiveness of adding the ESP is excessively high regardless of whether it is viewed in terms of average or incremental cost effectiveness. As such, this combination of controls (scrubber and ESP) is demonstrated to be economically infeasible for the Lime Kiln at the Palatka Mill.

Since a scrubber and a stand-alone ESP are the options with the second highest control effectiveness and the scrubber (and a cyclonic dust collector) is already in place on the Palatka Lime Kiln, no further cost analysis is required.

Volatile Organic Compounds

As discussed in Step 3, both technologies (*i.e.,* venturi scrubber with fresh water and good combustion practices/proper design and operation) are already being utilized at the Palatka Mill. However, based on the experiences of GP, NCASI and others, it is highly unlikely that the scrubber is leading to any significant decrease in VOC emissions. Since these systems are already in place, a cost effectiveness analysis is not required.

Total Reduced Sulfur

As discussed in Step 3, the two technologies with the highest control efficiency are a wet scrubber with optimal mud washing and gas absorption with a caustic scrubber. Since a venturi scrubber is already present on the Lime Kiln and the Mill employs optimal mud washing, a cost effectiveness evaluation is not required.

D.6.5 Step 5-Selecting BACT

This step of the BACT process identifies the selection of BACT. Table D-4 summarizes the BACT selection for the Lime Kiln.

Table D-4. Summary of Proposed Selection of BACT for Lime Kiln

Pollutant	Control Technology	Ranking	Destruction Efficiency or Emission Rate
NO_x	Good Combustion	1	275 ppmvd at 10% O_2
PM/PM_{10}	Venturi Scrubber	3	0.081 gr/dscf at 10% O_2
VOC	Good Combustion/Proper Design and Operation	1	185 ppmvd at 10% O_2
TRS	Wet (Venturi) Scrubber with Optimal Mud Washing	1	20 ppmvd at 10% O_2
H_2S	Good Combustion	1	20 ppmvd at 10% O_2

Appendix 1
RBLC Search Results
Lime Kiln Controls

RBLC Search Results of Lime Kiln NOx Controls

RBLCID	FACILITY	STATE	PERMIT NUMBER	PERMIT DATE	CONTROLS	THRUPUT	THRUPUT UNIT	EMISSION LIMIT	EMISSION LIMIT UNIT	BASIS	NOTES
GA-0095	WEYERHAEUSER - FLINT RIVER OPERATIONS	GA	2631-193-0013-V-0	5/28/2003	DRY PLATE ESP	370	T/D	175	PPM @ 10% O2	BACT-PSD	THE MODIFICATION IS FOR THE REPLACEMENT OF THE CALCINER WITH A LIME KILN, INSTALLATION OF WHITE LIQUOR SCRUBBER, AND REPLACEMENT OF THE SLAKER.
LA-0174	PORT HUDSON OPERATIONS	LA	PSD-LA-581 (M-2)	1/25/2002	GOOD EQUIPMENT DESIGN AND PROPER COMBUSTION TECHNIQUES	340	T/D	48.78	LB/H	BACT-OTHER	PERMIT IS FOR INSTALLATION OF THE NO. 6 THROUGH AIR DRIED (TAD) TOWEL MACHINE AND ASSOCIATED EQUIPMENT. PRODUCTION RATE IS 306 MACHINE DRY TONS PER DAY
LA-0174	PORT HUDSON OPERATIONS	LA	PSD-LA-581 (M-2)	1/25/2002	GOOD EQUIPMENT DESIGN AND PROPER COMBUSTION TECHNIQUES	270	T/D	38.75	LB/H	BACT-OTHER	PERMIT IS FOR INSTALLATION OF THE NO. 6 THROUGH AIR DRIED (TAD) TOWEL MACHINE AND ASSOCIATED EQUIPMENT. PRODUCTION RATE IS 306 MACHINE DRY TONS PER DAY (MDTPD) OF SHEETS OF TISSUE/TOWEL. THE PROJECT DOES NOT EXPECT TO ADVERSELY IMPACT SOILS, VEGETATION, O
WA-0303	LONGVIEW FIBRE COMPANY	WA	PSD-01-03	12/10/2001	LOW-VOC ADDITIVES, GOOD COMBUSTION PRACTICES	240	T CAO/D	340	PPMDV @ 10% O2	BACT-OTHER	IN LIEU OF SPECIFIC INFORMATION, THE PLANT ADDRESS IS PROVIDED IN THE PLANT CONTACT FIELD. PLANTWIDE EMISSION LIMITS PROVIDED (NOT SPECIFIED AS CHANGE IN PLANTWIDE EMISSION LIMITS): PM & PM10, 698.5 T/YR; SO2, 1885 T/YR; CO, 7056.5 T/YR; NOX, 3028.5 T/YR;
WA-0303	LONGVIEW FIBRE COMPANY	WA	PSD-01-03	12/10/2001	LOW-VOC ADDITIVES, GOOD COMBUSTION PRACTICES	250	T CAO/D	340	PPMDV @ 10% O2	BACT-OTHER	IN LIEU OF SPECIFIC INFORMATION, THE PLANT ADDRESS IS PROVIDED IN THE PLANT CONTACT FIELD. PLANTWIDE EMISSION LIMITS PROVIDED (NOT SPECIFIED AS CHANGE IN PLANTWIDE EMISSION LIMITS): PM & PM10, 698.5 T/YR; SO2, 1885 T/YR; CO, 7056.5 T/YR; NOX, 3028.5 T/YR;
WA-0303	LONGVIEW FIBRE COMPANY	WA	PSD-01-03	12/10/2001	LOW-VOC ADDITIVES, GOOD COMBUSTION PRACTICES	325	T CAO/D	275	PPMDV @ 10% O2	BACT-OTHER	IN LIEU OF SPECIFIC INFORMATION, THE PLANT ADDRESS IS PROVIDED IN THE PLANT CONTACT FIELD. PLANTWIDE EMISSION LIMITS PROVIDED (NOT SPECIFIED AS CHANGE IN PLANTWIDE EMISSION LIMITS): PM & PM10, 698.5 T/YR; SO2, 1885 T/YR; CO, 7056.5 T/YR; NOX, 3028.5 T/YR;
WA-0303	LONGVIEW FIBRE COMPANY	WA	PSD-01-03	12/10/2001	LOW-VOC ADDITIVES, GOOD COMBUSTION PRACTICES	140	T CAO/D EACH	340	PPMDV @ 10% O2	BACT-OTHER	IN LIEU OF SPECIFIC INFORMATION, THE PLANT ADDRESS IS PROVIDED IN THE PLANT CONTACT FIELD. PLANTWIDE EMISSION LIMITS PROVIDED

