



KBN ENGINEERING AND APPLIED SCIENCES, INC.

**PSD PERMIT  
APPLICATION**

**Georgia-Pacific Corporation  
February 1991**

**Prepared For:**

**Georgia-Pacific Corporation  
P.O. Box 919  
Palatka, FL 32078**

**Prepared By:**

**KBN Engineering and Applied Sciences, Inc.  
1034 NW 57th Street  
Gainesville, FL 32605**

**February 1991  
90133B1**

DEPARTMENT OF ENVIRONMENTAL REGULATION

#5,000 pd.  
2-13-91  
Receipt # 151243

RECEIVED



AC54-192250  
PSD-FL-171

FEB 13 1991

DER-BAQM

APPLICATION TO OPERATE/CONSTRUCT AIR POLLUTION SOURCES

SOURCE TYPE: Recovery Boiler [ ] New<sup>1</sup> [X] Existing<sup>1</sup>

APPLICATION TYPE: [X] Construction [ ] Operation [ ] Modification

COMPANY NAME: Georgia-Pacific Corporation COUNTY: Putnam

Identify the specific emission point source(s) addressed in this application (i.e., Lime Kiln No. 4 with Venturi Scrubber; Peaking Unit No. 2, Gas Fired) No. 4 Recovery Boiler and Smelt Dissolving Tank

SOURCE LOCATION: Street N. of SR 216; W. of U.S. 17 City Palatka

UTM: East 17: 434.0 North 3,283.4

Latitude 29 ° 41 ' 00 "N Longitude 81 ° 40 ' 45 "W

APPLICANT NAME AND TITLE: Henry Hirschman, General Manager

APPLICANT ADDRESS: P.O. Box 919, Palatka, FL 32078-0919

SECTION I: STATEMENTS BY APPLICANT AND ENGINEER

A. APPLICANT

I am the undersigned owner or authorized representative\* of Georgia-Pacific

I certify that the statements made in this application for a construction permit are true, correct and complete to the best of my knowledge and belief. Further, I agree to maintain and operate the pollution control source and pollution control facilities in such a manner as to comply with the provision of Chapter 403, Florida Statutes, and all the rules and regulations of the department and revisions thereof. I also understand that a permit, if granted by the department, will be non-transferable and I will promptly notify the department upon sale or legal transfer of the permitted establishment.

\*Attach letter of authorization

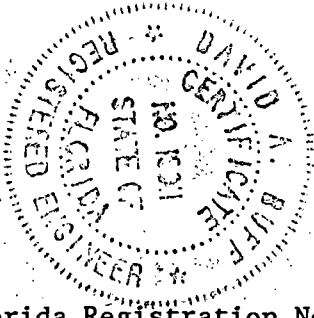
Signed: Henry Hirschman  
Henry Hirschman, General Manager  
Name and Title (Please Type)

Date: 2/11/91 Telephone No. (904) 325-2001

B. PROFESSIONAL ENGINEER REGISTERED IN FLORIDA (where required by Chapter 471, F.S.) This is to certify that the engineering features of this pollution control project have been designed/examined by me and found to be in conformity with modern engineering principles applicable to the treatment and disposal of pollutants characterized in the permit application. There is reasonable assurance, in my professional judgement, that

<sup>1</sup>See Florida Administration Code Rule 17-2.100(57) and (104)

the pollution control facilities, when properly maintained and operated, will discharge an effluent that complies with all applicable statutes of the State of Florida and the rules and regulations of the department. It is also agreed that the undersigned will furnish, if authorized by the owner, the applicant a set of instructions for the proper maintenance and operation of the pollution control facilities and, if applicable, pollution sources.



Signed David A. Buff  
David A. Buff

Name (Please Type)  
KBN Engineering & Applied Sciences, Inc.  
Company Name (Please Type)

1034 N.W. 57th Street, Gainesville, FL 32605  
Mailing Address (Please Type)

Florida Registration No. 19011 Date: Feb. 11, 1991 Telephone No. (904) 331-9000

SECTION II: GENERAL PROJECT INFORMATION

A. Describe the nature and extent of the project. Refer to pollution control equipment, and expected improvements in source performance as a result of installation. State whether the project will result in full compliance. Attach additional sheet if necessary.

Refer to PSD Report

B. Schedule of project covered in this application (Construction Permit Application Only)  
Start of Construction May 1991 Completion of Construction May 1992

C. Costs of pollution control system(s): (Note: Show breakdown of estimated costs only for individual components/units of the project serving pollution control purposes. Information on actual costs shall be furnished with the application for operation permit.)

Control equipment is already in place.

D. Indicate any previous DER permits, orders and notices associated with the emission point, including permit issuance and expiration dates.

A054-131787 Issued 5/14/87 Expires 6/10/92

E. Requested permitted equipment operating time: hrs/day 24; days/wk 7; wks/yr 52;  
If power plant, hrs/yr \_\_\_\_\_; if seasonal, describe: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

F. If this is a new source or major modification, answer the following questions.  
(Yes or No)

- 1. Is this source in a non-attainment area for a particular pollutant? No
  - a. If yes, has "offset" been applied? \_\_\_\_\_
  - b. If yes, has "Lowest Achievable Emission Rate" been applied? \_\_\_\_\_
  - c. If yes, list non-attainment pollutants. \_\_\_\_\_
- 2. Does best available control technology (BACT) apply to this source?  
If yes, see Section VI. Yes
- 3. Does the State "Prevention of Significant Deterioration" (PSD)  
requirement apply to this source? If yes, see Sections VI and VII. Yes
- 4. Do "Standards of Performance for New Stationary Sources" (NSPS)  
apply to this source? No
- 5. Do "National Emission Standards for Hazardous Air Pollutants"  
(NESHAP) apply to this source? No

- H. Do "Reasonably Available Control Technology" (RACT) requirements apply  
to this source? No
- a. If yes, for what pollutants? \_\_\_\_\_
  - b. If yes, in addition to the information required in this form, any information  
requested in Rule 17-2.650 must be submitted.

Attach all supportive information related to any answer of "Yes". Attach any  
justification for any answer of "No" that might be considered questionable.

SECTION III: AIR POLLUTION SOURCES & CONTROL DEVICES (Other than Incinerators)

A. Raw Materials and Chemicals Used in your Process, if applicable:

JSC permit for flow diagram

Description	Contaminants		Utilization Rate - lbs/hr	Relate to Flow Diagram
	Type	% Wt		
Black liquor	Particulate	65	323,077	
Black liq. solid	Particulate	100	210,000	
Smelt	Particulate	100	85,890	

P. 1000/19,000

B. Process Rate, if applicable: (See Section V, Item 1)

1. Total Process Input Rate (lbs/hr): 210,000 lb/hr BLS

2520 TPD

2. Product Weight (lbs/hr): 85,890 lb/hr smelt

C. Airborne Contaminants Emitted: (Information in this table must be submitted for each emission point, use additional sheets as necessary)

Name of Contaminant	Emission <sup>1</sup>		Allowed <sup>2</sup> Emission Rate per Rule 17-2	Allowable <sup>3</sup> Emission lbs/hr	Potential <sup>4</sup> Emission		Relate to Flow Diagram
	Maximum lbs/hr	Actual T/yr			lbs/hr	T/yr	
	See PSD report						

<sup>1</sup>See Section V, Item 2.

<sup>2</sup>Reference applicable emission standards and units (e.g. Rule 17-2.600(5)(b)2. Table II, E. (1) - 0.1 pounds per million BTU heat input)

<sup>3</sup>Calculated from operating rate and applicable standard.

<sup>4</sup>Emission, if source operated without control (See Section V, Item 3).

D. Control Devices: (See Section V, Item 4)

Name and Type (Model & Serial No.)	Contaminant	Efficiency	Range of Particles Size Collected (in microns) (If applicable)	Basis for Efficiency (Section V Item 5)
No.4 RB: Envir. Elements ESP-Model #370741	Particulate	99%	Submicron	Design
No.4 SDT: Venturi Scrubber	Particulate	95%	Submicron	Design
	TRS	99%	N/A	Design

E. Fuels

Type (Be Specific)	Consumption*		Maximum Heat Input (MMBTU/hr)
	avg/hr	max./hr	
Black Liquor @ 66.3% solids	316,742	316,742	1,277.7
Fuel Oil	0 <sup>+</sup>	5,400	787

\*Units: Natural Gas--MMCF/hr; Fuel Oils--gallons/hr; Coal, wood, refuse, others--lbs/hr.  
+Normal operation

Fuel Analysis: Black liquor/No. 6 Fuel Oil

Percent Sulfur: 4.7/2.5 Percent Ash: NA/0.05

Density: 27.91/7.88 lbs/gal Typical Percent Nitrogen: NA/3.0

Heat Capacity: 4.034/18.500 BTU/lb 112,589/145,780 BTU/gal

Other Fuel Contaminants (which may cause air pollution): \_\_\_\_\_

F. If applicable, indicate the percent of fuel used for space heating.

Annual Average N/A Maximum \_\_\_\_\_

G. Indicate liquid or solid wastes generated and method of disposal.

None generated.

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No. 4 Recovery Boiler

H. Emission Stack Geometry and Flow Characteristics (Provide data for each stack):

Stack Height: 230 ft. Stack Diameter: 12.0 ft.  
 Gas Flow Rate: 427,560 ACFM 210,000 DSCFM Gas Exit Temperature: 400 °F.  
 Water Vapor Content: 20 % Velocity: 63.0 FPS

SECTION IV: INCINERATOR INFORMATION

Not Applicable

Type of Waste	Type 0 (Plastics)	Type II (Rubbish)	Type III (Refuse)	Type IV (Garbage)	Type IV (Pathological)	Type V (Liq. & Gas By-prod.)	Type VI (Solid By-prod.)
Actual lb/hr Incinerated							
Uncontrolled (lbs/hr)							

Description of Waste \_\_\_\_\_

Total Weight Incinerated (lbs/hr) \_\_\_\_\_ Design Capacity (lbs/hr) \_\_\_\_\_

Approximate Number of Hours of Operation per day \_\_\_\_\_ day/wk \_\_\_\_\_ wks/yr. \_\_\_\_\_

Manufacturer \_\_\_\_\_

Date Constructed \_\_\_\_\_ Model No. \_\_\_\_\_

	Volume (ft) <sup>3</sup>	Heat Release (BTU/hr)	Fuel		Temperature (°F)
			Type	BTU/hr	
Primary Chamber					
Secondary Chamber					

Stack Height: \_\_\_\_\_ ft. Stack Diameter: \_\_\_\_\_ Stack Temp. \_\_\_\_\_

Gas Flow Rate: \_\_\_\_\_ ACFM \_\_\_\_\_ DSCFM\* Velocity: \_\_\_\_\_ FPS

\*If 50 or more tons per day design capacity, submit the emissions rate in grains per standard cubic foot dry gas corrected to 50% excess air.

Type of pollution control devices:  Cyclone  Wet Scrubber  Afterburner  
 Other (specify) \_\_\_\_\_



B&S A 0.42 = smelt blow for process wt.

No. 4 Smelt Dissolving Tank (North & South sides) Non-MSPS  
*2 separate stacks*

Note: Two identical stacks; data are for each stack

H. Emission Stack Geometry and Flow Characteristics (Provide data for each stack):

Stack Height: 222 ft. Stack Diameter: 5.0 ft.  
 Gas Flow Rate: 24,150 ACFM 14,515 DSCFM Gas Exit Temperature: 155 °F.  
 Water Vapor Content: 30 % Velocity: 20.5 FPS

SECTION IV: INCINERATOR INFORMATION

*Not Applicable*

Type of Waste	Type 0 (Plastics)	Type II (Rubbish)	Type III (Refuse)	Type IV (Garbage)	Type IV (Pathological)	Type V (Liq. & Gas By-prod.)	Type VI (Solid By-prod.)
Actual lb/hr Incinerated							
Uncontrolled (lbs/hr)							

Description of Waste \_\_\_\_\_  
 Total Weight Incinerated (lbs/hr) \_\_\_\_\_ Design Capacity (lbs/hr) \_\_\_\_\_  
 Approximate Number of Hours of Operation per day \_\_\_\_\_ day/wk \_\_\_\_\_ wks/yr. \_\_\_\_\_  
 Manufacturer \_\_\_\_\_  
 Date Constructed \_\_\_\_\_ Model No. \_\_\_\_\_

	Volume (ft) <sup>3</sup>	Heat Release (BTU/hr)	Fuel		Temperature (°F)
			Type	BTU/hr	
Primary Chamber					
Secondary Chamber					

Stack Height: \_\_\_\_\_ ft. Stack Diameter: \_\_\_\_\_ Stack Temp. \_\_\_\_\_  
 Gas Flow Rate: \_\_\_\_\_ ACFM \_\_\_\_\_ DSCFM\* Velocity: \_\_\_\_\_ FPS

\*If 50 or more tons per day design capacity, submit the emissions rate in grains per standard cubic foot dry gas corrected to 50% excess air.

Type of pollution control devices:  Cyclone  Wet Scrubber  Afterburner  
 Other (specify) \_\_\_\_\_

Brief description of operating characteristics of control devices: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Ultimate disposal of any effluent other than that emitted from the stack (scrubber water, ash, etc.):  
\_\_\_\_\_  
\_\_\_\_\_

NOTE: Items 2, 3, 4, 6, 7, 8, and 10 in Section V must be included where applicable.

#### SECTION V: SUPPLEMENTAL REQUIREMENTS

Please provide the following supplements where required for this application.

1. Total process input rate and product weight -- show derivation [Rule 17-2.100(127)]
2. To a construction application, attach basis of emission estimate (e.g., design calculations, design drawings, pertinent manufacturer's test data, etc.) and attach proposed methods (e.g., FR Part 60 Methods, 1, 2, 3, 4, 5) to show proof of compliance with applicable standards. To an operation application, attach test results or methods used to show proof of compliance. Information provided when applying for an operation permit from a construction permit shall be indicative of the time at which the test was made.
3. Attach basis of potential discharge (e.g., emission factor, that is, AP42 test).
4. With construction permit application, include design details for all air pollution control systems (e.g., for baghouse include cloth to air ratio; for scrubber include cross-section sketch, design pressure drop, etc.)
5. With construction permit application, attach derivation of control device(s) efficiency. Include test or design data. Items 2, 3 and 5 should be consistent: actual emissions = potential (1-efficiency).
6. An 8 1/2" x 11" flow diagram which will, without revealing trade secrets, identify the individual operations and/or processes. Indicate where raw materials enter, where solid and liquid waste exit, where gaseous emissions and/or airborne particles are evolved and where finished products are obtained.
7. An 8 1/2" x 11" plot plan showing the location of the establishment, and points of airborne emissions, in relation to the surrounding area, residences and other permanent structures and roadways (Examples: Copy of relevant portion of USGS topographic map).
8. An 8 1/2" x 11" plot plan of facility showing the location of manufacturing processes and outlets for airborne emissions. Relate all flows to the flow diagram.