RBLC Search Results of Lime Kiln NOx Controls

RBLCID	FACILITY	STATE	PERMIT NUMBER	PERMIT DATE	CONTROLS	THRUPUT	THRUPUT UNIT	EMISSION LIMIT	EMISSION LIMIT UNIT	BASIS	NOTES
SC-0084	BOWATER COATED PAPER DIVISION	SC	2400-0005-CO-CT	10/31/2001	ESP'S, SCRUBBER'S, BAG HOUSE'S, CENTRIFUGAL COLLECTOR, FILTERS, AND BOILER INCINERATION			152	PPMVD @ 10 % O2	BACT-PSD	The facility manufactures coated paper, newsprint, and market pulp. This PSD involves major modifications. The facility is constructing a new kraft mill fiber line (pulping and bleaching system). The facility will be converting paper machine no. 3 from ne
LA-0122	MANSFIELD MILL	LA	PSD-LA-93 (M-6)	8/14/2001	PREVENTATIVE MAINTENANCE, BAGHOUSES, SCRUBBERS, FUEL SULFUR LIMITS.	142	MMBTU/H	103.7	LB/H	BACT-PSD	ADDITIONAL SIC: 2621. PHYSICAL PLANT ADDRESS: HWY. 509 EAST; MANSFIELD, LA 71052.
LA-0122	MANSFIELD MILL	LA	PSD-LA-93 (M-6)	8/14/2001	PREVENTATIVE MAINTENANCE, BAGHOUSES, SCRUBBERS, FUEL SULFUR LIMITS.	370	HP	4.2	LB/H	BACT-PSD	ADDITIONAL SIC: 2621. PHYSICAL PLANT ADDRESS: HWY. 509 EAST; MANSFIELD, LA 71052.
OR-0031	HALSEY PULP MILL	OR	22-0027	3/2/2001	NONE INDICATED	156	T CAO/D	1.8	LB/T LIME PRODUCTION	BACT-PSD	COMPANY IS INCREASING ITS PULP PRODUCTION FROM 252,701 TO 276,612 AIR DRIED METRIC TONS (ADMT) PER YR (12-MO ROLLING BASIS)
*TX-0263	DONAHUE INDUSTRIES, INC. PAPER MILL	TX	PSD-TX-437	10/17/2000	DIGESTERS ARE CONTROLLED BY VENTING THE OFF-			22.7	LB/H	BACT-OTHER	THIS IS A PAPER MILL THAT MANUFACTURES PULP FOR THE PRODUCTION OF NEWSPRINT AND SPECIALTY PAPER PRODUCTS. IT UTILIZES
MS-0029	WEYERHAEUSER COMPANY	MS	1680-00044	9/10/1996	EFFECTIVE OPERATION OF THE KILN	504	T/D CAO	300	PPMVD @3.6% O2	BACT-PSD	Weyerhaeuser Is Proposing to Expand its Production Capabilities for Both Market Pulp and Light Weight Coated (LWC) Paper.
FL-0111	BUCKEYE FLORIDA, L.P.	FL	1230001-004-AC / PSD-FL-232	8/13/1996	GOOD COMBUSTION/BURNER MODIFICATIONS	750	T/D LIME	68.44	LB/H	BACT-PSD	Increased Throughput of Existing No. 4 Lime Kiln from 650 To 750 Tpd
GA-0064	RIVERWOOD INTERNATIONAL CORPORATION	GA	2631-011-11958	7/11/1996	LOW NOX BURNERS	8.4	T/H CAO PER KILN	3.5	LB/T CAO	BACT-PSD	FACILITY ALSO INCLUDES WAREHOUSE AND SHIPPING AREA THAT IS FOR THE ADDITIONAL PRODUCTION OF PAPER PRODUCT. NO POLLUTANTS ARE GENERATED FROM THIS AREA. KILNS HAVE NEW LOW NOX BURNERS AND THE NOX LIMIT IS BASED ON AP-42 EMISSION FACTORS.
WV-0016	APPLE GROVE PULP AND PAPER COMPANY, INC	NY	R14-11	6/17/1996	ESP, VENTURI SCRUBBER, MULTICYCLONE, SELECTIVE NON-CATALYTIC REDUCTION SYSTEM, FABRIC FILTER, BLEACH PLANT USES A CHLORIDE OXIDE PROCESS: ELEMENTAL CHLORINE-FREE (ECF) TECHNOLOGY.	65600	LB/H	21.8	LB/H	BACT-PSD	This Facility Was Never Built. There Are No Plans for Construction. Plant Wide Emissions (T/YR) : H_2SO_4 = 137.5, Chloroform = 0.5758, Carbon Tetrachloride = 0.0335, Methylene Chloride = 50.84, HCL = 22.2, Formaldehyde = 121.55, Benzene = 0.9358, Cl_2 = 0.1

RBLC Search Results of Lime Kiln NOx Controls

RBLCID	FACILITY	STATE	PERMIT NUMBER	PERMIT DATE	CONTROLS	THRUPUT	THRUPUT UNIT	EMISSION LIMIT	EMISSION LIMIT UNIT	BASIS	NOTES
SC-0045	WILLAMETTE INDUSTRIES - MARLBORO MILL	SC	1680-0043	4/17/1996	GOOD COMBUSTION CONTROL	450	T/D CAO	175	PPM	BACT-OTHER	1) SO2 Limit Higher Because of NCG Incineration. 2) VOX, NOX, & CO Looked at as One BACT Unit Because of Their Interdependence. 3) Temperature Monitoring for Trs Gas Control.
NH-0006	GROVETON PAPER BOARD, INC.	NH	NOT AVAILABLE	5/31/1995	NONE	16.5	GAL/MIN@50+-5% SOLID	0.85	LBS/TON BLACK LIQ/SL	RACT	
WI-0097	NEKOOSA PAPER INCORPORATED	WI	94POY067	3/9/1995	THE PERMITTEE SHALL MAINTAIN AND OPERATE THE LIME KILN UNDER EFFICIENT COMBUSTION CONDITIONS.	45	MMBTU/H	21.62	LB/H	BACT-PSD	START UP AND COMPLIANCE DATES ARE NOT AVAILABLE.
FL-0087	CHAMPION INTERNATIONAL CORP	FL	PSD-FL-200	3/25/1994	GOOD COMBUSTION			200	PPM	BACT-PSD	This Modification Results from a Consent Order for Wastewater Violations. Modifications Include Construction Of a New Nat. Gas Fired No. 6 Power Boiler, Surrendering of The Operation Permits for Existing No. 1 and No. 2 Power Boilers, Mod to Bleach Plants
AL-0152	GULF STATES PAPER CORP.	AL	105-0001-X026	1/31/1994		650	TONS CAO/D	175	PPMV @ 10% O2	BACT-PSD	

RBLC Search Results of Lime Kiln PM Controls

RBLCID	FACILITY	STATE	PERMIT NUMBER	PERMIT DATE	THRUPUT	THRUPUT UNIT	CONTROLS	EMISSION LIMIT	EMISSION LIMIT UNIT	BASIS
GA-0095	WEYERHAEUSER - FLINT RIVER OPERATIONS	GA	2631-193-0013-V-01-1	5/28/2003	370	T/D	ESP	0.01	GR/DSCF @ 10% O2	MACT
LA-0174	PORT HUDSON OPERATIONS	LA	PSD-LA-581 (M-2)	1/25/2002	340	T/D	WET SCRUBBERS	25.76	LB/H	BACT-PSD
LA-0174	PORT HUDSON OPERATIONS	LA	PSD-LA-581 (M-2)	1/25/2002	340	T/D	WET SCRUBBERS	25.76	LB/H	BACT-PSD
LA-0174	PORT HUDSON OPERATIONS	LA	PSD-LA-581 (M-2)	1/25/2002	270	T/D	ELECTROSTATIC PRECIPITATOR	20.45	LB/H	BACT-PSD
LA-0174	PORT HUDSON OPERATIONS	LA	PSD-LA-581 (M-2)	1/25/2002	270	T/D	ELECTROSTATIC PRECIPITATOR	20.45	LB/H	BACT-PSD
WA-0303	LONGVIEW FIBRE COMPANY	WA	PSD-01-03	12/10/2001	240	T CAO/D		34	T/YR	BACT-OTHER
WA-0303	LONGVIEW FIBRE COMPANY	WA	PSD-01-03	12/10/2001	250	T CAO/D		35.6	T/YR	BACT-OTHER
WA-0303	LONGVIEW FIBRE COMPANY	WA	PSD-01-03	12/10/2001	325	T CAO/D		0.06	GR/DSCF @ 10% O2	BACT-OTHER
WA-0303	LONGVIEW FIBRE COMPANY	WA	PSD-01-03	12/10/2001	140	T CAO/D EACH		20	T/YR	BACT-OTHER
SC-0084	BOWATER COATED PAPER DIVISION	SC	2400-0005-CO-CT	10/31/2001			ESP	0.03	GR/DSCF @ 10% O2	BACT-PSD
LA-0122	MANSFIELD MILL	LA	PSD-LA-93 (M-6)	8/14/2001	142	MMBTU/H	VENTURI SCRUBBER USING CAUSTIC SOLUTION	39.2	LB/H	BACT-PSD
LA-0155	ST. FRANCISVILLE MILL	LA	PSD-LA-540 (M-2)	4/29/2001	12.25	T CAO/H	NONE INDICATED. STACK TESTS WILL BE CONDUCTED.	7.35	LB/H	OTHER
OR-0031	HALSEY PULP MILL	OR	22-0027	3/2/2001	156	T CAO/D	NONE INDICATED	2.2	LB/T LIME PRODUCTION	BACT-PSD
OR-0031	HALSEY PULP MILL	OR	22-0027	3/2/2001	156	T CAO/D	NOT IN PERMIT	2.2	LB/T LIME PRODUCTION	BACT-PSD
TX-0263	DONAHUE INDUSTRIES, INC. PAPER MILL	TX	PSD-TX-437	10/17/2000			SCRUBBER	22.7	LB/H	BACT-PSD
MS-0029	WEYERHAEUSER COMPANY	MS	1680-00044	9/10/1996	504	T/D CAO	ESP M.O.420297 ENVIRONMENTAL ELEMENTS CORPORATION	0.033	GR/DSCF @ 10% O2	BACT-PSD
MS-0029	WEYERHAEUSER COMPANY	MS	1680-00044	9/10/1996	504	T/D CAO	ESP M.O.420297 ENVIRONMENTAL ELEMENTS CORPORATION	0.033	GR/DSCF @ 10% O2	BACT-OTHER
FL-0111	BUCKEYE FLORIDA, L.P.	FL	1230001-004-AC / PSD-FL-232	8/13/1996	750	T/D LIME	ESP	20	LB/H	BACT-PSD
WV-0016	APPLE GROVE PULP AND PAPER COMPANY, INC	WV	R14-11	6/17/1996	65600	LB/H	FABRIC FILTER -MINIMUM CONTROL EFFICIENCY OF 99.96%	1.88	LB/H	BACT-PSD
SC-0045	WILLAMETTE INDUSTRIES - MARLBORO MILL	SC	1680-0043	4/17/1996	450	T/D CAO	ESP	0.033	GR/DSCF	BACT-OTHER
WI-0097	NEKOOSA PAPER INCORPORATED	WI	94POY067	3/9/1995	45	MMBTU/H	ESP. ALTERNATE LIMIT IS FOR FUEL OIL (0.067 GR/DSCF), STANDARD EMISSION LIMIT IS FOR NATURAL GAS (0.05 GR/DSCF).	9.9	LB/H	BACT-PSD
FL-0087	CHAMPION INTERNATIONAL CORP	FL	PSD-FL-200	3/25/1994				10.9	LB/H	BACT-PSD
AL-0152	GULF STATES PAPER CORP.		105-0001-X026	1/31/1994	650	TONS CAO/D	BOTH GRAIN LOADING LIMITS AT 10% OXYGEN. ALSO 22 LB/H @ 10% O2 GAS, 42 LB/H OIL.	22	LB/H @ 10% O2 (GAS)	BACT-PSD

RBLC Search Results of Lime Kiln VOC Controls

RBLCID	FACILITY	STATE	PERMIT NUMBER	PERMIT DATE	CONTROLS	THRUPU	THRUPUT UNIT	EMISSION LIMIT	EMISSION LIMIT UNIT
LA-0122	MANSFIELD MILL	LOUISIANA	PSD-LA-93 (M-6)	8/14/2001	VENTURI SCRUBBER USING FRESH WATER	142	MMBTU/H	8.3	LB/H
*TX-0263	DONAHUE INDUSTRIES, INC. PAPER MILL	TEXAS	PSD-TX-437	10/17/2000				7.5	LB/H
WV-0016	APPLE GROVE PULP AND PAPER COMPANY, INC	WEST VIRGINIA	R14-11	6/17/1996		65600	LB/H	2.4	LB/H
SC-0045	WILLAMETTE INDUSTRIES - MARLBORO MILL	SOUTH CAROLINA	1680-0043	4/17/1996	GOOD COMBUSTION CONTROL	450	T/D CAO	50	PPM
WI-0097	NEKOOSA PAPER INCORPORATED	WISCONSIN	94POY067	3/9/1995	SYNTHETIC MINOR LIMIT	45	MMBTU/H	6.44	LB/H
FL-0087	CHAMPION INTERNATIONAL CORP	FLORIDA	PSD-FL-200	3/25/1994				104	PPMVD @ 10% O2
AL-0152	GULF STATES PAPER CORP.	ALABAMA	105-0001-X026	1/31/1994		650	TONS CAO/D	0.69	LB/T CAO
WA-0022	JAMES RIVER CORP.	WASHINGTON	PSD-88-3 & DE-88-360 MODIFICAT	9/26/1991		0		45	T/YR
ME-0030	LINCOLN PULP AND PAPER CO.,INC	MAINE	A-177-71-A/R	9/25/1991	PROPER KILN OPERATION	650	ADT/D	25	PPMV @ 10% O2
FL-0058	GEORGIA-PACIFIC CORPORATION	FLORIDA	PSD-FL-171	6/12/1991	COMBUSTION CONTROL	0		185	PPMVD @ 10% O2
LA-0074	WILLAMETTE INDUSTRIES INC	LOUISIANA	PSD-LA-562	2/4/1991	DESIGN & OPERATION	1740	ADT/D PULP	17.2	LB/H
AL-0047	ALABAMA RIVER PULP CO.	ALABAMA	106-0010	1/22/1990		465	T/D CAO	78	PPMV AT 10% O2
MS-0015	*WEYERHAEUSER CO.*	*MISSISSIPPI*	*1680-00044*	*10/24/1989*	*GOOD COMBUSTION PRACTICES*	21	T/H	1	*LB/T CAO*
ME-0009	BOISE CASCADE CORP.	MAINE	A-214-71-E-A/R	7/18/1989		327	T/D PRODUCT	2	LB/H
AL-0042	CHAMPION INTERNATIONAL	ALABAMA	707-0001	7/18/1989		300	T/D CAO	31	PPMV AT 10% O2
MN-0011	BOISE CASCADE	MINNESOTA	102A-89-OT-2	5/12/1989	COMBUSTION CONTROL	230	T/D	11.4	LB/H
SC-0016	UNION CAMP PULP AND PAPER MILL	SOUTH CAROLINA	1900-0046	5/1/1989	KILN DESIGN & OPERATION	265	T/D CAO	1.6	LB/T CAO
AL-0039	MEAD COATED BOARD	ALABAMA	211-0004	10/1/1988		1200	T ADP/D	78	PPMV AT 10% O2
SC-0015	WILLAMETTE INDUSTRIES	SOUTH CAROLINA	1680-0043	9/29/1988	KILN DESIGN & OPERATION	220	T/D CAO	8.8	LB/H