- 9. The appropriate application fee in accordance with Rule 17-4.05. The check should be made payable to the Department of Environmental Regulation.
- 10. With an application for operation permit, attach a Certificate of Completion of Construction indicating that the source was constructed as shown in the construction permit.

**SECTION VI: BEST AVAILABLE CONTROL TECHNOLOGY**

Refer to PSD Report

- A. Are standards of performance for new stationary sources pursuant to 40 C.F.R. Part 60 applicable to the source?

[ ] Yes [ ] No

Contaminant	Rate or Concentration

- B. Has EPA declared the best available control technology for this class of sources (If yes, attach copy)

[ ] Yes [ ] No

Contaminant	Rate or Concentration

- C. What emission levels do you propose as best available control technology?

Contaminant	Rate or Concentration

- D. Describe the existing control and treatment technology (if any).

- |                           |                          |
|---------------------------|--------------------------|
| 1. Control Device/System: | 2. Operating Principles: |
| 3. Efficiency:*           | 4. Capital Costs:        |

\*Explain method of determining

5. Useful Life:

6. Operating Costs:

7. Energy:

8. Maintenance Cost:

9. Emissions:

Contaminant

Rate or Concentration

Contaminant	Rate or Concentration

10. Stack Parameters

a. Height: ft.

b. Diameter ft.

c. Flow Rate: ACFM

d. Temperature: °F.

e. Velocity: FPS

E. Describe the control and treatment technology available (As many types as applicable, use additional pages if necessary).

1.

a. Control Devices:

b. Operating Principles:

c. Efficiency:<sup>1</sup>

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:<sup>2</sup>

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

2.

a. Control Device:

b. Operating Principles:

c. Efficiency:<sup>1</sup>

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:<sup>2</sup>

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

<sup>1</sup>Explain method of determining efficiency.

<sup>2</sup>Energy to be reported in units of electrical power - KWH design rate.

- j. Applicability to manufacturing processes:
- k. Ability to construct with control device, install in available space, and operate within proposed levels:

3.

- a. Control Device:
- b. Operating Principles:
- c. Efficiency:<sup>1</sup>
- d. Capital Cost:
- e. Useful Life:
- f. Operating Cost:
- g. Energy:<sup>2</sup>
- h. Maintenance Cost:
- i. Availability of construction materials and process chemicals:
- j. Applicability to manufacturing processes:
- k. Ability to construct with control device, install in available space, and operate within proposed levels:

4.

- a. Control Device:
- b. Operating Principles:
- c. Efficiency:<sup>1</sup>
- d. Capital Cost:
- e. Useful Life:
- f. Operating Cost:
- g. Energy:<sup>2</sup>
- h. Maintenance Cost:
- i. Availability of construction materials and process chemicals:
- j. Applicability to manufacturing processes:
- k. Ability to construct with control device, install in available space, and operate within proposed levels:

F. Describe the control technology selected:

- 1. Control Device:
- 2. Efficiency:<sup>1</sup>
- 3. Capital Cost:
- 4. Useful Life:
- 5. Operating Cost:
- 6. Energy:<sup>2</sup>
- 7. Maintenance Cost:
- 8. Manufacturer:
- 9. Other locations where employed on similar processes:
  - a. (1) Company:
  - (2) Mailing Address:
  - (3) City:
  - (4) State:

<sup>1</sup>Explain method of determining efficiency.

<sup>2</sup>Energy to be reported in units of electrical power - KWH design rate.

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:<sup>1</sup>

Contaminant

Rate or Concentration


(8) Process Rate:<sup>1</sup>

b. (1) Company:

(2) Mailing Address:

(3) City:

(4) State:

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:<sup>1</sup>

Contaminant

Rate or Concentration


(8) Process Rate:<sup>1</sup>

10. Reason for selection and description of systems:

<sup>1</sup>Applicant must provide this information when available. Should this information not be available, applicant must state the reason(s) why.

**SECTION VII - PREVENTION OF SIGNIFICANT DETERIORATION**

Refer to PSD Report

**A. Company Monitored Data**

1. \_\_\_\_\_ no. sites \_\_\_\_\_ TSP \_\_\_\_\_ ( ) SO<sup>2\*</sup> \_\_\_\_\_ Wind spd/dir

Period of Monitoring \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_ to \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_  
month day year month day year

Other data recorded \_\_\_\_\_

Attach all data or statistical summaries to this application.

\*Specify bubbler (B) or continuous (C).

2. Instrumentation, Field and Laboratory

a. Was instrumentation EPA referenced or its equivalent? [ ] Yes [ ] No

b. Was instrumentation calibrated in accordance with Department procedures?

[ ] Yes [ ] No [ ] Unknown

B. Meteorological Data Used for Air Quality Modeling

1. \_\_\_\_\_ Year(s) of data from \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_ to \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_  
month day year month day year

2. Surface data obtained from (location) \_\_\_\_\_

3. Upper air (mixing height) data obtained from (location) \_\_\_\_\_

4. Stability wind rose (STAR) data obtained from (location) \_\_\_\_\_

C. Computer Models Used

1. \_\_\_\_\_ Modified? If yes, attach description.

2. \_\_\_\_\_ Modified? If yes, attach description.

3. \_\_\_\_\_ Modified? If yes, attach description.

4. \_\_\_\_\_ Modified? If yes, attach description.

Attach copies of all final model runs showing input data, receptor locations, and principle output tables.

D. Applicants Maximum Allowable Emission Data

Pollutant	Emission Rate
TSP	_____ grams/sec
SO <sup>2</sup>	_____ grams/sec

E. Emission Data Used in Modeling

Attach list of emission sources. Emission data required is source name, description of point source (on NEDS point number), UTM coordinates, stack data, allowable emissions, and normal operating time.

F. Attach all other information supportive to the PSD review.

G. Discuss the social and economic impact of the selected technology versus other applicable technologies (i.e, jobs, payroll, production, taxes, energy, etc.). Include assessment of the environmental impact of the sources.

H. Attach scientific, engineering, and technical material, reports, publications, journals, and other competent relevant information describing the theory and application of the requested best available control technology.

DEPARTMENT OF ENVIRONMENTAL REGULATION

\$5,000 pd.  
2-13-91  
Recpt. #151243



AC54-192251  
PSD-FL-171

APPLICATION TO OPERATE/CONSTRUCT AIR POLLUTION SOURCES

SOURCE TYPE: No. 4 Lime Kiln [ ] New<sup>1</sup> [X] Existing<sup>1</sup>

APPLICATION TYPE: [X] Construction [ ] Operation [ ] Modification

COMPANY NAME: Georgia-Pacific Corporation COUNTY: Putnam

Identify the specific emission point source(s) addressed in this application (i.e., Lime Kiln No. 4 with Venturi Scrubber; Peaking Unit No. 2, Gas Fired) No. 4 Lime Kiln

SOURCE LOCATION: Street N. of SR 216; W. of U.S. 17 City Palatka

UTM: East 17; 434.0 North 3,283.4

Latitude 29 ° 41 ' 00 "N Longitude 81 ° 40 ' 45 "W

APPLICANT NAME AND TITLE: Henry Hirschman, General Manager

APPLICANT ADDRESS: P.O. Box 919, Palatka, FL 32078-0919

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I certify that the statements made in this application for a construction permit are true, correct and complete to the best of my knowledge and belief. Further, I agree to maintain and operate the pollution control source and pollution control facilities in such a manner as to comply with the provision of Chapter 403, Florida Statutes, and all the rules and regulations of the department and revisions thereof. I also understand that a permit, if granted by the department, will be non-transferable and I will promptly notify the department upon sale or legal transfer of the permitted establishment.

\*Attach letter of authorization

Signed: Henry Hirschman  
Henry Hirschman, General Manager  
Name and Title (Please Type)

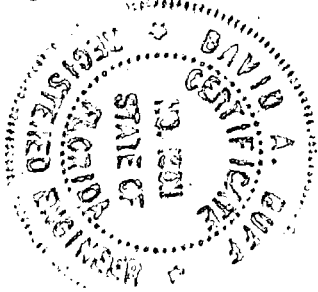
Date: 2/11/91 Telephone No. (904) 325-2001

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<sup>1</sup>See Florida Administration Code Rule 17-2.100(57) and (104)



the pollution control facilities, when properly maintained and operated, will discharge an effluent that complies with all applicable statutes of the State of Florida and the rules and regulations of the department. It is also agreed that the undersigned will furnish, if authorized by the owner, the applicant a set of instructions for the proper maintenance and operation of the pollution control facilities and, if applicable, pollution sources.



Signed David A. Buff

David A. Buff  
Name (Please Type)

KBN Engineering & Applied Sciences, Inc.  
Company Name (Please Type)

1034 N.W. 57th Street, Gainesville, FL 32605  
Mailing Address (Please Type)

Florida Registration No. 19011 Date: Feb. 11, 1991 Telephone No. (904) 331-9000

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Start of Construction May 1991 Completion of Construction May 1992

C. Costs of pollution control system(s): (Note: Show breakdown of estimated costs only for individual components/units of the project serving pollution control purposes. Information on actual costs shall be furnished with the application for operation permit.)

Control equipment is already in place.

D. Indicate any previous DER permits, orders and notices associated with the emission point, including permit issuance and expiration dates.

A054-124829 Issued 9/15/86 Expires 9/15/91

E. Requested permitted equipment operating time: hrs/day 24; days/wk 7; wks/yr 52;  
If power plant, hrs/yr \_\_\_\_\_; if seasonal, describe: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

F. If this is a new source or major modification, answer the following questions.  
(Yes or No)

1. Is this source in a non-attainment area for a particular pollutant? No
    - a. If yes, has "offset" been applied? \_\_\_\_\_
    - b. If yes, has "Lowest Achievable Emission Rate" been applied? \_\_\_\_\_
    - c. If yes, list non-attainment pollutants. \_\_\_\_\_
  2. Does best available control technology (BACT) apply to this source?  
If yes, see Section VI. Yes
  3. Does the State "Prevention of Significant Deterioration" (PSD)  
requirement apply to this source? If yes, see Sections VI and VII. Yes
  4. Do "Standards of Performance for New Stationary Sources" (NSPS)  
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(NESHAP) apply to this source? No
- H. Do "Reasonably Available Control Technology" (RACT) requirements apply  
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A. Raw Materials and Chemicals Used in your Process, if applicable:

Description	Contaminants		Utilization Rate - lbs/hr	Relate to Flow Diagram
	Type	% Wt		
CaCO <sub>3</sub>	Particulate	100	62,500	
Inerts	Particulate	100	3,889	
Recycle CaCO <sub>3</sub>	Particulate	100	13,645	
Recycle Inerts	Particulate	100	972	

B. Process Rate, if applicable: (See Section V, Item 1)

1. Total Process Input Rate (lbs/hr): 82,986 (without recycle)
2. Product Weight (lbs/hr): 38,889 (dry) @ 90% CaO

*468 TPA CaO*

C. Airborne Contaminants Emitted: (Information in this table must be submitted for each emission point; use additional sheets as necessary)

Name of Contaminant	Emission <sup>1</sup>		Allowed <sup>2</sup> Emission Rate per Rule 17-2	Allowable <sup>3</sup> Emission lbs/hr	Potential <sup>4</sup> Emission		Relate to Flow Diagram
	Maximum lbs/hr	Actual T/yr			lbs/hr	T/yr	
	See PSD report						

<sup>1</sup>See Section V, Item 2.

<sup>2</sup>Reference applicable emission standards and units (e.g. Rule 17-2.600(5)(b)2. Table II, E. (1) - 0.1 pounds per million BTU heat input)

<sup>3</sup>Calculated from operating rate and applicable standard.

<sup>4</sup>Emission, if source operated without control (See Section V, Item 3).

D. Control Devices: (See Section V, Item 4)

Name and Type (Model & Serial No.)	Contaminant	Efficiency	Range of Particles Size Collected (in microns) (If applicable)	Basis for Efficiency (Section V Item 5)
Zurn Scrubber	Particulate	99.0%	Submicron	Design

E. Fuels

Type (Be Specific)	Consumption*		Maximum Heat Input (MMBTU/hr)
	avg/hr	max./hr	
No. 6 Fuel Oil	933	933	136

\*Units: Natural Gas--MMCF/hr; Fuel Oils--gallons/hr; Coal, wood, refuse, others--lbs/hr.

Fuel Analysis: No. 6 Fuel Oil

Percent Sulfur: 2.5 Percent Ash: 0.05

Density: 7.88 lbs/gal Typical Percent Nitrogen: 3.0

Heat Capacity: 18,500 BTU/lb 145,780 BTU/gal

Other Fuel Contaminants (which may cause air pollution): \_\_\_\_\_

F. If applicable, indicate the percent of fuel used for space heating.

Annual Average N/A Maximum \_\_\_\_\_

G. Indicate liquid or solid wastes generated and method of disposal.

Scrubber liquid is recycled back into process

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No. 4 Lime Kiln

H. Emission Stack Geometry and Flow Characteristics (Provide data for each stack):

Stack Height: 131 ft. Stack Diameter: 4.33 ft.  
 Gas Flow Rate: 44,800 ACFM 24,200 DSCFM Gas Exit Temperature: 165 °F.  
 Water Vapor Content: 36 % Velocity: 50.7 FPS

SECTION IV: INCINERATOR INFORMATION

Not Applicable

Type of Waste	Type 0 (Plastics)	Type II (Rubbish)	Type III (Refuse)	Type IV (Garbage)	Type IV (Pathological)	Type V (Liq. & Gas By-prod.)	Type VI (Solid By-prod.)
Actual lb/hr Incinerated							
Uncontrolled (lbs/hr)							

Description of Waste \_\_\_\_\_

Total Weight Incinerated (lbs/hr) \_\_\_\_\_ Design Capacity (lbs/hr) \_\_\_\_\_

Approximate Number of Hours of Operation per day \_\_\_\_\_ day/wk \_\_\_\_\_ wks/yr. \_\_\_\_\_

Manufacturer \_\_\_\_\_

Date Constructed \_\_\_\_\_ Model No. \_\_\_\_\_

	Volume (ft) <sup>3</sup>	Heat Release (BTU/hr)	Fuel		Temperature (°F)
			Type	BTU/hr	
Primary Chamber					
Secondary Chamber					

Stack Height: \_\_\_\_\_ ft. Stack Diameter: \_\_\_\_\_ Stack Temp. \_\_\_\_\_

Gas Flow Rate: \_\_\_\_\_ ACFM \_\_\_\_\_ DSCFM\* Velocity: \_\_\_\_\_ FPS

\*If 50 or more tons per day design capacity, submit the emissions rate in grains per standard cubic foot dry gas corrected to 50% excess air.