RBLC Search Results of Lime Kiln TRS Controls

RBLCID	FACILITY	STATE	PERMITNUM	PERMIT DATE	CONTROLS	THRUPUT	THRUPUT UNIT	EMISSION LIMIT	EMISSION LIMIT UNIT	BASIS
GA-0095	WEYERHAEUSER - FLINT RIVER OPERATIONS	GA	2631-193-0013-V-01-1	5/28/2003	LOW SULFUR FUEL	370	T/D	8	PPMVD @ 10% O2	MACT
LA-0174	PORT HUDSON OPERATIONS		PSD-LA-581 (M-2)	1/25/2002		340	T/D	3.5	LB/H	BACT-PSD
LA-0174	PORT HUDSON OPERATIONS		PSD-LA-581 (M-2)	1/25/2002		270	T/D	2.81	LB/H	BACT-PSD
WA-0303	LONGVIEW FIBRE COMPANY	WA	PSD-01-03	12/10/2001		140	T CAO/D EACH	20	PPMDV @ 10% O2	BACT-OTHER
WA-0303	LONGVIEW FIBRE COMPANY	WA	PSD-01-03	12/10/2001		240	T CAO/D	20	PPMDV @ 10% O2	BACT-PSD
WA-0303	LONGVIEW FIBRE COMPANY	WA	PSD-01-03	12/10/2001		250	T CAO/D	20	PPMDV @ 10% O2	BACT-OTHER
WA-0303	LONGVIEW FIBRE COMPANY	WA	PSD-01-03	12/10/2001		325	T CAO/D	20	PPMDV @ 10% O2	BACT-OTHER
LA-0122	MANSFIELD MILL		PSD-LA-93 (M-6)	8/14/2001	VENTURI SCRUBBER USING FRESH WATER	142	MMBTU/H	6.5	PPM	BACT-PSD
OR-0031	HALSEY PULP MILL	OR	22-0027	3/2/2001	NONE INDICATED	156	T CAO/D	0.12	LB/T LIME PRODUCTION	BACT-OTHER
TX-0263	DONAHUE INDUSTRIES, INC. PAPER MILL		PSD-TX-437	10/17/2000	SCRUBBER			0.9	LB/H	BACT-OTHER
MS-0029	WEYERHAEUSER COMPANY		1680-00044	9/10/1996	EFFICIENT LIME MUD WASHING AND EFFICIENT KILN OPERATION	504	T/D CAO	8	PPMVD @10% O2	BACT-PSD
GA-0064	RIVERWOOD INTERNATIONAL CORPORATION		2631-011-11958	7/11/1996		8.4	T/H CAO PER KILN	8	PPMV	BACT-PSD
WV-0016	APPLE GROVE PULP AND PAPER COMPANY, INC	NY	R14-11	6/17/1996	COMBUSTION CONTROL.	65600	LB/H	8	PPMVD @ 10% O2	BACT-PSD
SC-0045	WILLAMETTE INDUSTRIES - MARLBORO MILL		1680-0043	4/17/1996	LIME KILN	450	T/D CAO	8	PPM @ 8% O2	BACT-OTHER
WI-0097	NEKOOSA PAPER INCORPORATED		94POY067	3/9/1995	SYNTHETIC MINOR LIMIT	45	MMBTU/H	0.71	LB/H	OTHER
FL-0087	CHAMPION INTERNATIONAL CORP	FL	PSD-FL-200	3/25/1994				8	PPMVD @ 10% O2	BACT-PSD

RBLC Search Results of Lime Kiln H2S Controls

RBLCID	FACILITY	STATE	PERMIT NUMBER	PERMIT DATE	THRUPUT	THRUPUT UNIT	CONTROLS	EMISSION LIMIT	EMISSION LIMIT UNIT	BASIS
AL-0152	GULF STATES PAPER CORP.	AL	105-0001-X026	1/31/1994	650	TONS CAO/D	NONE	1.2	LB/H	BACT-PSD

Appendix 2
BACT Determination
Weyerhaeuser, Flint River, GA

Prevention of Significant Air Quality Deterioration Review
Of Weyerhaeuser – Flint River Operations
Located in Macon County, Georgia

PRELIMINARY DETERMINATION
SIP Permit Application No. 14050
March 2003

State of Georgia
Department of Natural Resources
Environmental Protection Division
Air Protection Branch

Stationary Source Permitting Program (SSPP)
Prepared by
Heather Cottrell – Chemicals Unit
Modeling Approved by: Jim Stogner Data and Modeling Unit
Reviewed and Approved by:
Heather Abrams – Chemicals Unit Coordinator Jimmy Johnston – SSPP Manager
Ron Methier – Chief, Air Protection Branch

Federal Rule – 40 CFR 63 Subpart MM

NESHAP Subpart MM, *NESHAP for Chemical Recovery Combustion Sources at Kraft, Soda, Sulfite, and Stand-Alone Semichemical Pulp Mills*, promulgated on January 12, 2001, requires the reductions of HAP emissions from the combustion sources at pulp mills that are major HAP sources. Specifically, the NESHAP requires HAP reductions from new or existing lime kilns. Using PM as a surrogate for metal HAP, the limit for the new lime kiln is 0.010 gr/dscf at ten percent oxygen. The subpart also requires reporting and corrective actions at an opacity value of 20 percent. It should be noted that the 20 percent excess emission trigger is not a standard under 40 CFR 63 Subpart MM. For this reason in Georgia Rule 391-3-1-.02(2)(b) – Visible Emissions is not subsumed although it has an opacity limit of 40%. Although compliance does not need to be achieved until March 13, 2004, for other existing units (recovery furnace, smelt dissolving tank), the new lime kiln must be in compliance upon commencement of operation.