Type of pollution control devices:  Cyclone  Wet Scrubber  Afterburner  
 Other (specify) \_\_\_\_\_

Brief description of operating characteristics of control devices: \_\_\_\_\_

Ultimate disposal of any effluent other than that emitted from the stack (scrubber water, ash, etc.):

NOTE: Items 2, 3, 4, 6, 7, 8, and 10 in Section V must be included where applicable.

**SECTION V: SUPPLEMENTAL REQUIREMENTS**

Please provide the following supplements where required for this application.

1. Total process input rate and product weight -- show derivation [Rule 17-2.100(127)]
2. To a construction application, attach basis of emission estimate (e.g., design calculations, design drawings, pertinent manufacturer's test data, etc.) and attach proposed methods (e.g., FR Part 60 Methods, 1, 2, 3, 4, 5) to show proof of compliance with applicable standards. To an operation application, attach test results or methods used to show proof of compliance. Information provided when applying for an operation permit from a construction permit shall be indicative of the time at which the test was made.
3. Attach basis of potential discharge (e.g., emission factor, that is, AP42 test).
4. With construction permit application, include design details for all air pollution control systems (e.g., for baghouse include cloth to air ratio; for scrubber include cross-section sketch, design pressure drop, etc.)
5. With construction permit application, attach derivation of control device(s) efficiency. Include test or design data. Items 2, 3 and 5 should be consistent: actual emissions = potential (1-efficiency).
6. An 8 1/2" x 11" flow diagram which will, without revealing trade secrets, identify the individual operations and/or processes. Indicate where raw materials enter, where solid and liquid waste exit, where gaseous emissions and/or airborne particles are evolved and where finished products are obtained.
7. An 8 1/2" x 11" plot plan showing the location of the establishment, and points of airborne emissions, in relation to the surrounding area, residences and other permanent structures and roadways (Examples: Copy of relevant portion of USGS topographic map).
8. An 8 1/2" x 11" plot plan of facility showing the location of manufacturing processes and outlets for airborne emissions. Relate all flows to the flow diagram.

9. The appropriate application fee in accordance with Rule 17-4.05. The check should be made payable to the Department of Environmental Regulation.
10. With an application for operation permit, attach a Certificate of Completion of Construction indicating that the source was constructed as shown in the construction permit.

**SECTION VI: BEST AVAILABLE CONTROL TECHNOLOGY**

Refer to PSD Report

- A. Are standards of performance for new stationary sources pursuant to 40 C.F.R. Part 60 applicable to the source?

Yes  No

Contaminant	Rate or Concentration

- B. Has EPA declared the best available control technology for this class of sources (If yes, attach copy)

Yes  No

Contaminant	Rate or Concentration

- C. What emission levels do you propose as best available control technology?

Contaminant	Rate or Concentration

- D. Describe the existing control and treatment technology (if any).

- |                           |                          |
|---------------------------|--------------------------|
| 1. Control Device/System: | 2. Operating Principles: |
| 3. Efficiency:*           | 4. Capital Costs:        |

\*Explain method of determining

5. Useful Life:

6. Operating Costs:

7. Energy:

8. Maintenance Cost:

9. Emissions:

Contaminant

Rate or Concentration

10. Stack Parameters

a. Height: ft.

b. Diameter ft.

c. Flow Rate: ACFM

d. Temperature: °F.

e. Velocity: FPS

E. Describe the control and treatment technology available (As many types as applicable, use additional pages if necessary).

1.

a. Control Devices:

b. Operating Principles:

c. Efficiency:<sup>1</sup>

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:<sup>2</sup>

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

2.

a. Control Device:

b. Operating Principles:

c. Efficiency:<sup>1</sup>

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:<sup>2</sup>

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

<sup>1</sup>Explain method of determining efficiency.

<sup>2</sup>Energy to be reported in units of electrical power - KWH design rate.



- j. Applicability to manufacturing processes:
  - k. Ability to construct with control device, install in available space, and operate within proposed levels:
- 3.
- a. Control Device:
  - b. Operating Principles:
  - c. Efficiency:<sup>1</sup>
  - d. Capital Cost:
  - e. Useful Life:
  - f. Operating Cost:
  - g. Energy:<sup>2</sup>
  - h. Maintenance Cost:
  - i. Availability of construction materials and process chemicals:
  - j. Applicability to manufacturing processes:
  - k. Ability to construct with control device, install in available space, and operate within proposed levels:
- 4.
- a. Control Device:
  - b. Operating Principles:
  - c. Efficiency:<sup>1</sup>
  - d. Capital Cost:
  - e. Useful Life:
  - f. Operating Cost:
  - g. Energy:<sup>2</sup>
  - h. Maintenance Cost:
  - i. Availability of construction materials and process chemicals:
  - j. Applicability to manufacturing processes:
  - k. Ability to construct with control device, install in available space, and operate within proposed levels:

F. Describe the control technology selected:

- 1. Control Device:
- 2. Efficiency:<sup>1</sup>
- 3. Capital Cost:
- 4. Useful Life:
- 5. Operating Cost:
- 6. Energy:<sup>2</sup>
- 7. Maintenance Cost:
- 8. Manufacturer:
- 9. Other locations where employed on similar processes:
- a. (1) Company:
- (2) Mailing Address:
- (3) City:
- (4) State:

<sup>1</sup>Explain method of determining efficiency.

<sup>2</sup>Energy to be reported in units of electrical power - KWH design rate.

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:<sup>1</sup>

Contaminant

Rate or Concentration

Contaminant	Rate or Concentration

(8) Process Rate:<sup>1</sup>

b. (1) Company:

(2) Mailing Address:

(3) City:

(4) State:

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:<sup>1</sup>

Contaminant

Rate or Concentration

Contaminant	Rate or Concentration

(8) Process Rate:<sup>1</sup>

10. Reason for selection and description of systems:

<sup>1</sup>Applicant must provide this information when available. Should this information not be available, applicant must state the reason(s) why.

**SECTION VII - PREVENTION OF SIGNIFICANT DETERIORATION**

Refer to PSD Report

**A. Company Monitored Data**

1. \_\_\_\_\_ no. sites \_\_\_\_\_ TSP \_\_\_\_\_ ( ) SO<sup>2\*</sup> \_\_\_\_\_ Wind spd/dir

Period of Monitoring \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_ to \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_  
month day year month day year

Other data recorded \_\_\_\_\_

Attach all data or statistical summaries to this application.

\*Specify bubbler (B) or continuous (C).

2. Instrumentation, Field and Laboratory

- a. Was instrumentation EPA referenced or its equivalent?  Yes  No
- b. Was instrumentation calibrated in accordance with Department procedures?  
 Yes  No  Unknown

B. Meteorological Data Used for Air Quality Modeling

1. \_\_\_\_\_ Year(s) of data from \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_ to \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_  
month day year month day year
2. Surface data obtained from (location) \_\_\_\_\_
3. Upper air (mixing height) data obtained from (location) \_\_\_\_\_
4. Stability wind rose (STAR) data obtained from (location) \_\_\_\_\_

C. Computer Models Used

1. \_\_\_\_\_ Modified? If yes, attach description.
2. \_\_\_\_\_ Modified? If yes, attach description.
3. \_\_\_\_\_ Modified? If yes, attach description.
4. \_\_\_\_\_ Modified? If yes, attach description.

Attach copies of all final model runs showing input data, receptor locations, and principle output tables.

D. Applicants Maximum Allowable Emission Data

Pollutant	Emission Rate
TSP	_____ grams/sec
SO <sup>2</sup>	_____ grams/sec

E. Emission Data Used in Modeling

Attach list of emission sources. Emission data required is source name, description of point source (on NEDS point number), UTM coordinates, stack data, allowable emissions, and normal operating time.

F. Attach all other information supportive to the PSD review.

G. Discuss the social and economic impact of the selected technology versus other applicable technologies (i.e, jobs, payroll, production, taxes, energy, etc.). Include assessment of the environmental impact of the sources.

H. Attach scientific, engineering, and technical material, reports, publications, journals, and other competent relevant information describing the theory and application of the requested best available control technology.

**PSD REPORT**  
**Georgia-Pacific Corporation**  
**February 1991**

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## 1.0 INTRODUCTION

Georgia-Pacific Corporation (G-P) will be performing routine maintenance on the existing recovery boiler (RB) and lime kiln (LK) at its kraft paper mill located in Palatka, Florida. The work will entail maintenance, repair, and replacement of component parts of these air emission sources. These activities will take place in May, 1991, during a month-long shutdown required to maintain safe operation of these sources. Concurrent with these activities, G-P will have the opportunity to add enhancements to the recovery boiler and lime kiln to increase their efficiency. These enhancements potentially may allow these sources to increase the rate of throughput. If the changes result in an increase in throughput and an associated increase in emissions, an air construction permit may be required. As a result, G-P is submitting the air construction permit application contained herein in anticipation that the future throughput rate may increase, an increase in emissions may occur, and regulatory review would be warranted.

Based on the current actual emissions and the future maximum emissions anticipated for the affected sources, the proposed project may constitute a major modification at a major stationary source under federal and state air quality regulations. This report addresses the requirements of the prevention of significant deterioration (PSD) review procedures pursuant to rules and regulations implementing the Clean Air Act (CAA) Amendments of 1977. The Florida Department of Environmental Regulation (FDER) has PSD review and approval authority in Florida. Based on the calculated emissions, a PSD review is indicated for the following pollutants: particulate matter (PM), particulate matter with an aerodynamic diameter of 10 microns or less (PM<sub>10</sub>), nitrogen oxides (NO<sub>x</sub>), carbon monoxide (CO), and volatile organic compounds (VOCs).

This application contains six additional sections. A complete description of the project, including air emission rates, is presented in Section 2.0. The air quality review requirements and source applicability of the

proposed project in relation to the regulations are discussed in Section 3.0.

Preconstruction PSD monitoring requirements are addressed in Section 4.0. The air quality impact analysis is presented in Section 5.0, while the best available control technology (BACT) analysis required as part of the PSD permitting process is presented in Section 6.0. The impacts of the project on soils, vegetation, and visibility are addressed in Section 7.0. Supportive information is provided in the appendices.

## 2.0 PROJECT DESCRIPTION

G-P will be performing routine maintenance on the existing No. 4 Recovery Boiler (RB4) and the No. 4 Lime Kiln (LK4) at its kraft paper mill located in Palatka, Florida. These activities will take place in May, 1991, during a month-long shutdown. The work on RB4 and LK4 will entail routine maintenance, repair, and replacement of component parts of these air emission sources. The work is required to maintain the safe operation of these sources. Because of the nature of these repairs, G-P also will have the opportunity to implement certain enhancements to RB4 and LK4 to increase their efficiency. These enhancements potentially may allow these sources to increase the rate of throughput.

The specific activities to be conducted on RB4 are as follows:

1. The bottom of the recovery boiler is in poor condition, with significant corrosion of the boiler steam tubes in this area. Recent tube readings have indicated serious tube wastage, and over 50 percent of the tubes between the primary air ports and the smelt bed have been pad welded. The deterioration is such that there is now a safety problem. To alleviate this problem, the entire bottom of the furnace will be replaced. This must be performed in the very near future to rectify the safety problem.
2. The design of the replacement furnace bottom will be according to the manufacturer's current design standards. Therefore, the new furnace bottom will be installed with the primary, secondary, and tertiary air nozzles in a different configuration and of different sizes. The current furnace has one forced-draft fan that supplies air to all levels in the furnace. The proposed changes will include addition of a tertiary forced-draft fan.
3. Routine maintenance of the electrostatic precipitator (ESP) serving RB4 will be performed.

The current capacity of RB4 is 189,00 lb/hr of black liquor solids (BLS). As a result of the proposed maintenance work, the maximum BLS-burning

capacity of the boiler may increase to 210,000 lb/hr. The boiler vendor has not guaranteed a BLS burning rate higher than the 189,000 lb/hr now permitted; however, G-P believes a higher throughput rate may be achievable.

No physical modification to the No. 4 Smelt Dissolving Tank (SDT4) or its air pollution control equipment will be performed as part of this project. The smelt tank presently is capable of accommodating the increased smelt throughput.

The specific activities performed on LK4 will consist of the following:

1. The ploughs in the kiln will be changed out. The existing plows are worn as a result of the abrasion of the lime mud.
2. A new dam will be installed in the kiln.

It is anticipated that the repairs to LK4 may allow an increase in the throughput of the kiln. However, the maximum throughput will not exceed the current maximum input capacity of 41.49 tons per hour (TPH). No changes to the air pollution control equipment for the lime kiln will be made as part of this project.

A comparison of the current and future permitted operating rates and emission rates for the three affected sources is presented in Table 2-1. In the case of RB4, the permitted PM emissions are actually being reduced from 189.0 lb/hr to 110.9 lb/hr, and permitted sulfur dioxide (SO<sub>2</sub>) emissions will decrease from 1,375.8 tons per year (TPY) to 962.3 TPY. Permitted total reduced sulfur (TRS) emissions will increase from 21.6 lb/hr to 27.2 lb/hr.

For SDT4, permitted PM, SO<sub>2</sub>, and TRS emissions will increase slightly. For LK4, the permitted PM emission rate will not change, while permitted SO<sub>2</sub> and TRS emissions will change slightly.

Table 2-1. Comparison of Current and Proposed Operating Rates for RB4, SDT4, and LK4.

Parameter	RB4		SDT4		LK4	
	Current	Proposed	Current	Proposed	Current	Proposed
Maximum operating rate	189,000 lb/hr BLS	210,000 lb/hr BLS	77,280 lb/hr smelt	85,890 lb/hr smelt	41.49 TPH input	41.49 TPH input
Maximum emissions:						
Particulate matter (TSP)						
(lb/hr)	189.0	110.9	31.1	31.6	31.4	31.4
(TPY)	825.6	485.7 364.4	135.7	138.4 55.2	137.2	137.2 99.9
Sulfur dioxide (lb/hr)	315.0	219.7 *	6.1	6.9	11.5	10.9
(TPY)	1,375.8	962.3	26.8	30.2	50.4	47.9
Total reduced sulfur						
(ppm)	17.5	17.5	-	-	20.0	20.0
(lb/hr)	21.6	27.2	3.0	3.4	3.0	4.0
(TPY)	94.1	119.1	13.2	14.7	13.0	17.5

\*Annual average basis.

*not to accept TRS uncontrolled emissions for credit; but, from actual hrs. x existing permitted rate (17.5 ppm)*

Current actual emissions of all regulated pollutants from the three affected sources are presented in Table 2-2. The basis for the actual emissions is presented in Appendix A. Anticipated future maximum emissions for all regulated pollutants are summarized in Table 2-3. The basis for the maximum emissions is presented in Appendix B.