A dry ESP will be installed to control PM emissions from the lime kiln. A COMS will be used to monitor the opacity.

State and Federal – Startup and Shutdown and Excess Emissions

Excess emission provisions for startup, shutdown, maintenance, and malfunction are provided in Georgia Rule 391-3-1-.02(2)(a)7. Excess emissions from the lime kiln will most likely result from a malfunction of the dry ESP (for particulate matter control). The facility cannot anticipate or predict malfunctions of control equipment; however, the dry ESP should be operational over 99 percent of the time. The facility will minimize emissions during periods of startup, shutdown, and malfunction.

4.0 CONTROL TECHNOLOGY REVIEW – Lime Kiln

Nitrogen Oxides (NO_X)

NO_X is formed from a series of chemical reactions in which diatomic nitrogen (N_2) and oxygen (O_2) present in the combustion air dissociate and react to form NO_X. This kind of NO_X is usually referred to as thermal NO_X and is primarily dependent on the combustion flame temperature. Another source of NO_X formation is when nitrogen in fuel undergoes oxidation in the presence of combustion air. Fuel NO_X production is a function of the fuel nitrogen content.

Available control technologies to control the NO_X emissions that will be generated in the proposed lime kiln include low NO_X burners, flue gas recirculation, oxidation/reduction scrubbing, selective catalytic reduction, selective non-catalytic reduction, and non-selective catalytic reduction. These technologies, as well as good design and operation practices, were evaluated for control of the NO_X emissions from the proposed lime kiln.

Step 1: Identify all control technologies

In reviewing the BACT alternatives to control emissions of NO_X from the facility, Weyerhaeuser considered low NO_X burners, flue gas recirculation, oxidation/reduction scrubbing, selective catalytic reduction, selective non-catalytic reduction, non-selective catalytic reduction, and good design and operation practices as noted in the following table:

Option 1: Low NO_X Burners (LNB)
Option 2: Flue Gas Recirculation (FGR)
Option 3: Oxidation/Reduction Scrubbing (O/R)
Option 4: Selective Catalytic Reduction (SCR)
Option 5: Selective Non-Catalytic Reduction (SNCR)
Option 6: Non-Selective Catalytic Reduction (NSCR)
Option 7: Good Design and Operation

Step 2: Eliminate technically infeasible options

Option 1 – Low NO_X Burners (LNB)

Traditional burner design introduces both the fuel and air into one combustion zone. To obtain optimal flames, large amounts of excess air must be combined with the fuel. This relatively "uncontrolled" combustion creates high flame temperatures. To control the generation of thermal NO_X, LNB technology stages combustion in the high temperature zone of the flame. The first stage is a fuel-rich, oxygen-lean atmosphere where little oxygen is available for NO_X formation and which reduces peak flame temperatures by delaying the completion of the combustion process. Combustion is then completed downstream in the second stage where excess air is available but temperatures are lower than the hottest portion of the flame core.

Although LNB have been extensively tested and used in the utility boilers and industrial furnaces, the transfer of this technology to lime processing has been met with difficulties, particularly when burning natural gas. Burner flame properties are critical to the quality control and calcining process to convert a high percentage of mud to reburnt lime in the lime kiln. The burner flame shape and properties have a dramatic effect on calcining efficiency. Poor efficiency increases energy usage and decreases the calcining capacity of the kiln. Due to these technical complexities, the conversion of a standard lime kiln burner to low NO_X design is not yet technically feasible. Further, no commercially available LNB is on the market for a lime kiln application.

Due to such technical and operational difficulties in addition to the unavailability, LNB are not a technically feasible control for NO_X emissions from the lime kiln.

Option 2 – Flue Gas Recirculation (FGR)

FGR redirects the post-combustion exhaust gas back to the primary combustion chamber to create a lower O_2 content atmosphere. This oxygen-lean atmosphere provides less O_2 for NO_X formation. Due to increased mass flow, peak flame temperature is lowered. Therefore, FGR reduces both fuel and thermal NO_X.

Major barriers to using FGR are: 1) it would reduce the peak flame temperature below the temperature necessary for proper lime formation, and 2) a long and lazy flame will be produced, which is not acceptable for ensuring lime quality. FGR would also require an excessive amount of ducting from the stack to the kiln inlet.

Finally, FGR has never been demonstrated on a lime kiln and is considered a technically infeasible control technology for lime kilns.

Option 3 – Oxidation/Reduction Scrubbing (O/R)

Several proprietary NO_X removal processes are commercially available such as Tri-Mer Corporation's TRI-NO_X and BOC's $LoTO_X$ System. It has been reported that O/R scrubbing has a theoretical NO_X removal efficiency of 90 percent. The basic elements of the system are:

1) Cooling of the gas stream to its dew point temperature (150 °F to 250 °F) which condenses a portion of the water vapor in the gas and generates condensate that requires disposal,

2) Low temperature oxidation of the NO_X, CO, and SO_2 to higher oxides through controlled injection of ozone or sodium chlorite in a static mixer or reaction duct (the ozone/NO_X ratios required to produce the desired NO_X oxidation are reported to be less than stoichiometric amounts),

$$NO + O_3 \rightarrow NO_2 + O_2$$

$$2NO_2 + O_3 \rightarrow N_2O_5 + O_2$$

$$CO + O_3 \rightarrow CO_2 + O_2$$

$$SO_2 + O_3 \rightarrow SO_3 + O_2$$

3) Absorption of higher vapor forms of nitrogen and sulfur oxides in a wet scrubber that produces nitric, sulfuric, and carbonic acid solution. These acids must be recovered and neutralized by the use of sodium hydroxide in the scrubber water (caustic scrubbing),

$$2\ NaOH + 2\ NO_2 + 1/2\ O_2 \rightarrow 2\ NaNO_3 + H_2O$$

$$N_2O_5 + H_2O \rightarrow 2\ HNO_3$$

4) Once neutralized, the resultant scrubber water, containing nitrate solution, can be discharged to a sanitary sewer system.

Due to heavy dust loading upstream of the ESP, the O/R scrubbing must be located downstream of the ESP. Saturated flue gas from the scrubber requires heating before exiting through the flue stack to prevent in-stack condensation of acid gases and other adverse ambient impacts. Further, bleed air or a water spray cooling tower could be required to cool the gases, thus increasing the size of the ID fan and its power consumption. When using bleed air, cooling the gases to the dew point temperature will condense a portion of the water vapor and acid vapor. This condensate must be properly disposed since it cannot be used in other portions of the lime kiln process. Also, oxygen must be supplied to cells that generate the ozone. This requires installation of very large liquid oxygen tanks. The liquid oxygen is withdrawn from the tank, sent through a vaporizer, and then to the generating cells. Considerable safety practices must be exercised when dealing with handling and vaporizing liquid oxygen. Finally, the ability of the O/R Scrubbing System to perform on a lime kiln or a similar source has never been demonstrated, particularly in the presence of CO_2 from both calcination and combustion and is not listed for lime kilns in the RACT/BACT/LAER Clearinghouse.
O/R Scrubbing is considered a technically infeasible control technology for the lime kiln installation.

Option 4 – Selective Catalytic Reduction (SCR)

SCR is an exhaust gas treatment process in which ammonia (NH_3) or urea is injected into the exhaust gas upstream of a catalyst bed. The NH_3 reacts to form nitrogen (N_2) and water on the surface of the catalyst. The overall chemical reaction is represented by the following equation.

$$NH_3 + NO + 1/4\ O_2 \rightarrow N_2 + 3/2\ H_2O$$

In the SCR process, urea or NH_3 from a liquid storage tank is vaporized and injected into the exhaust prior to the catalyst. The exhaust gas/ammonia mixture passes over the catalyst. The function of the catalyst is to lower the activation energy of the NO decomposition reaction, therefore, lowering the temperature necessary to carry out the reaction.

Several technical and operational difficulties exist with SCR technology. The SCR process is temperature sensitive. Efficient operation requires constant exhaust temperatures within a defined range, usually ± 50°F. Any load fluctuation resulting in exhaust gas temperature fluctuations reduces removal efficiency and upsets the NH_3/NO_X molar ratio. A low temperature results in slow reaction rates which leads to low nitrogen oxides conversion, and unreacted NH_3 passing through the reactor bed (ammonia slip). A high temperature results in shortened catalyst life and can lead to the oxidation of NH_3 and the formation of additional NO_X.[4] Under ideal conditions the catalytic reaction can result in NO_X removal between 60 and 90 percent.[5] SCR technology has not been applied to lime kilns due to the variable exhaust temperatures associated with the process. Further, the optimum temperature range for the catalytic reaction is 575 °F to 750 °F.[6] A lime kiln typically operates in the 1,600 – 2,700 °F range.

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[4] Marvin M. Schorr, GE Industrial & Power Systems, "NO_X Control For Gas Turbines: Regulation and Technology", for presentation at the Association of Energy Engineers World Energy Engineering Congress, October 11, 1990, page 6.

[5] *Air Pollution Engineering Manual.* Air & Waste Management Association. Edited by A.J. Buinicore A.J. and W.T. Davis, page 244.

[6] W.R. Epperly and J.E. Hoffman, "Control of Ammonia and Carbon Monoxide Emissions in SNCR Technologies," July 14, 1989. Paper presented at the 1989 Summer National AIChE Meeting, page 3.

Additional concerns with using a SCR system include the hazards involved with storing large quantities of NH_3 and with disposal of spent catalyst which has been contaminated by SO_2 and Cl_2. The NH_3 also causes potential corrosion problems. Because anhydrous NH_3 used in SCR systems is stored in pressurized vessels, leaks in ammonia supply systems can result in toxic vapor releases. NH_3 transportation, transfer operations, and use can be hazardous because of potential equipment failure and human error. The EPA has listed NH_3 as a hazardous substance (40 CFR 355, Appendix A), and as a toxic chemical (40 CFR §372.65). The Clean Air Act Amendments of 1990 also list NH_3 as extremely hazardous (Section 112(r)(3)). Therefore emissions of ammonia may be subject to several other regulatory requirements.

Another operating condition that has a major impact on SCR performance is the NH_3/NO_X molar ratio. Ammonia is typically injected to produce a NH_3/NO_X molar ratio of 1.05-1.1/1 to achieve NO_X conversions of 80 to 90 percent with an ammonia slip of about 10 ppm.[7] Increasing this ratio would drastically increase the ammonia slip, with little change in conversion, and decreasing the ratio would result in lower conversion.

The ammonia may also react with sulfur to form ammonium bisulfate, which has the potential to create a visible and/or detached plume. The lime may also react with the sulfur to form calcium sulfate. Ammonium bisulfate and calcium sulfate coatings, along with other dusts, will block the catalyst pores, thereby reducing the catalyst effectiveness.

The SCR unit could be placed downstream of the ESP to alleviate the catalyst blockage problem; however, the flue gas is less than 500 °F and would require a heat exchanger system to achieve the desired reaction temperature. The necessary equipment includes a catalytic reactor, heat exchanger, and blower.

This technology is not listed for lime kilns in the RACT/BACT/LAER Clearinghouse. SCR is not considered to be technically feasible for controlling NO_X emissions from lime kilns.

Option 5 – Selective Non-Catalytic Reduction (SNCR)

SNCR is an exhaust gas treatment process in which urea or ammonia is injected into the exhaust gas. High temperatures, normally between 1,300 °F and 1,900 °F, promote the reaction between NH_3 and NO_X to form nitrogen (N_2) and water. The overall chemical reaction is represented by the following equation.

$$NH_3 + NO + 1/4\ O_2 \rightarrow N_2 + 3/2\ H_2O$$

In this process, NH_3 from a liquid storage tank is vaporized and injected into the exhaust. The system is temperature dependent.

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[7] *Alternative Control Techniques Document - NO_X Emissions from Cement Manufacturing.* U.S. EPA. EPA-453/R-94-004, March 1994, pages 5-14.

Several difficulties preclude use of an SNCR for control of NO_X emissions from a lime kiln. If burner temperatures exceed 2,000 °F, the NH_3 injected with the SNCR will begin to oxidize, creating additional NO_X. Another difficulty involves maintaining the correct NH_3/NO_X ratio during any load fluctuations. Any excess NH_3 would be released into the atmosphere, creating NH_3 slip. Not only does NH_3 slip result in emissions to the atmosphere, but leads to the formation of ammonium salts. These salts can result in a visible plume. In addition, the NH_3 injection, storage, and waste by-product collection system must be properly designed for spill containment and waste removal. Ammonia is listed as a hazardous substance (40 CFR 302.1), as an extremely hazardous substance (40 CFR 355, Appendix A), and is regulated under the Chemical Release Provisions of the Clean Air Act Amendments of 1990 (Section 112(r)).

Use of this control technology in a lime kiln would cause several concerns. Due to load and exhaust gas temperature fluctuations, optimum NH_3/NO_X molar ratio, as well as correct reaction temperatures, would be extremely difficult to monitor and maintain, and release of NH_3 into the atmosphere can occur. Further, it is likely that formation of NH_3 salts would occur which could result in an increase of process downtime. In addition, the hazards involved with the storage of NH_3 and the increased emissions from NH_3 slip cause environmental and safety concerns.

The correct temperature window of 1,300 °F to 1 900 °F occurs inside the rotating body of the kiln. Locating injection nozzles in such an area is not technically feasible at the present time and has not been attempted on any lime kiln.