A site location map of the G-P mill is shown in Figure 2-1. A plot plan showing the location of the air emission sources is presented in Figure 2-2.

The other air emission sources at Georgia-Pacific will not be affected by the proposed project. These consist of the batch digester system, multiple effect evaporators, condensate stripper system, No. 4 Power Boiler, No. 5 Power Boiler, No. 4 Combination Boiler, the tall oil system, and the TRS incinerator. Currently, the No. 4 Recovery Boiler cannot handle all the black liquor produced by the digester system and the evaporator system. Black liquor is now sold and transported off-site. Therefore, increased recovery boiler operation will not affect digester system operation and will only decrease the amount of black liquor sold off-site. Operation of the multiple effect evaporators, condensate stripper system, tall oil system, and TRS incinerator are dependent on the batch digester system, and therefore will not be affected.

In a similar manner, the current No. 4 Lime Kiln operation is not sufficient to supply the batch digesters with enough white liquor. White liquor is artificially produced by G-P to make up the difference between lime kiln output and batch digester needs. As a result, increased lime production by the No. 4 Lime Kiln will not affect batch digester operation and will only decrease the amount of artificial white liquor produced and used at the mill.

Currently, the batch digester system operation is dependent on market conditions and the design capacity of the digesters. Operation is not



Table 2-2. Estimated Current Actual Emissions from No. 4 Recovery Boiler, No. 4 Smelt Dissolving Tank, and No. 4 Lime Kiln

Regulated Pollutant	Current Actual Emissions <sup>a</sup> (TPY)			
	No. 4 RB	No. 4 SDT	No. 4 LK	Totals
Particulate [PM(TSP)]	169.4	34.7	92.5	296.6 vs 519.5 net: 222.9
Particulate (PM10)	127.1	31.1	90.9	249.1
Sulfur Dioxide	64.9	24.5	36.0	125.4
Nitrogen Oxides	477.9	-	148.4	626.3
Carbon Monoxide	2,086.1	-	24.0	2,110.1
Volatile Organic Compounds	194.4	-	52.1	246.5
Lead	0.19	-	-	0.19
Mercury	-	-	-	-
Beryllium	0.00012	-	-	0.00012
Fluorides,	-	-	-	-
Sulfuric Acid Mist	12.8	-	-	12.8
Total Reduced Sulfur	8.3	5.3	3.6	17.2
Asbestos	-	-	-	-
Vinyl Chloride	-	-	-	-

Note: LK = Lime Kiln  
 PM10 = Particulate matter with aerodynamic diameter of 10 μm or less  
 PM(TSP) = total suspended particulate matter  
 RB = Recovery Boiler  
 SDT = Smelt Dissolving Tank  
 TPY = tons per year

<sup>a</sup>Based on average 1989-1990 operating data.

Table 2-3. Future Maximum Emissions, Georgia-Pacific Corporation

Regulated Pollutant	Future Maximum Emissions (TPY)						Totals (TPY)
	No. 4 RB		No. 4 SDT		No. 4 LK		
	(lb/hr)	(TPY)	(lb/hr)	(TPY)	(lb/hr)	(TPY)	
Particulate [PM(TSP)]	110.9	485.7	31.6	138.4	31.4	137.2	761.3
Particulate (PM10)	110.9	485.7	28.3	123.9	30.9	134.9	744.5
Sulfur Dioxide	219.7 *	962.3	6.9	30.2	10.9	47.9	1,040.4
Nitrogen Oxides	210.6 *	922.4	-	-	50.3	220.3	1,142.7
Carbon Monoxide	1,025.4	2,245.6	-	-	7.3	32.0	2,277.6
Volatile Organic Compounds	54.6	239.1	-	-	17.7	77.5	316.6
Lead	0.049	0.21	-	-	-	-	0.21
Mercury	-	-	-	-	-	-	-
Beryllium	0.000078	0.00034	-	-	-	-	0.00034
Fluorides	-	-	-	-	-	-	-
Sulfuric Acid Mist	3.24	14.2	-	-	-	-	14.2
Total Reduced Sulfur	27.2	119.1	3.4	14.7	4.0	17.5	151.3
Asbestos	-	-	-	-	-	-	-
Vinyl Chloride	-	-	-	-	-	-	-

Note: LK = Lime Kiln  
 PM10 = Particulate matter with aerodynamic diameter of 10  $\mu$ m or less  
 PM(TSP) = total suspended particulate matter  
 RB = Recovery Boiler  
 SDT = Smelt Dissolving Tank  
 TPY = tons per year

\*Annual average basis.

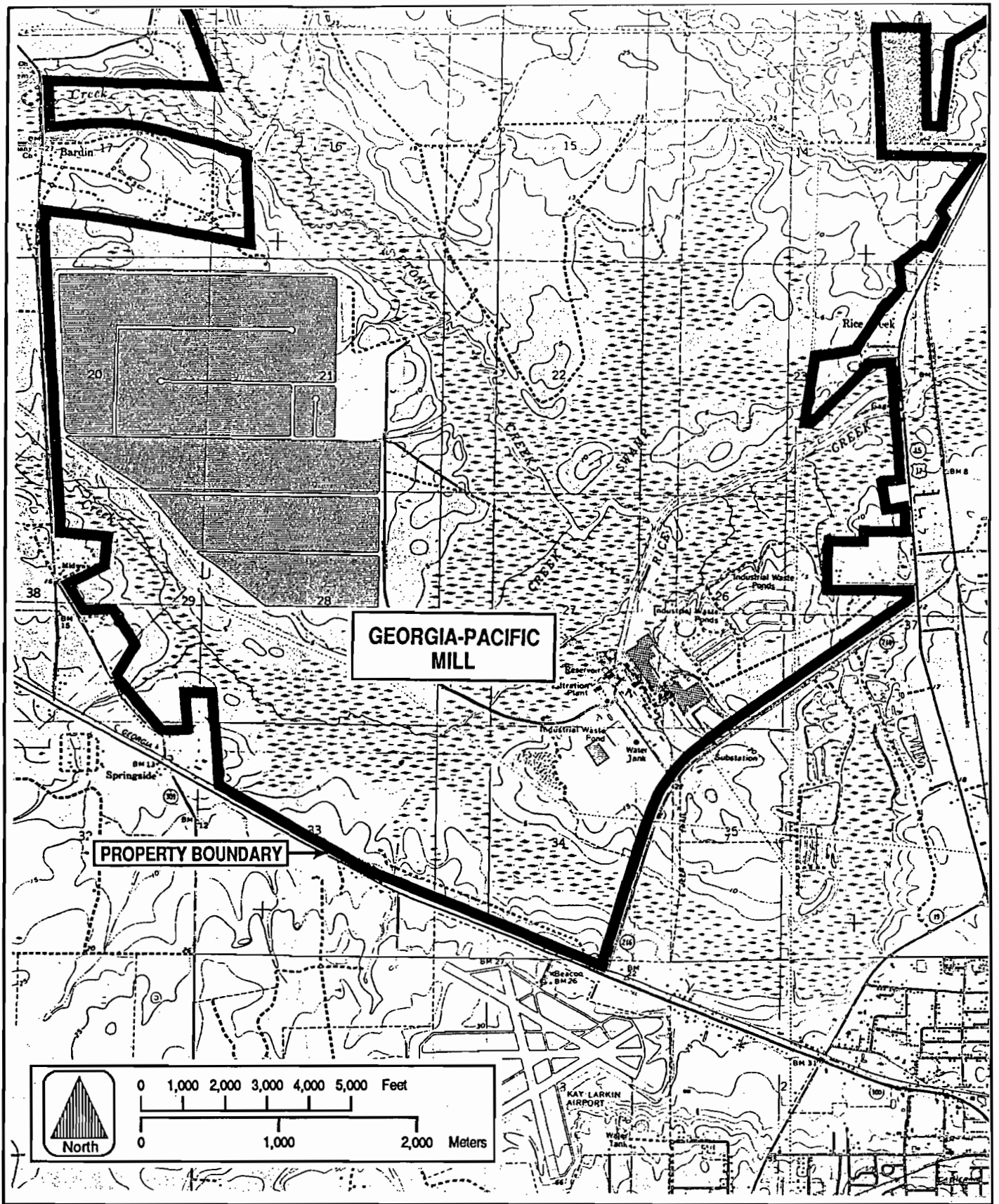


Figure 2-1 LOCATION OF THE GEORGIA-PACIFIC FACILITY, PALATKA, FLORIDA



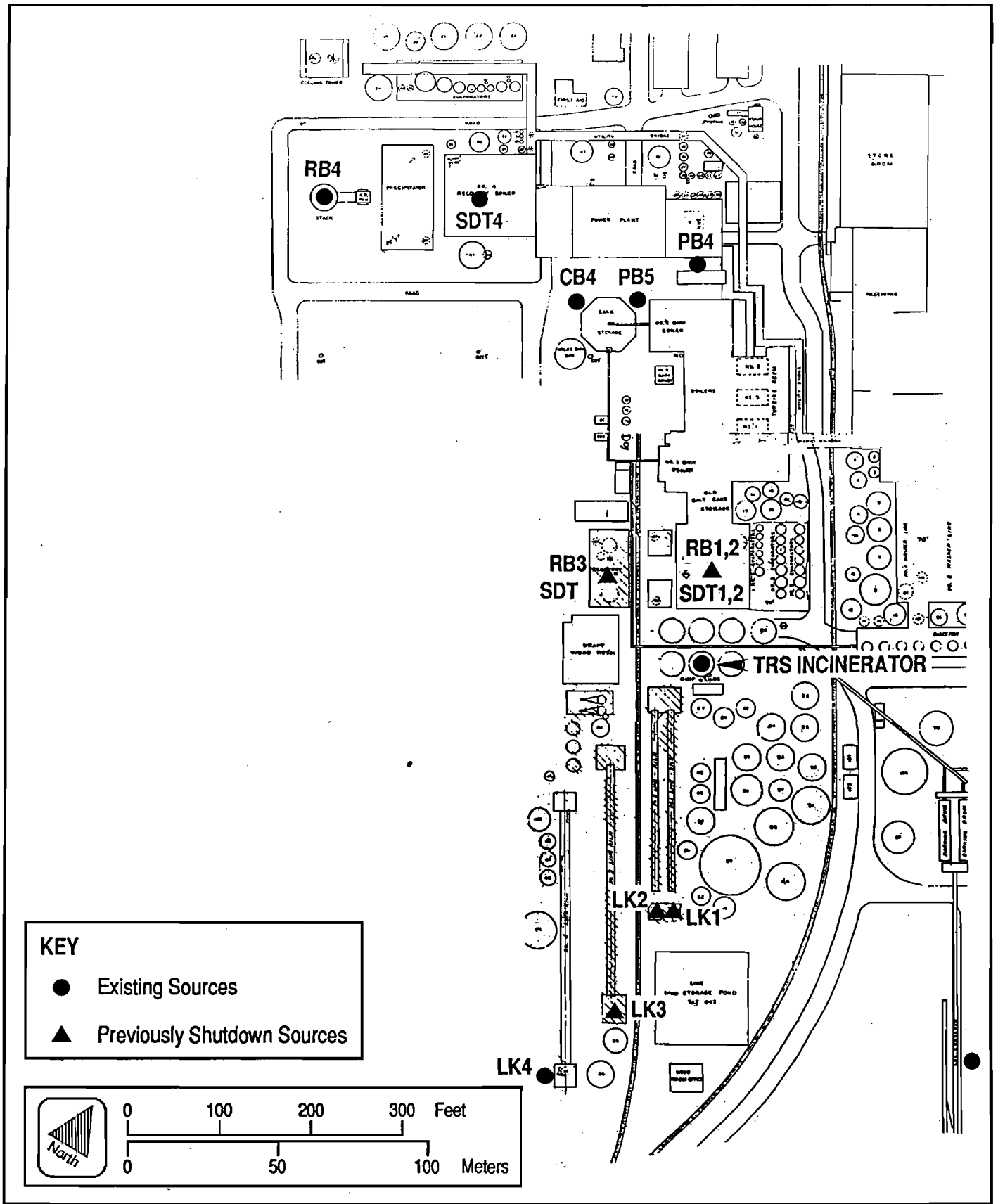


Figure 2-2 LOCATIONS OF THE SOURCES AND BUILDINGS AT THE GEORGIA-PACIFIC FACILITY



dependent on the recovery boiler or the lime kiln. As a result, the batch digesters and multiple effect evaporators will not be affected by the proposed project.

The power boilers and combination boiler operation will not be affected by the proposed project. These boilers provide steam to support the pulping process. Increased recovery boiler operation actually will translate to more steam generated by the recovery boiler, and may therefore result in reduced operation of the other on-site, steam-generating units.

### 3.0 AIR QUALITY REVIEW REQUIREMENTS AND APPLICABILITY

The following discussion pertains to the federal and state air regulatory requirements and their applicability to G-P's proposed modifications. These requirements must be satisfied before construction can begin on the proposed project.

#### 3.1 NATIONAL AND STATE AAQS

The existing applicable national and Florida ambient air quality standards (AAQS) are presented in Table 3-1. National primary AAQS were promulgated to protect the public health, and national secondary AAQS were promulgated to protect the public welfare from any known or anticipated adverse effects associated with the presence of pollutants in the ambient air. Areas of the country in violation of AAQS are designated as nonattainment areas, and new sources to be located in or near these areas may be subject to more stringent air permitting requirements.

#### 3.2 PSD REQUIREMENTS

##### 3.2.1 GENERAL REQUIREMENTS

Federal PSD requirements are contained in the Code of Federal Regulations (CFR), Part 40, Section 52.21, prevention of significant deterioration (PSD) of air quality. The State of Florida has adopted PSD regulations [Chapter 17-2.510, Florida Administrative Code (F.A.C.)] that essentially are identical to the federal regulations. PSD regulations require that all new major stationary sources or major modifications to existing major sources of air pollutants regulated under CAA be reviewed and a construction permit issued. Florida's State Implementation Plan (SIP), which contains PSD regulations, has been approved by the U.S. Environmental Protection Agency (EPA), and PSD approval authority in Florida has been granted to FDER.