SNCR has never been demonstrated on a lime kiln and is not listed on the RACT/BACT/LAER Clearinghouse. SNCR is considered a technically infeasible control technology for the lime kiln.

Option 6 – Non-Selective Catalytic Reduction (NSCR)

NSCR is an exhaust gas treatment technique for NO_X reduction. It is the type of catalyst control used to treat automobile exhaust and typically uses a platinum/rhodium catalyst. Use of NSCR reduces emissions of NO_X, CO, and VOC simultaneously across the catalyst bed, but it is only effective in fuel rich combustion air. To achieve a fuel-rich environment, excess combustion air must be kept to a minimum, resulting in an exhaust gas with less than three percent oxygen by volume (ideally, the oxygen content should be less than half a percent by volume for proper operation).

The Flint River lime kiln will normally operate with stack exhaust gas oxygen concentrations much higher than 3 percent (by volume). Decreasing the excess air, and thus the O_2 concentrations, would result in increased CO emissions - an unacceptable compromise. In addition to the operational incompatibility of the control strategy, various problems will arise from the fuel-borne contaminants causing catalyst fouling (dust, SO_2, and Cl_2 in the flue gas can poison the catalyst), excessive backpressure, plugging of the catalyst, and efficiency reduction.

NSCR is technically infeasible for lime kiln NO_X emissions control.

Step 3: Rank remaining control technologies by control effectiveness

Table 3: Ranking of Control Technology

Control Technology Ranking	Control Technology	Control Efficiency
1	Good Design and Operation	Reduction of emissions to 175 ppmvd at 10% O_2

Step 4: Evaluate most effective controls and document

Since there is only one control option remaining, the use of good design and operation will be the only option evaluated.

Option 7 – Good Design and Operation

The formation of NO_X is minimized by proper kiln design and operation. Generally, emissions are minimized when the lime kiln temperature is kept at the lower end of the desired range and when the distribution of air at the air and fuel injection zones is controlled. Ideally, maintaining a low-oxygen condition near fuel injection points approaches an off-stoichiometric staged combustion process.

A high thermal efficiency would lead to less consumption of heat and fuel and would produce less NO_X emissions. General improvement in thermal efficiency is one design method of reducing NO_X formation, since less fuel is used.

Step 5: Select BACT

The proposed lime kiln will utilize good design and operation practices to minimize NO_X emissions.

Conclusion – NO_X Control

The Division has determined that Weyerhaeuser's proposal to use good design and operation practices for the proposed lime kiln to minimize NO_X emissions constitutes BACT. The BACT emission limit has been established as 175 ppmvd at 10 percent oxygen. This limit shall be taken as a 3-hour average limit.

Summary – Control Technology Review for Lime Kiln

To fulfill the PSD permitting requirements for NO_X, a BACT analysis was conducted for the new lime kiln. The BACT selection for the lime kiln is summarized in Table 4. The emission limit selected is representative of previous PSD BACT determination levels published in U.S. EPA's RACT/BACT/LAER Clearinghouse (RBLC) database for lime kilns of similar type and size.

Table 4: BACT Summary for the Proposed Lime Kiln

Pollutant	Control Technology	Proposed BACT Limit	Averaging Period
NO_X	Good Design and Operation	175 ppmvd at 10 percent oxygen	3-hour

Appendix 3
Cost Analyses
Lime Kiln PM Controls

TOTAL ANNUAL COST SPREADSHEET PROGRAM--ELECTROSTATIC PRECIPITATORS [1]

COST BASE DATE: Second Quarter 1987 [2]

VAPCCI (1st Quarter 2004--FINAL): [3] 124.9

INPUT PARAMETERS:		
-- Inlet stream flowrate (acfm):	65,000	(a)
-- Inlet stream temperature (oF):	600	
-- Particulate type:	lime kiln dust	
-- ESP type:	flat plate	
-- ESP 'options' included? ('yes'=1; 'no'=0):	1	
-- Inlet particulate loading (gr/ft3):	2	
-- Particulate mass median diameter (microns):	5	(assume same as cement kiln dust)
-- Most penetrating particle size (microns):	2	
-- Particle rapping puff size (microns):	5	
-- Particulate resistivity (ohm-cm):	2.00E+07	
-- Overall PM collection efficiency (fraction):	0.999	
-- PM migration velocity (cm/s):	16.0	
-- Sneakage factor:	0.07	
-- Rapping reentrainment factor:	0.124	
-- Gas free space permittivity (F/m):	8.85E-12	
-- Average field/sparking field adjust. factor:	0.7937	
-- ESP pressure drop (in. w.c.):	0.50	
-- Material of construction (see list below):[4]	1	

DESIGN PARAMETERS	
-- Overall penetration:	0.001
-- Specific collection area #1 (ft2/1000 acfm):	219.3
-- Gas viscosity (kg/m-s):	2.97E-05
-- Electric field at sparking (V/m):	1.77E+05
-- Average electric field (V/m):	1.41E+05
-- Loss factor:	0.19
-- Number of collecting sections in ESP:	6

-- Section 'Lookup Table':

Efficiency:	No. Sections:
0	2
0.965	3
0.990	4
0.998	5
0.999	6

-- Average section penetration: 0.3162
-- Section collection penetration: 0.1607
-- Particle size change factor, D (micron): 0.3162
-- Particle size change factor, MMDrp (micron): 1.530
-- Section parameters:

Section #	MMDi	SCAi
1	7	41.13
2	4.504	63.92
3	3.748	76.81
4	3.519	81.81
5	3.450	83.46
6	3.429	83.97

-- Specific collection area #2 (ft2/1000 acfm): 2190.02
-- SCA #2/SCA #1 (SCA ratio): 9.99
-- SCA Ratio 'Lookup Table':

No. Sections	SCA Ratio (avg.)
2	2.60
3	2.65
4	2.89
5	2.96
6	3.09

-- SCA Ratio (avg.)-THIS STREAM: 3.09
-- SCA = SCA Ratio (avg.) x SCA #1: 677.7
-- Total collector plate area (ft2): 44051

CAPITAL COSTS

Equipment Costs ($):	
-- Basic ESP	504,780
-- ESP 'standard options'	227,151
-- Auxiliaries (ductwork, etc.)	0
-- Total (base)	731,930
' (escalated)	1,289,770
Purchased Equipment Cost ($):	1,521,929
Total Capital Investment ($):	3,409,120

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ANNUAL COST INPUTS:

Operating factor (hr/yr):	8,760
Operating labor rate ($/hr):	20
Operating labor factor (hr/sh):	1.0
Electricity price ($/kWhr):	0.05
Dust disposal ($/ton):	15
Annual interest rate (fraction):	0.07
Control system life (years):	10
Capital recovery factor:	0.1424
Taxes, insurance & admin. factor:	0.00

ANNUAL COSTS ($/yr):

Item	Cost ($/yr)	Wt. Factor	W.F. (cond.)
Operating labor	21,900	0.032	----
Supervisory labor	3,285	0.005	----
ESP coordinator labor	7,300	0.011	----
Maintenance labor	4,125	0.006	0.086
Maintenance materials	15,219	0.022	----
Electricity	42,408	0.062	----
Dust disposal	68,999	0.102	----
Overhead	31,098	0.046	----
Taxes, insurance, administrative	0	0.000	----
Capital recovery	485,382	0.714	0.750
Total Annual Cost	679,716	1.000	1.000

Operating Labor Factor 'Lookup Table'

Plate Area (ft2):	Factor (hr/sh):
0	0.5
10000	1.0
100000	1.5
1000000	2.0

Notes:

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[1] This spreadsheet was developed based on data and procedures in Chapter 6 of the OAQPS CONTROL COST MANUAL (4th Edition). However, modifications were made to SCA calculation procedure (SCA #2) to correct equation discontinuities and other anomalies.