A "major facility" is defined under Florida PSD regulations as any one of 28 named source categories that has the potential to emit 100 tons per year

Table 3-1. National and State AAQS, Allowable PSD Increments, and Significance Levels (  $\mu\text{g}/\text{m}^3$  )

Pollutant	Averaging Time	AAQS			PSD Increments		Significant Impact Levels
		National		State of Florida	Class I	Class II	
		Primary Standard	Secondary Standard				
Particulate Matter (TSP)	Annual Geometric Mean	NA	NA	NA	5	19	1
	24-Hour Maximum <sup>a</sup>	NA	NA	NA	10	37	5
Particulate Matter (PM10)	Annual Arithmetic Mean	50	50	50	4 <sup>c</sup>	17 <sup>c</sup>	1
	24-Hour Maximum <sup>b</sup>	150	150	150	8 <sup>c</sup>	30 <sup>c</sup>	5
Sulfur Dioxide	Annual Arithmetic Mean	80	NA	60	2	20	1
	24-Hour Maximum <sup>b</sup>	365	NA	260	5	91	5
	3-Hour Maximum <sup>b</sup>	NA	1,300	1,300	25	512	25
Carbon Monoxide	8-Hour Maximum <sup>b</sup>	10,000	10,000	10,000	NA	NA	500
	1-Hour Maximum <sup>b</sup>	40,000	40,000	40,000	NA	NA	2,000
Nitrogen Dioxide	Annual Arithmetic Mean	100	100	100	2.5	25	1
Ozone	1-Hour Maximum <sup>d</sup>	235	235	235	NA	NA	NA
Lead	Calendar Quarter Arithmetic Mean	1.5	1.5	15	NA	NA	NA

<sup>a</sup>Maximum concentration not to be exceeded more than once per year.

<sup>b</sup>Achieved when the expected number of exceedances per year is less than 1.

<sup>c</sup>Proposed by EPA in the Federal Register on October 5, 1989.

<sup>d</sup>Achieved when the expected number of days per year with concentrations above the standard is less than 1.

Note: Particulate matter (TSP) = total suspended particulate matter.

Particulate matter (PM10) = particulate matter with aerodynamic diameter less than or equal to 10 micrometers.

$\mu\text{g}/\text{m}^3$  = micrograms per cubic meter.

NA = Not applicable, i.e., no standard exists.

Sources: Federal Register, Vol. 43, No. 118, June 19, 1978.

40 CFR 50.

40 CFR 52.21.

Chapter 17-2.400, F.A.C.

(TPY) or more of any pollutant regulated under the CAA, or any other stationary facility that has the potential to emit 250 TPY or more of any pollutant regulated under the CAA. A "source" is defined as an identifiable piece of process equipment or emissions unit. "Potential to emit" means the capability, at maximum design capacity, to emit a pollutant, considering the application of control equipment and any other federally enforceable limitations on the source's capacity. A "major modification" is defined under PSD regulations as a change at an existing major stationary facility that increases emissions by greater than significant amounts. PSD significant emission rates are shown in Table 3-2.

PSD review is used to determine whether significant air quality deterioration will result from the new or modified facility. Major new facilities and major modifications are required to undergo the following analyses related to PSD for each pollutant emitted in significant amounts:

1. Source information,
2. Control technology review,
3. Source impact analysis,
4. Preconstruction air quality monitoring analysis, and
5. Additional impact analyses.

In addition to these analyses, a new source also must be reviewed with respect to good engineering practices (GEP) stack height regulations. If the proposed new source or modification is located in a nonattainment area for any pollutant, the source may be subject to nonattainment new source review requirements.

Discussions concerning each of these requirements are presented in the following sections.



Table 3-2. PSD Significant Emission Rates and De Minimis Monitoring Concentrations

Pollutant	Regulated Under	Significant Emission Rate (TPY)	<u>De Minimis</u> Monitoring Concentration ( $\mu\text{g}/\text{m}^3$ )
Sulfur Dioxide	NAAQS, NSPS	40	13, 24-hour
Particulate Matter (TSP)	NAAQS, NSPS	25	10, 24-hour
Particulate Matter (PM10)	NAAQS	15	10, 24-hour
Nitrogen Oxides	NAAQS, NSPS	40	14, annual
Carbon Monoxide	NAAQS, NSPS	100	575, 8-hour
Volatile Organic Compounds (Ozone)	NAAQS, NSPS	40	100 TPY <sup>a</sup>
Lead	NAAQS	0.6	0.1, 3-month
Sulfuric Acid Mist	NSPS	7	NM
Total Fluorides	NSPS	3	0.25, 24-hour
Total Reduced Sulfur	NSPS	10	10, 1-hour
Reduced Sulfur Compounds	NSPS	10	10, 1-hour
Hydrogen Sulfide	NSPS	10	0.2, 1-hour
Asbestos	NESHAP	0.007	NM
Beryllium	NESHAP	0.0004	0.001, 24-hour
Mercury	NESHAP	0.1	0.25, 24-hour
Vinyl Chloride	NESHAP	1	15, 24-hour

<sup>a</sup>No de minimis concentration; an increase in VOC emissions of 100 TPY or more will require monitoring analysis for ozone.

<sup>b</sup>Any emission rate of these pollutants.

Note: Ambient monitoring requirements for any pollutant may be exempted if the impact of the increase in emissions is below de minimis monitoring concentrations.

- NAAQS = National Ambient Air Quality Standards.
- NM = No ambient measurement method.
- NSPS = New Source Performance Standards.
- NESHAP = National Emission Standards for Hazardous Air Pollutants.
- $\mu\text{g}/\text{m}^3$  = micrograms per cubic meter.

Source: F.A.C., Rule 17-2.510, Table 500-2.

### 3.2.2 INCREMENTS/CLASSIFICATIONS

The 1977 CAA amendments address the prevention of significant deterioration of air quality. The law specifies that certain increases in air quality concentrations above the baseline concentration level of SO<sub>2</sub> and PM(TSP) would constitute significant deterioration. The magnitude of the allowable increment depends on the classification of the area in which a new source (or modification) will be located or will have an impact. Congress also directed EPA to evaluate PSD increments for other criteria pollutants and, if appropriate, to promulgate PSD increments for such pollutants.

Three classifications were designated, based on criteria established in the CAA amendments. Certain types of areas (international parks, national wilderness areas, memorial parks larger than 5,000 acres, and national parks larger than 6,000 acres) were designated as Class I areas. All other areas of the country were designated as Class II. PSD increments for Class III areas were defined, but no areas were designated as Class III. However, Congress made provisions in the law to allow the redesignation of Class II areas to Class III areas.

In 1978, EPA promulgated PSD regulations related to the requirements for classifications, increments, and area designations as set forth by Congress. PSD increments were initially set for only SO<sub>2</sub> and PM(TSP). However, in 1988, EPA promulgated final PSD regulations for NO<sub>x</sub> and established PSD increments for nitrogen dioxide (NO<sub>2</sub>).

The current federal PSD increments are shown in Table 3-1. As shown, Class I increments are the most stringent, allowing the smallest amount of air quality deterioration, while the Class III increments allow the greatest amount of deterioration. FDER has adopted the EPA class designations and allowable PSD increments for PM(TSP), SO<sub>2</sub>, and NO<sub>2</sub>. The Florida NO<sub>2</sub> increments were adopted in August 1990.

On October 5, 1989, EPA proposed PSD increments for PM<sub>10</sub>. Those proposed increments are shown in Table 3-1. The PM<sub>10</sub> increments as proposed are somewhat lower in magnitude than the current PM(TSP) increments.

The term "baseline concentration" evolves from federal and state PSD regulations and refers to a fictitious concentration level corresponding to a specified baseline date and certain additional baseline sources. In reference to the baseline concentration, the baseline date actually includes three different dates:

1. The major source baseline date, which is January 6, 1975, in the cases of SO<sub>2</sub> and PM(TSP), and February 8, 1988, in the case of NO<sub>2</sub>;
2. The minor source baseline date, which is the earliest date after the trigger date on which a major stationary source or major modification subject to PSD regulations submits a complete PSD application; and
3. The trigger date, which is August 7, 1977, for SO<sub>2</sub> and PM(TSP), and February 8, 1988, for NO<sub>2</sub>.

By definition in the PSD regulations, baseline concentration means the ambient concentration level that exists in the baseline area at the time of the applicable baseline date. A baseline concentration is determined for each pollutant for which a baseline date is established and includes:

1. The actual emissions representative of sources in existence on the applicable minor source baseline date; and
2. The allowable emissions of major stationary facilities that began construction before January 6, 1975, for SO<sub>2</sub> and PM(TSP) sources, or February 8, 1988, for NO<sub>x</sub> sources, but which were not in operation by the applicable baseline date.

The following emissions are not included in the baseline concentration and, therefore, affect PSD increment consumption:

1. Actual emissions representative of a major stationary source on which construction began after January 6, 1975, for SO<sub>2</sub> and PM(TSP) sources, and after February 8, 1988, for NO<sub>x</sub> sources; and
2. Actual emission increases and decreases at any stationary facility occurring after the major source baseline date that result from a physical change or change in the method of operation of the facility.

The minor source baseline date for SO<sub>2</sub> and PM(TSP) has been set as December 27, 1977, for the entire State of Florida (Chapter 17-2.450, F.A.C.). The minor source baseline date for NO<sub>2</sub> has been set as March 28, 1988, for all of Florida.

### 3.2.3 CONTROL TECHNOLOGY REVIEW

The control technology review requirements of the federal and state PSD regulations require that all applicable federal and state emission-limiting standards be met, and that BACT be applied to control emissions from the source [Chapter 17-2.500(5)(c), F.A.C]. The BACT requirements are applicable to all regulated pollutants for which the increase in emissions from the facility or modification exceeds the significant emission rate (see Table 3-2).

BACT is defined in Chapter 17-2.100(25), F.A.C. as:

An emissions limitation, including a visible emission standard, based on the maximum degree of reduction of each pollutant emitted which the department, on a case by case basis, taking into account energy, environmental, and economic impacts, and other costs, determines is achievable through application of production processes and available methods, systems, and techniques (including fuel cleaning or treatment or innovative fuel combustion techniques) for control of such pollutant. If the Department determines that technological or economic limitations on the application of measurement methodology to a particular part of a source or facility would make the imposition of an emission standard infeasible, a design, equipment, work practice, operational standard or combination thereof, may be prescribed instead to satisfy the requirement for the application of BACT. Such standard shall, to the degree possible, set forth

the emissions reductions achievable by implementation of such design, equipment, work practice, or operation.

The requirements for BACT were promulgated within the framework of PSD in the 1977 amendments of the 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 EPA's Guidelines for Determining Best Available Control Technology (BACT) (EPA, 1978) and in the PSD Workshop Manual (EPA, 1980). These guidelines were promulgated by EPA 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 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 proposed facility. BACT must, as a minimum, demonstrate compliance with 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).

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.

Under the current top-down BACT approach, the analysis starts with the most stringent (or top) technology and emissions limits that have been applied elsewhere to the same or a similar source category. The applicant must next provide a basis for rejecting this technology in favor of the next most stringent technology or propose to use it. Rejection of control alternatives may be based on technical or economic infeasibility. Such decisions are made on the basis of physical differences (e.g., fuel type), locational differences (e.g., availability of water), or significant differences that may exist in the environmental, economic, or energy impacts. The differences between the proposed facility and the facility on which the control technique was applied previously must be justified.

Recently, EPA issued a draft guidance document on the top-down approach entitled Top-Down Best Available Control Technology Guidance Document (EPA, 1990a). However, the validity of all BACT guidance currently is the subject of litigation and could lead to changes in regulatory interpretations. Nonetheless, in preparing the PSD permit application for G-P, the top-down approach was used.

#### 3.2.4 AIR QUALITY MONITORING REQUIREMENTS

In accordance with requirements of 40 CFR 52.21(m) and Chapter 17-2.500(f), F.A.C, any application for a PSD permit must contain an analysis of continuous ambient air quality data in the area affected by the proposed major stationary facility or major modification. For a new major facility, the affected pollutants are those that the facility potentially would emit in significant amounts. For a major modification, the pollutants are those for which the net emissions increase exceeds the significant emission rate (see Table 3-2).

Ambient air monitoring for a period of up to 1 year is generally appropriate to satisfy the PSD monitoring requirements. A minimum of 4 months of data is required. Existing data from the vicinity of the proposed source may be used if the data meet certain quality assurance requirements; otherwise, additional data may need to be gathered. Guidance in designing a PSD monitoring network is provided in EPA's Ambient Monitoring Guidelines for Prevention of Significant Deterioration (EPA, 1987a).

Under the exemption rule, FDER may exempt a proposed major stationary facility or major modification from the monitoring requirements with respect to a particular pollutant if the emissions increase of the pollutant from the facility or modification would cause, in any area, air quality impacts less than the de minimis levels presented in Table 3-2 [Chapter 17-2.500(3)(e), F.A.C.].

#### 3.2.5 SOURCE IMPACT ANALYSIS

A source impact analysis must be performed for a proposed major source subject to PSD for each pollutant for which the increase in emissions exceeds the significant emission rate (Table 3-2). 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 AAQS and allowable PSD increments.

Designated EPA models normally must be used in performing the impact analysis. Specific applications for other than EPA-approved models require EPA's consultation and prior approval. Guidance for the use and application of dispersion models is presented in the EPA publication, Guideline on Air Quality Models (EPA, 1987b). The source impact analysis for criteria pollutants can be limited to the new or modified source if the net increase in impacts as a result of the new or modified source is below significance levels, as presented in Table 3-1.

Various lengths of record for meteorological data can be used for impact analyses. A 5-year period can be used with corresponding evaluation of highest, second-highest short-term concentrations for comparison to AAQS or PSD increments. The term "highest, second-highest" (HSH) refers to the highest of the second-highest concentrations at all receptors (i.e., the highest concentration at each receptor is discarded). The second-highest concentration is significant because short-term AAQS specify that the standard should not be exceeded at any location more than once a year. If less than 5 years of meteorological data are used in the modeling analysis, the highest concentration at each receptor normally must be used for comparison to air quality standards.

#### 3.2.6 ADDITIONAL IMPACT ANALYSES

In addition to air quality impact analyses, federal and State of Florida PSD regulations require analysis of the impairment to visibility and the impacts on soils and vegetation that would occur as a result of the proposed source [40 CFR 52.21; Chapter 17-2.500(5)(e), F.A.C.]. These analyses are to be conducted primarily for PSD Class I areas. Impacts from general commercial, residential, industrial, and other growth associated with the source also must be addressed. These analyses are required for each pollutant emitted in significant amounts (Table 3-2).



### 3.2.7 GOOD ENGINEERING PRACTICE STACK HEIGHT

The 1977 CAA amendments require that the degree of emission limitation required for control of any pollutant not be affected by a stack height that exceeds GEP or any other dispersion technique. On July 8, 1985, EPA promulgated final stack height regulations (EPA, 1985b). Identical regulations have been adopted by FDER [Chapter 17-2.270, F.A.C.]. GEP stack height is defined as the highest of:

1. 65 meters (m); or
2. A height established by applying the formula:

$$H_g = H + 1.5L$$

where:  $H_g$  = GEP stack height,

$H$  = Height of the structure or nearby structure, and

$L$  = Lesser dimension (height or projected width) of nearby structure(s); or

3. A height demonstrated by a fluid model or field study.

"Nearby" is defined as a distance up to five times the lesser of the height or width dimensions of a structure or terrain feature but not greater than 0.8 kilometers (km). Although GEP stack height regulations require that the stack height used in modeling for determining compliance with AAQS and PSD increments not exceed the GEP stack height, the actual stack height may be greater.

The stack height regulations also allow increased GEP stack height beyond that resulting from the formula in cases where plume impaction occurs. Plume impaction is defined as concentrations measured or predicted to occur when the plume interacts with elevated terrain. Elevated terrain is defined as terrain that exceeds the height calculated by the GEP stack height formula. Because the terrain in the vicinity of the G-P paper mill is generally flat, plume impaction was not considered in determining the GEP stack height.

### 3.3 NONATTAINMENT RULES

Based on the current nonattainment provisions (Chapter 17-2.510, F.A.C.), all major new facilities and modifications to existing major facilities located in a nonattainment area must undergo nonattainment review if the proposed pieces of equipment have the potential to emit 100 TPY or more of the nonattainment pollutant, or if the modification results in a significant net emission increase of the nonattainment pollutant.

For major facilities or major modifications that locate in an attainment or unclassifiable area, the nonattainment review procedures apply if the source or modification is located within the area of influence of a nonattainment area. The area of influence is defined as an area that is outside the boundary of a nonattainment area but within the locus of all points that are 50 km outside the boundary of the nonattainment area. Based on Chapter 17-2.510(2)(a)2.a, F.A.C., all VOC sources that are located within an area of influence are exempt from the provisions of new source review for nonattainment areas. Sources that emit other nonattainment pollutants and are located within the area of influence are subject to nonattainment review unless the maximum allowable emissions from the proposed source do not have a significant impact within the nonattainment area.

### 3.4 SOURCE APPLICABILITY

#### 3.4.1 PSD REVIEW

##### 3.4.1.1 Pollutant Applicability

The G-P paper mill is located in Putnam County, which has been designated by EPA and FDER as an attainment area for all criteria pollutants. Putnam County and surrounding counties are designated as PSD Class II areas for SO<sub>2</sub>, PM(TSP), and NO<sub>2</sub>. The site is not located within 100 km of any PSD Class I area.

The G-P facility is considered to be an existing major stationary facility because potential emissions of certain regulated pollutants exceed 100 TPY.

As a result, PSD review is required for the proposed modification for each pollutant for which the net increase in emissions exceeds the PSD significant emission rates presented in Table 3-2 (i.e., a major modification).

According to FAC Rule 17-2.500(2)(e), the net increase in emissions is to be determined on the basis of changes in actual emissions. The calculated net change in actual annual emissions resulting from the proposed project is presented in Table 3-3. The basis for the calculations is presented in Appendix C. Compared to the PSD significant emission rates shown in Table 3-1, the following pollutants would be subject to PSD review: NO<sub>x</sub>, CO, and VOC.

Historically, FDER and EPA have required that current actual emissions be compared with future maximum emissions (not actual) to determine PSD source applicability. This analysis is also to consider any contemporaneous emission changes at the facility that occurred within the past 5 years. The PSD applicability analysis based on this method is presented in Table 3-4. Current actual emissions are shown, taken from Table 2-2 and Appendix A. Future maximum emissions are shown, taken from Table 2-3 and Appendix B. Also shown are two contemporaneous emission reductions.

In the case of TRS, there was a large decrease in mill-wide TRS emissions as a result of the TRS control project implemented at the mill. The reductions occurred in 1990. The decrease in emissions (1,823.8 TPY) was documented in the TRS permits issued in 1988.

In the case of SO<sub>2</sub> from RB4, G-P implemented changes in the boiler in May 1987 that resulted in a large decrease in SO<sub>2</sub> emissions. The creditable change in SO<sub>2</sub> emissions is based on the old level of actual emissions (971.1 TPY; refer to Appendix D) and the proposed future maximum limit of 962.3 TPY. This results in a net decrease in SO<sub>2</sub> emissions for RB4 of

Table 3-3. Summary of Calculated Net Actual Emissions Increases Per Rule 17-2.500(2)(e)

Regulated Pollutant	Changes in Actual Emissions (TPY)			Totals
	No. 4 RB	No. 4 SDT	No. 4 Lime Kiln	
Particulate (TSP)	0.0	7.8	0.0	7.8
Particulate (PM10)	0.0	7.0	0.0	7.0
Sulfur Dioxide	10.4	5.6	17.3	33.3
Nitrogen Oxides	110.2	--	72.0	182.2
Carbon Monoxide	238.0	--	11.5	249.5
Volatile Organic Compounds	44.9	--	25.3	70.2
Lead	0.02	--	--	0.02
Mercury	--	--	--	--
Beryllium	0.0	--	--	0.0
Flourides	--	--	--	--
Sulfuric Acid Mist	1.14	--	--	1.14
Total Reduced Sulfur	8.4	1.2	0.0	9.6
Asbestos	--	--	--	--
Vinyl Chloride	--	--	--	--

Table 3-4. Summary of Net Emissions Increase (Based on Future Maximum Emissions)\*

Regulated Pollutant	(A) Current Actual Emissions	(B) Future Maximum Emissions	(C) Contemporaneous Reductions <sup>b</sup>	Net Change (B-A+C)	PSD Significant Emission Rate (TPY)
Particulate [PM(TSP)]	296.6	761.3	-	464.7	25
Particulate (PM10)	249.1	744.5	-	495.4	15
Sulfur Dioxide					
RB4	<sup>b</sup>	962.3	-971.1 <sup>c</sup>	-8.8 <sup>b</sup>	
SDT4, LK4	60.5	<u>78.1</u>	-	<u>17.6</u>	
Total		1,040.4		8.8	40
Nitrogen Oxides	626.3	1,142.7	-	516.4	40
Carbon Monoxide	2,110.1	2,277.6	-	167.5	100
Volatile Organic Compounds	246.5	316.6	-	70.1	40
Lead	0.19	0.21	-	0.02	0.6
Mercury	-	-	-	-	0.1
Beryllium	0.00012	0.00034	-	0.00022	0.0004
Fluorides	-	-	-	-	3
Sulfuric Acid Mist	12.8	14.2	-	1.4	7
Total Reduced Sulfur	17.2	151.3	-1,823.8 <sup>d</sup>	-1,689.7	10
Asbestos	-	-	-	0.0	0.007
Vinyl Chloride	-	-	-	0.0	1

Note: All figures are in tons per year (TPY).

\* For No. 4 Recovery Boiler, No. 4 Smelt Dissolving Tank, and No. 4 Lime Kiln.

<sup>b</sup> Net increase in emissions for RB4 based on old level of actual emissions and new level of allowable emissions.

<sup>c</sup> Represents old level of actual emissions from No. 4 Recovery Boiler before May 1987.

<sup>d</sup> Based on AC54-142282; AC54-142283; AC54-142288; and AC54-142291.

RB4 = No. 4 Recovery Boiler  
SDT4 = No. 4 Smelt Dissolving Tank  
LK4 = No. 4 Lime Kiln  
PSD = prevention of significant deterioration  
PM10 = Particulate matter with aerodynamic diameter of 10 µm or less  
PM(TSP) = total suspended particulate matter

8.8 TPY. It is noted that the old level of actual emissions does not exceed the old level of allowable emissions that existed before 1987: 1,259.3 TPY, based on A054-54072, as amended on September 11, 1986. In addition, the decrease in SO<sub>2</sub> that occurred as a result of the change to RB4 has not been considered in any prior permitting or air quality impact analysis conducted for the mill. In the TRS permitting, the increase in SO<sub>2</sub> from the TRS incinerator was permitted and was evaluated for air quality impacts at that time.

As shown in Table 3-4, the increase in PM(TSP), PM10, NO<sub>x</sub>, CO, and VOC emissions, based on current actuals and future allowables, will exceed the PSD significant emission rate. Therefore, FDER/EPA may determine that the proposed project is subject to PSD review for these pollutants. For purposes of minimizing the permit review time by FDER, it will be assumed that the project is subject to PSD review for PM(TSP), PM10, NO<sub>x</sub>, CO, and VOC.

#### 3.4.1.2 Ambient Monitoring

Based upon the increase in emissions from G-P's proposed project, a PSD preconstruction ambient monitoring analysis is required for PM(TSP), PM10, NO<sub>x</sub>, CO, and VOC. However, if the increase in impacts of a pollutant is less than the de minimis monitoring concentration, then an exemption from the preconstruction ambient monitoring requirement may be granted for that pollutant. In addition, if an acceptable ambient monitoring method for the pollutant has not been established by EPA, monitoring is not required.

The air quality impact analysis presented in Section 5.0 demonstrates that the maximum impacts resulting from the net increase in emissions will be below the de minimis monitoring concentrations for PM(TSP), PM10, NO<sub>x</sub>, and CO. The predicted maximum impacts are compared to the de minimis concentrations in Section 4.0. In addition, the net increase in VOC emissions is less than 100 TPY and, therefore, ozone may be exempt from the preconstruction monitoring requirements.

#### 3.4.1.3 GEP Stack Height Analysis

The GEP stack height regulations allow any stack to be at least 65 m [213 (ft)] high. All sources being modified at G-P are existing sources, with existing stacks. None of these sources exceeds GEP stack height based on the significant structures at the facility.

#### 3.4.2 NONATTAINMENT REVIEW

The G-P mill is located in Putnam County, which has been designated as an attainment area for all pollutants. As a result, nonattainment review does not apply to the proposed project.

#### 3.4.3 NEW SOURCE PERFORMANCE STANDARDS

Federal New Source Performance Standards (NSPS) have been promulgated for recovery boilers, smelt tanks, and lime kilns in the pulp and paper industry (40 CFR 60, Subpart BB). In the case of modifications to existing sources, the NSPS apply if the sources would meet the definition of "modification" under Part 60. A modification is defined as any physical or operational change to the source that would result in an increase in the emission rate (in lb/hr) of any pollutant regulated under the applicable NSPS. Only PM and TRS are regulated under the NSPS for recovery boilers, lime kilns, and smelt tanks. However, the following by themselves are not considered modifications under this part:

1. Maintenance, repair, and replacement of component parts that are considered routine; and,
2. An increase in the production rate, if that increase can be accomplished without a capital expenditure.

Most of the changes being implemented by G-P will be routine maintenance, repair, and replacement. Some of the changes are not considered as normal or routine. However, the increase in production rate on RB4/SDT4 and on LK4 can be accomplished without a capital expenditure and, therefore, the NSPS do not apply. A "capital expenditure" is defined under NSPS as an expenditure for a physical or operational change that exceeds the product

of the "annual asset guideline repair allowance percentage" and the existing facility's basis, as specified in the latest IRS publications. The allowable percentage for a recovery boiler or a lime kiln is 10 percent. The cost of the changes being proposed by G-P falls well below the definition of capital expenditure.

G-P has determined the existing basis for RB4 to be \$16,797,849 (1987 dollars) and the basis for LK4 to be \$2,573,000 (1987 dollars). Therefore, a capital expenditure would be an expenditure in excess of \$1.67 million for RB4 and an expenditure in excess of \$257,000 for LK4.

The only nonroutine repair or replacement being performed on RB4 will be the addition of the new tertiary air fan and associated ductwork and the "tipping" of the induced draft fan. Tipping of the fan involves adding extra metal to the tips of the fan blades. These repairs will cost approximately \$100,000, which is well below the \$1.67 million dollar figure defining a capital expenditure.

The only nonroutine repair or replacement being performed on LK4 will be the new ploughs and new dam. These repairs will cost about \$80,000, which again is well below the \$257,000 defining a capital expenditure for LK4.



#### 4.0 AMBIENT MONITORING ANALYSIS

As described in Section 3.4.1.2, a PSD preconstruction monitoring analysis is required for applicable pollutants unless the net increase in emissions causes impacts less than the de minimis concentrations. Presented in Table 4-1 is the predicted increase in impacts for each applicable pollutant as a result of the proposed project. Also shown are the de minimis concentrations. As shown, the increase in impacts for PM(TSP), PM10, NO<sub>x</sub>, and CO are below the de minimis levels. As a result, these pollutants can be exempt from the PSD preconstruction monitoring requirements. The air impact analysis methodology and results are presented in Section 5.0.

Table 4-1. Predicted Maximum Increase in Impacts Compared to De Minimis Concentrations

Regulated Pollutant	Averaging Time	Maximum Impact <sup>a</sup> ( $\mu\text{g}/\text{m}^3$ )	<u>De Minimis</u> Concentration ( $\mu\text{g}/\text{m}^3$ )
PM(TSP)	24-Hour	9.9	10
PM10	24-Hour	<9.9	10
NO <sub>x</sub>	Annual Average	0.4	14
CO	8-Hour	8.2	575

<sup>a</sup>Based on net increase in emissions. Highest, second-highest concentrations are presented for short-term averaging times.

## 5.0 AIR QUALITY MODELING APPROACH

### 5.1 GENERAL MODELING APPROACH

The general modeling approach followed EPA and FDER modeling guidelines for determining compliance with AAQS and PSD increments. In general, when model predictions are used to determine compliance with AAQS and PSD increments, 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 concentrations for the G-P facility, the general modeling approach was divided into screening and refined phases to reduce the computation time required to perform the modeling analysis. The basic difference between the two phases was the receptor grid used in the analysis.

In general, concentrations for the screening phase were predicted using a coarse receptor grid and a 5-year meteorological record. After a final list of HSH short-term concentrations was developed, the refined phase of the analysis was conducted by predicting concentrations for a refined receptor grid centered on the receptor at which the HSH concentration was produced from the screening phase. The air dispersion model was executed for the meteorological periods during which both the highest and second-

highest concentrations were predicted to occur at that receptor, based on the screening phase results. This approach was used to ensure that valid HSH concentrations were obtained. More detailed descriptions of the emission inventory and receptor grids used in the screening and refined phases of the analysis are presented in the following sections.

## 5.2 MODEL SELECTION

The selection of an appropriate air dispersion model was based on the model's ability to simulate impacts in areas surrounding the G-P facility. Within 50.0 km of the mill, the terrain can be described as simple, i.e., flat to gently rolling. As defined in the EPA modeling guidelines, simple terrain is considered to be an area where the terrain features are all lower in elevation than the top of the stack(s) under evaluation. Therefore, a simple terrain model was selected to predict maximum ground-level concentrations.

The Industrial Source Complex ISC short-term (ISC) dispersion model (EPA, 1988a) was used to evaluate the pollutant emissions from G-P and other existing facilities. This model is contained in EPA's User's Network for Applied Modeling of Air Pollution (UNAMAP), Version 6 (EPA, 1988b). The ISC model is applicable to sources located in either flat or rolling terrain where terrain heights do not exceed stack heights.