[2] Base equipment costs reflect this date.

[3] VAPCCI = Vatavuk Air Pollution Control Cost Index (for electrostatic precipitators) corresponding to year and quarter shown. Base equipment cost, purchased equipment cost, and total capital investment have been escalated to this date via the VAPCCI and control equipment vendor data.

[4] Enter one of the following numbers: carbon steel--'1'; 316 stainless steel--'1.3'; Carpenter 20 (CB-3)--'1.9'; Monel-400--'2.3'; Nickel-200--'3.2'; titanium--'4.5'.

(a) Highest 3-run average flowrate observed during source tests is approximatley 59,500 acfm To accommodate short term process variability and incorporate a 10% safety factor, the design parameter for these calculations reflect a flowrate of 65,000 acfm

TOTAL ANNUAL COST SPREADSHEET PROGRAM--HI-ENERGY (VENTURI) SCRUBBERS [1]

COST BASE DATE: June 1988 [2]		
VAPCCI (1st Quarter 2004--FINAL): [3]	127.4	

INPUT PARAMETERS

-- Inlet stream flowrate (acfm):	65,000	(a)
-- Inlet stream temperature (oF):	600	
-- Inlet moisture content (molar, fraction):	0.25	
-- Inlet absolute humidity (lb/lb b.d.a.): [4]	0.207	
-- Inlet water flowrate (lb/min):	378.0	
-- Saturation absolute humidity (lb/lb b.d.a.):	0.4000	
-- Saturation enthalpy temperature term (oF):[5]	37.7	
-- Saturation temperature (oF):	170.0	(assume as satured temp.)
-- Inlet dust loading (gr/dscf):	1.89	
-- Overall control efficiency (fractional):	0.99	
-- Overall penetration (fractional):	0.01	
-- Mass median particle diameter (microns): [6]	1.7	
-- 84th % aerodynamic diameter (microns): [6]	3.4	
-- Particle cut diameter (microns): [6]	0.44	
-- Scrubber liquid solids content (lb/lb H2O):	0.25	
-- Liquid/gas (L/G) ratio (gpm/1000 acfm):	5.0	
-- Recirculation pump head (ft of water):	100	
-- Material of construction (see list below):[7]	1	

DESIGN PARAMETERS

-- Scrubber pressure drop (in. w.c.): [8]	24.73
-- Inlet dry air flow rate (dscfm): [9]	24,375
-- Inlet (= outlet) air mass rate (lb/min):	1827
-- Water recirculation rate (gpm):	325
-- Outlet water mass rate (lb/min):	731
-- Outlet total stream flow rate (acfm):	47,646
-- Scrubber liquid bleed rate (gpm):	3.12
-- Scrubber evaporation rate (gpm):	42.35
-- Scrubber liquid makeup rate (gpm):	45.47

CAPITAL COSTS

Equipment Costs ($):	
-- Scrubber (base)	74,270
' (escalated)	107,877
-- Other (auxiliaries, e.g.)	0
-- Total	107,877
Purchased Equipment Cost ($):	127,295
Total Capital Investment ($):	243,134

ANNUAL COST INPUTS

Operating factor (hr/yr):	8,760
Operating labor rate ($/hr):	20.00
Maintenance labor rate ($/hr):	22.00
Operating labor factor (hr/sh):	2
Maintenance labor factor (hr/sh):	1.5
Electricity price ($/kWhr):	0.053
Chemicals price (specify) ($/ton):	0
Process water price ($/1000 gal):	0.62
Wastewater treatment ($/1000 gal):	0.25
Overhead rate (fractional):	0.60
Annual interest rate (fractional):	0.07
Control system life (years):	10
Capital recovery factor (system):	0.1424
Taxes, insurance, admin. factor:	0.04

ANNUAL COSTS

Item	Cost ($/yr)	Wt. Fact.	W.F.(cond.)
Operating labor	43,800	0.122	----
Supervisory labor	6,570	0.018	----
Maintenance labor	36,135	0.101	----
Maintenance materials	36,135	0.101	----
Electricity--fan	98,879	0.275	----
Electricity--recirculation pump	4,361	0.012	
Chemicals	0	0.000	----
Process water	14,818	0.041	----
Wastewater treatment	410	0.001	----
Overhead	73,584	0.205	0.547
Taxes, insurance, administrative	9,725	0.027	----
Capital recovery	34,617	0.096	0.124
Total Annual Cost ($/yr)	359,034	1.000	1.000

Notes:

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[1] Data used to develop this program were taken from 'Estimating Costs of Air Pollution Control' (CRC Press/Lewis Publishers, 1990).

[2] Base equipment costs reflect this date.

[3] VAPCCI = Vatavuk Air Pollution Control Cost Index (for wet scrubbers) corresponding to year and quarter shown. Base equipment cost, purchased equipment cost, and total capital investment have been escalated to this date via the VAPCCI and control equipment vendor data.

[4] Program calculates from the inlet moisture content.

[5] To obtain the saturation temperature, iterate on the saturation humidity. Continue iterating until the saturation temperature and the saturation enthalpy term are approximately equal.

[6] Both the 'mass median' and '84th percentile aerodynamic' diameters are obtained from a log-normal distribution of the inlet stream particle diameters. The particle cut diameter is a graphical function of the the penetration, the mass median diameter, and the standard deviation of the particle size distribution.(For detailed guidance in determining these particle sizes, see "Wet Scrubbers: A Practical Handbook" by K.C. Schifftner and H.E. Hesketh (CRC Press/Lewis Publishers, 1986). A condensed procedure is given in "Estimating Costs of Air Pollution Control" by W.M. Vatavuk (CRC Press/Lewis Publishers, 1990).)

[7] Enter one of the following numbers: carbon steel--'1'; rubber-lined carbon steel--'1.6'; epoxy-coated carbon steel--'1.6'; fiber-reinforced plastic (FRP)--'1.6'.

[8] The scrubber pressure drop is extremely sensitive to the particle cut diameter. Hence, the user must determine the cut diameter with great care.

[9] Measured at 70 oF and 1 atmosphere.

(a) Highest 3-run average flowrate observed during source tests is approximatley 59,500 acfm
To accommodate short term process variability and incorporate a 10% safety factor, the design parameter for these calculations reflect a flowrate of 65,000 acfm