The ISC model consists of two sets of computer codes which are used to calculate short- and long-term ground level concentrations. The main differences between the two codes are the input format of the meteorological data and the method of estimating the plume's horizontal dispersion.

The first model code, the ISC Short-Term (ISCST) model, is designed to calculate hourly concentrations based on hourly meteorological parameters (i.e., wind direction, wind speed, atmospheric stability, ambient temperature, and mixing heights). The hourly concentrations are processed

into non-overlapping, short-term and annual averaging periods. For example, a 24-hour average concentration is based on 24 1-hour averages calculated from midnight to midnight of each day. For each short-term averaging period selected, the highest and second-highest average concentrations are calculated for each receptor. As an option, a table of the 50 highest concentrations over the entire field of receptors can be produced.

The second model code within the ISC model is the ISC Long-Term (ISCLT) model. The ISCLT model uses joint frequencies of wind direction, wind speed, and atmospheric stability to calculate seasonal and/or annual average ground-level concentrations. Because the input wind directions are for 16 sectors, with each sector defined as 22.5 degrees, the model calculates concentrations by assuming that the pollutant is uniformly distributed in the horizontal plane within a 22.5-degree sector.

In this analysis, the ISCST model was used to calculate both short-term and annual average concentrations because these concentrations are readily obtainable from the model output. In general, the ISCST model will produce higher annual average concentrations as compared to the ISCLT model.

Major features of the ISCST model are presented in Table 5-1. Concentrations due to stack and volume sources are calculated by the ISCST model using the steady-state Gaussian plume equation for a continuous source. The area source equation in the ISCST model is based on the equation for a continuous and finite crosswind line source. The ISC model has rural and urban options which affect the wind speed profile exponent law, dispersion rates, and mixing-height formulations used in calculating ground level concentrations. The criteria used to determine when the rural or urban mode is appropriate are based on land use near the proposed plant's surroundings (Auer, 1978). If the land use is classified as heavy industrial, light-moderate industrial, commercial, or compact residential for more than 50 percent of the area within a 3-km radius circle centered

Table 5-1. Major Features of the ISCLT Model

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ISCLT Model Features
<ul style="list-style-type: none"><li>• Polar or Cartesian coordinate systems for receptor locations</li><li>• Rural or one of three urban options that affect windspeed profile exponent, dispersion rates, and mixing height calculations</li><li>• Plume rise as a result of momentum and buoyancy as a function of downwind distance for stack emissions (Briggs, 1969, 1971, 1972, and 1975)</li><li>• Procedures suggested by Huber and Snyder (1976), Huber (1977), Schulmann and Hanna (1986), and Schulmann and Scire (1980) for evaluating building downwash and wake effects</li><li>• Procedures suggested by Briggs (1974) for evaluating stack-tip downwash</li><li>• Separation of multiple point sources</li><li>• Consideration of the effects of gravitational settling and dry deposition on ambient particulate concentrations</li><li>• Capability of simulating point, line, volume, and area sources</li><li>• Capability to calculate dry deposition</li><li>• Variation of windspeed with height (windspeed-profile exponent law)</li><li>• Concentration estimates for annual average</li><li>• Terrain-adjustment procedures for elevated terrain including a terrain truncation algorithm</li><li>• Receptors located above local terrain (i.e., "flagpole" receptors)</li><li>• Consideration of time-dependent exponential decay of pollutants</li><li>• The method of Pasquill (1976) to account for buoyancy-induced dispersion</li><li>• A regulatory default option to set various model options and parameters to EPA recommended values (see text for regulatory options used)</li></ul>

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Source: EPA, 1988a.

on the proposed source, the urban option should be selected. Otherwise, the rural option is more appropriate.

For modeling analyses that will undergo regulatory review, such as PSD permit applications, the following model features are recommended by EPA (1987b) and are referred to as the regulatory options in the ISCST model:

1. Final plume rise at all receptor locations,
2. Stack-tip downwash,
3. Buoyancy-induced dispersion,
4. Default wind speed profile coefficients for rural or urban option,
5. Default vertical potential temperature gradients,
6. Calm wind processing, and
7. Reducing calculated SO<sub>2</sub> concentrations in urban areas by using a decay half-life of 4 hours (i.e., reduce the SO<sub>2</sub> concentration emitted by 50 percent for every 4 hours of plume travel time).

In this analysis, the EPA regulatory options were used to address maximum impacts. Based on a review of the land use around G-P, the rural mode was selected based on the degree of residential, industrial, and commercial development within 3 km of the site.

### 5.3 METEOROLOGICAL DATA

Meteorological data used in the ISCST model to determine air quality impacts consisted of a concurrent 5-year period of hourly surface weather observations and twice-daily upper air soundings from the National Weather Service (NWS) stations at Jacksonville International Airport. The 5-year period of meteorological data was from 1983 through 1987. The NWS station at Jacksonville, located approximately 94 km due north of the G-P site, was selected for use in the study because it is the closest primary weather station to the study area which is representative of the plant site.

The surface observations included 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).

The hourly surface data and mixing heights were used to develop a sequential series of hourly meteorological data (i.e., wind direction, wind speed, temperature, stability, and mixing heights). Because the observed hourly wind directions were classified into one of thirty-six 10-degree sectors, the wind directions were randomized within each sector to account for the expected variability in air flow. These calculations were performed by using the EPA RAMMET meteorological preprocessor program.

#### 5.4 BUILDING DOWNWASH CONSIDERATIONS

Many of the sources at G-P have stack heights below Good Engineering Practice. Therefore, according to EPA modeling guidelines, the potential effects of building downwash must be addressed in the modeling analysis. The potential for building downwash was evaluated for all source/structure combinations at the G-P facility. Those structures found to potentially cause downwash are presented in Table 5-2. A plot plan showing building and stack locations was presented in Figure 2-2.

#### 5.5 SIGNIFICANT IMPACT ANALYSIS

##### 5.5.1 METHODOLOGY

The proposed changes to RB4, LK4, and SDT4 will result in an emission increase above significant emission levels for PM(TSP), PM10, NO<sub>x</sub>, and CO (refer to Table 3-4). Proposed increases in SO<sub>2</sub> emissions are below



Table 5-2. Structure Dimensions Used in the Modeling Analysis

Structure	<u>Actual Building Dimensions (m)</u>			<u>Modeled Building Dimensions (m)</u>	
	Height	Length	Width	Height	Projected Width
RB4 Preciptator	25.8	36.0	17.8	25.8	40.2
RB4 Boiler Building	59.7	30.4	28.0	59.7	41.3
Power Plant Building	33.5	43.9	24.6	33.5	50.3
No. 4 Turbine Building	19.3	27.4	27.4	19.3	38.8

significant emission rates and are not required to be addressed in this analysis.

Modeling was performed for applicable pollutants to determine if the proposed increase in emissions results in impacts greater than significant impact levels (Table 3-1). For those pollutants that are shown not to exceed significant impact levels, no further modeling is required. For those pollutants for which predicted concentrations exceed these impact levels, further modeling is required to determine the significant impact area and compliance with AAQS and PSD increments.

#### 5.5.2 SOURCE INVENTORY

The source inventory used in the significant impact analysis is presented in Table 5-3. Current emission rates (refer to Appendix A and Table 5-3) and stack parameters are based on recent stack tests of these units. Future maximum emission rates (refer to Table 2-3 and Appendix B) and stack parameters are based on manufacturers' data or engineering estimates. To determine the impacts caused by the increase in emissions from RB4, LK4, and SDT4, current emissions were modeled as negative in the ISCST, with the future maximum emissions as positive.

#### 5.5.3 RECEPTORS

A total of 237 receptors was used in the significant impact analysis. These receptors were placed along 36 polar radials spaced 10 degrees apart and centered on the TRS incinerator at G-P. The first receptor was located at the extent of plant property with subsequent receptors located at distances of 700, 1100, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000, 5500, 6000, and 6500 m. In those directions in which plant property extends more than 700 m from the TRS incinerator, receptors were placed only beyond the extent of plant property. The plant property receptors used in the significant impact analysis are presented in Table 5-4.

Table 5-3. Source Inventory Used in the Significant Impact Analysis

Source	Relative* Location (m)		Stack Parameters (m)		Operating Parameters		Emissions (g/s)			
	X	Y	Height	Diameter	Temp (K)	Velocity (m/s)	PM(TSP)	PM10	NO <sub>x</sub>	CO
<u>Current</u>										
RB4	-192	58	70.1	3.66	479	14.7	5.80	4.35	13.75	85.88
LK4	40	-137	39.9	1.32	347	14.6	3.04	2.99	4.27	0.88
SDT4	-150	87	62.8	1.52	344	5.79	1.24	1.11	-	-
<u>Proposed</u>										
RB4	-192	58	70.1	3.66	477	18.5	13.97	13.97	26.54	129.2
LK4	40	-137	39.9	1.32	347	15.5	3.96	3.89	6.34	0.92
SDT4	-150	87	62.8	1.52	341	6.1	3.98	3.57	-	-

\*Relative to the G-P TRS incinerator

Note: Basis for Current Emissions:

RB4

PM(TSP): 1989 stack test; 46.0 lb/hr

PM10: PM10/PM(TSP) = 0.75 (AP-42), 1989 stack test; 34.5 lb/hr

NO<sub>x</sub>: Based on 477.9 TPY NO<sub>x</sub> or 109.1 lb/hr; refer to Appendix A.

CO: 189,000 lb/hr BLS/3,050 lb BLS/ton ADUP x 11.0 lb CO/ton ADUP = 681.6 lb/hr

LK4

PM(TSP): 1990 stack test; 24.08 lb/hr

PM10: PM10/PM(TSP) = 0.983 (AP-42), 1990 stack test; 23.7 lb/hr

NO<sub>x</sub>: 148.4 TPY, or 33.9 lb/hr; refer to Appendix A.

CO: 1990 stack test, 40 ton/hr input CaCO<sub>3</sub>, 90% conversion, 16.87 ton/hr CaO, 0.24 ton CaO/ton ADUP, 70.3 ton/hr ADUP, 0.1 lb CO/ton ADUP = 7.0 lb/hr

SDT4

PM(TSP): 1989 stack test; 9.88 lb/hr

PM10: PM10/PM(TSP) = 0.895 (AP-42), 1989 stack test; 8.84 lb/hr

Basis for Proposed Emissions:

See Appendix B

Table 5-4. Summary of Direction-Specific Distances From the TRS Incinerator to G-P Plant Property Boundaries

Direction (Degrees)	Distance (m)	Direction (Degrees)	Distance (m)
10	5,000	190	750
20	4,500	200	1,829
30	2,500	210	1,829
40	2,500	220	1,981
50	1,500	230	2,134
60	1,500	240	2,438
70	1,500	250	2,896
80	838	260	3,048
90	686	270	3,658
100	533	280	3,962
110	457	290	4,572
120	457	300	5,182
130	457	310	4,801
140	457	320	4,875
150	457	330	6,000
160	488	340	5,500
170	533	350	5,250
180	610	360	5,125

#### 5.5.4 RESULTS

The results of the significant impact analysis are presented in Table 5-5. Only PM(TSP)/PM10 impacts exceed significant impact levels and therefore require additional analysis for significant impact area and compliance with AAQS and PSD increments.

#### 5.6 SIGNIFICANT IMPACT AREA

As shown in Table 5-5, PM(TSP)/PM10 impacts as a result of increased emissions from RB4, LK4, and SDT4 are above significant impact levels. Therefore, a significant impact area analysis was performed to determine the distance at which PM(TSP)/PM10 impacts from the G-P facility fall below significant impact levels. The significant impact area for the G-P facility was determined to be 15 km.

#### 5.7 PM10 AAQS ANALYSIS

##### 5.7.1 INVENTORY

A summary of the other G-P PM10 sources, emissions, and stack parameters used in the modeling analysis is presented in Table 5-6. PM10 emissions were calculated from PM(TSP) emissions and AP-42 emission factors. These calculations are presented in Appendix B.

A summary of other facilities with PM(TSP) emissions greater than 25 TPY and located within 50 km of the G-P facility is presented in Table 5-7. All sources at facilities within the significant impact area (a circle with a radius of 15 km and centered on the TRS incinerator at G-P) were included in the modeling analysis. Those facilities outside the significant impact area and within 50 km from G-P were further screened using the "Threshold Screening" technique described in Appendix E. Sources at those facilities with PM(TSP) emissions greater than  $Q [20 \times (\text{distance from GP} - 15\text{km})]$  were included in the AAQS analysis. A summary of those sources included in the modeling and their respective stack and operating parameters is presented in Table 5-8.

Table 5-5. Results of the Significant Impact Analysis

Pollutant	Averaging Period	<u>Predicted Concentration (<math>\mu\text{g}/\text{m}^3</math>) for year:</u>					Maximum Concentration ( $\mu\text{g}/\text{m}^3$ )	Significant Impact Level ( $\mu\text{g}/\text{m}^3$ )
		1983	1984	1985	1986	1987		
Carbon Monoxide	1-hour	38	38	40	45	42	45	40,000
	8-hour	6.5	8.2	7.0	6.9	6.0	8.2	10,000
Nitrogen Dioxide	Annual	0.3	0.3	0.3	0.3	0.4	0.4	1.0
PM(TSP)	24-hour	7.1	9.4	8.7	9.7	9.9	9.9	5.0
	Annual	1.1	1.1	1.1	1.1	1.4	1.4	1.0

Table 5-6. Georgia-Pacific Source Inventory Used in the PM10 AAQS Analysis

Source	Modeled Number	Location (m)*		Stack Height (m)	Stack Temp. (K)	Exit Velocity (m/s)	Stack Diameter (m)	PM10 Emissions (g/s)
		X	Y					
RB4	104	-192	58	70.1	477	18.50	3.66	13.97
SDT4	204	-150	87	62.8	341	6.10	1.52	3.57
LK4	304	40	-137	39.9	347	15.45	1.31	3.89
PB4	501	-78	110	37.2	474	19.72	1.22	2.33
PB5	502	-87	88	72.9	502	24.02	2.44	4.51
CB4	601	-104	78	72.9	440	17.89	2.44	10.60
TRS Incin.	701	0	0	76.2	531	26.76	0.98	0.69

\*Location relative to the TRS incinerator.

Table 5-7. PM10/PM(TSP) Facilities (&gt;25 TPY) Eliminated from the Modeling Analysis Using the "Screening Threshold" Technique

APIS Number	Facility	UTM Coordinates (km)		Relative Location <sup>a</sup> To Georgia Pacific (km)		Distance From Georgia-Pacific (km)	Direction From Georgia-Pacific (degree)	Maximum SO <sub>2</sub> Emissions (TPY)	Q,	Source
		East	North	X	Y				Emissions (TPY)	Threshold (20 x D) <sup>b</sup>
31JAX540002	Florida Furniture Industries	436.3	3283.6	2.3	0.2	2.3	85	37	<sup>c</sup>	Yes
31JAX540030	Georgia-Pacific	436.4	3284.3	2.4	0.9	2.6	69	36	<sup>c</sup>	Yes
31JAX540025	Seminole Electric Co.	438.8	3289.2	4.8	5.8	7.5	40	1,206	<sup>c</sup>	Yes
31JAX540016	FPL-Palatka	442.8	3277.6	8.8	-5.8	10.5	123	1,422	<sup>c</sup>	Yes
31JAX540014	FPL-Putnam	443.3	3277.6	9.3	-5.8	11.0	122	1,406	<sup>c</sup>	Yes
31JAX100007	Associated Minerals	432.4	3304.2	-1.6	20.8	20.9	356	245	117	Yes
31JAX540001	Feldspar Corporation	407.8	3274.2	-26.2	-9.2	27.8	251	135	255	No
31JAX100017	J-M Manufacturing Co., Inc.	435.1	3316.7	1.1	33.3	33.3	2	72	366	No
31JAX100019	Gates Roofing Manufacture	435.2	3316.8	1.2	33.4	33.4	2	37	368	No
31JAX540015	Georgia-Pacific Plywood Plant	399.6	3273.8	-34.4	-9.6	35.7	254	198	414	No
31JAX100011	E.I. Dupont DeNemours & Co.	400.2	3308.6	-33.8	25.2	42.2	307	267	543	No
31JAX100004	Florida Solite	427.4	3326.5	-6.6	43.1	43.6	351	191	572	No
31JAX040004	Griffin Industries	389.7	3294.9	-44.3	11.5	45.8	285	27	615	No
31JAX180001	ITT Rayonier Lumber	474.0	3261.5	40.0	-21.9	45.6	119	44	612	No
31JAX180002	Tarmac Florida	477.0	3260.2	43.0	-23.2	48.9	118	46	677	No

<sup>a</sup> The UTM coordinates of Georgia-Pacific are 434.0 km east and 3283.4 km north.

<sup>b</sup> These sources are within the significant impact area of 15 km and therefore are included in the modeling analysis, regardless of the emission threshold, Q.

<sup>c</sup> The parameter D equals the distance in km from the facility in the screening area to the nearest edge of the significant impact area.



Table 5-8. Summary of Other PM10/PM(TSP) Emission Sources to be Used in the AAQS Modeling Analysis

APIS Facility Number	Facility	Modeled Source Number	Relative Location To		Source Description	Stack Data (ft)		Operating Data		Modeled Emissions (lb/hr)
			Georgia-Pacific (km)			Height	Diameter	Temperature (degrees F)	Velocity (ft/sec)	
			X	Y						
31JAX540014	FPL-Putnam	801	9.1	-5.7		73	10.3	365	104.0	275.40
31JAX540016	FPL-Palatka	802	8.7	-5.7		150	13.0	275	39.0	321.00
31JAX540025	Seminole Electric	901	4.6	5.8		673	50.9	127	27.6	324.60
31JAX540002	Florida Furniture Industries	1001	2.3	0.2	Waste Wood Boiler	50	3.2	491	13.0	8.45
31JAX100007	Associated Minerals	1101	-1.6	20.8	Dryer #1	46	0.67	320	71.0	3.85
		1102			Dryer #2	46	0.34	330	26.0	1.44
		1103			Zircon Calcinator	46	0.34	700	13.0	1.30
		1104			Dryer #4	56	0.24	275	26.0	3.59
31JAX540030	Georgia-Pacific Lumber Yard	1401	2.4	0.9	Lumber Kiln #1	25	4.8	240	39.0	2.63
		1401			Lumber Kiln #2	25	4.8	240	39.0	2.63
		1402			Kiln Fuel Silo	80	2.2	80	12.0	1.80
		1403			Planer Mill	43	6.7	80	18.0	4.68
		1404			Planer Shavings Bin	56	2.2	80	10.0	2.34

### 5.7.2 RECEPTORS

A total of three receptor grids was used in the PM10 AAQS analysis. The first receptor grid used in the screening analysis was as described in section 5.5.3. This receptor grid includes plant property and additional receptors out to a distance of 5.5 km. An additional screening grid was used with receptors placed every kilometer from 6.0 to 12.0 km from G-P along 36 radials spaced at 10 degrees. The final grid used in the AAQS analysis was the refined receptor grid. The grid was centered on the receptor of highest, second-highest concentration determined from the screening analysis. Receptors were located at 100 m intervals along radials with 2 degree-spacing.

### 5.7.3 BACKGROUND CONCENTRATIONS

A background PM10 concentration (i.e., impacts from sources not modeled in the analysis) is added to the maximum predicted concentration from the modeled sources to produce a total concentration for comparison with the PM10 AAQS. Background concentrations were developed from ambient monitoring data available from FDER.

There are two monitors that measured TSP concentrations in Putnam County during 1989 that meet FDER's quality assurance standards. However, based on conversations with Brian Kirkhoff (February 1991, FDER, Tallahassee, Florida. Telephone conversation with S.A. McCann), measured concentrations at the James A. Long Elementary School were not representative of background concentrations as a result of construction at the school. Mr. Kirkhoff suggested that measured concentrations from the monitor located at Kay Larkin Airport would be more representative of background concentrations. The monitor at Kay Larkin Airport is located approximately 2.1 km south-southwest of the G-P facility. A summary of the maximum PM(TSP) concentrations measured at this monitor is presented in Table 5-9.

The second-highest PM(TSP) concentration measured at Kay Larkin Airport in 1989 was  $107 \mu\text{g}/\text{m}^3$ , while the annual average concentration was  $44 \mu\text{g}/\text{m}^3$ .

Table 5-9. Maximum PM(TSP) Concentrations Measured During 1989 at FDER Monitoring Stations in Palatka, Florida

Site Number	Location	Number of Observations	Measured Concentration ( $\mu\text{g}/\text{m}^3$ )		
			24-Hour Highest	Second-Highest	Annual Arithmetic Mean
3780-001-F02	Key Larkin Airport UTM: 433.42 E, 3281.35 N	60	145	107	44

Note: The monitor at Key Larkin Airport is located 2.1 km south-southwest of the Georgia-Pacific facility.

These values were used as conservative PM(TSP) background concentrations.

Since there are no PM10 measurements from sites in Putnam County, the PM(TSP) data were used to estimate PM10 background concentrations. EPA recommends using the national average PM(TSP)/PM10 distribution in cases where site-specific data are not available (EPA, 1985a). This national distribution of PM(TSP)/PM10 ratio is based on evaluating high PM(TSP) concentrations [i.e. data when PM(TSP) concentrations exceeded 100  $\mu\text{g}/\text{m}^3$  for a 24-hour period or 55  $\mu\text{g}/\text{m}^3$  for an annual average]. This distribution is, therefore, appropriate for estimating maximum background concentrations.

The national distribution of PM(TSP)/PM10 ratios shows that the 50-percentile PM10/PM(TSP) ratio (i.e., average ratio) is 0.48 for both the 24-hour and annual averaging period. Using this ratio, the PM10 background concentrations are calculated as follows:

$$\begin{aligned} \text{24-hour average} & \text{ -- } 107 \mu\text{g}/\text{m}^3 \times 0.48 = 51 \mu\text{g}/\text{m}^3 \\ \text{Annual average} & \text{ -- } 44 \mu\text{g}/\text{m}^3 \times 0.48 = 21 \mu\text{g}/\text{m}^3 \end{aligned}$$

#### 5.7.4 RESULTS

The results of the PM10 AAQS screening analysis are presented in Table 5-10. The locations of maximum predicted annual and 24-hour concentrations for each year were further refined. The results of the refined analysis are presented in Table 5-11. Background concentrations, as discussed in Section 5.7.3, were added to the predicted concentrations. The maximum total annual and 24-hour concentrations were 27.5 and 99.0  $\mu\text{g}/\text{m}^3$ , respectively. Both the total predicted annual and 24-hour averages are well below the annual and 24-hour AAQS for PM10 of 50 and 150  $\mu\text{g}/\text{m}^3$ , respectively.

#### 5.8 PM(TSP) PSD CLASS I AND CLASS II ANALYSIS

PSD baseline PM(TSP) emissions and stack parameters for G-P are presented

Table 5-10. Results of the PM10 AAQS Screening Analysis

Year	Concentration ( $\mu\text{g}/\text{m}^3$ )	Receptor		Period (day)
		Direction (deg)	Distance (km)	
<u>Annual</u>				
1983	5.1	120	0.457	—
1984	5.0	120	0.457	—
1985	4.9	120	0.457	—
1986	4.9	120	0.457	—
1987	6.5	120	0.457	—
<u>24-Hour<sup>a</sup></u>				
1983	31	140	0.457	106
1984	35	140	0.457	31
1985	29	120	0.457	6
1986	27	110	0.457	112
1987	48	120	0.457	1

<sup>a</sup>Highest, second-highest 24-hour concentration.

Table 5-11. Results of the PM10 AAQS Refined Analysis

Year	Concentration ( $\mu\text{g}/\text{m}^3$ )			Receptor		Period (day)	PM10 AAQS ( $\mu\text{g}/\text{m}^3$ )
	Background	Modeled	Total	Direction (deg)	Distance (km)		
<u>Annual</u>							
1983	21	5.1	26.1	120	0.457	-	
1984	21	5.0	26.0	118	0.457	-	
1985	21	5.0	26.0	118	0.457	-	50
1986	21	5.2	26.2	114	0.457	-	
1987	21	6.5	27.5	120	0.457	-	
<u>24-Hour</u>							
1983	51	31.2	82.2	142	0.457	359	
1984	51	35.2	86.2	140	0.457	31	
1985	51	29.9	80.9	114	0.457	189	150
1986	51	35.0	86.0	114	0.457	364	
1987	51	48.0	99.0	120	0.457	1	

in Table 5-12. This inventory was obtained from the PSD permit issued to G-P in 1982 (PSD-FL-079) for a new recovery boiler, combination boiler, and lime kiln. (Note: These sources were never constructed, and the construction permits have lapsed). Review of the baseline inventory shows that, during the baseline period, all currently operating sources at G-P were permitted or operating except for the TRS incinerator. In addition, the three old recovery boilers, smelt tanks, and lime kilns all were operating. Comparison of the PSD "baseline" and "projected" PM(TSP) emission inventories for G-P, presented in Table 5-12, shows a significant decrease in emissions from the baseline period. In addition, the older sources that were shut down had shorter stack heights than the currently operating sources. Based on these considerations, it is apparent that there will be PSD increment expansion for PM(TSP) and, therefore, further modeling is not necessary.

Table 5-12. Georgia-Pacific PM(TSP) Source Inventory Used in PSD Analysis

Source	Modeled Number	Location (m) <sup>a</sup>		Stack Height (m)	Stack Temp. (K)	Exit Velocity (m/s)	Stack Diameter (m)	PM(TSP) Emissions (g/s)
		X	Y					
<u>Baseline<sup>b</sup></u>								
RB1	99101	-15	30	76.2	360	3.41	3.66	9.93
RB2	99102	-15	30	76.2	372	5.40	3.66	12.69
RB3	99103	-43	7	40.5	372	7.28	3.41	13.73
RB4	99104	-192	58	70.1	474	16.86	3.66	20.98
SDT1	99201	-15	30	30.5	366	7.53	0.76	0.30
SDT2	99202	-15	30	30.5	375	9.51	0.91	0.45
SDT3	99203	-43	7	33.2	369	3.57	0.76	0.42
SDT4	99204	-150	87	62.8	346	8.26	1.52	3.81
LK1	99301	40	-73	15.2	401	5.24	1.28	22.68
LK2	99302	34	-77	15.9	341	10.67	1.71	11.97
LK3	99303	41	-112	15.9	342	8.47	1.71	11.72
LK4	99304	40	-137	45.4	351	16.46	1.31	3.98
PB4	99501	-78	110	37.2	477	14.54	1.22	1.69
PB5	99502	-87	88	72.9	520	15.97	2.74	161.15
CB4	99601	-104	78	72.9	477	10.52	3.05	<u>121.28</u>
Total Baseline Emissions = 396.78								
<u>Projected</u>								
RB4	104	-192	58	70.1	477	18.50	3.66	13.47
SDT4	204	-150	87	62.8	341	6.10	1.52	3.97
LK4	304	40	-137	39.9	347	15.45	1.31	3.96
PB4	501	-78	110	37.2	474	19.72	1.22	3.28
PB5	502	-87	88	72.9	502	24.02	2.44	7.16
CB4	601	-104	78	72.9	440	17.89	2.44	15.82
TRS Incin.	701	0	0	76.2	531	26.76	0.98	<u>0.68</u>
Total Projected Emissions = 48.34								

<sup>a</sup>Location relative to the TRS incinerator.<sup>b</sup>From PSD Permit PSD-FL-079.



## 6.0 BEST AVAILABLE CONTROL TECHNOLOGY

### 6.1 REQUIREMENTS

The 1977 Clean Air Act Amendments established requirements for the approval of preconstruction permit applications under the PSD program. One of these requirements is that the best available control technology (BACT) be installed for applicable pollutants. BACT determinations must be made on a case-by-case basis considering technical, economic, energy, and environmental impacts for various BACT alternatives. To bring consistency to the BACT process, the EPA developed the so called "top-down" approach to BACT determinations. As mentioned previously, this approach currently is being challenged in court. Nonetheless, the "top-down" approach is followed in the G-P BACT analysis.

The first step in a top-down BACT analysis is to determine, for each applicable pollutant, the most stringent control alternative available for a similar source or source category. If it can be shown that this level of control is infeasible on the basis of technical, economic, energy, or environmental impacts for the source in question, then the next most stringent level of control is identified and similarly evaluated. This process continues until the BACT level under consideration cannot be eliminated by any technical, economic, energy, or environmental consideration.

In the case of the proposed modification at G-P, PM(TSP)/PM10, NO<sub>x</sub>, CO, and VOC require BACT analysis. The following sections present the BACT analysis for each applicable pollutant and for each emissions unit being modified (i.e., RB4, SDT4, and LK4).

### 6.2 KRAFT RECOVERY BOILER

#### 6.2.1 PARTICULATE MATTER

RB4 is currently equipped with a high-efficiency electrostatic precipitator (ESP) for PM(TSP)/PM10 control. ESPs have been demonstrated in practice to

be the best and most appropriate control device for PM emissions. Previous BACT determinations for PM emissions from kraft recovery boilers, issued within the past 5 years, are summarized in Table 6-1. This summary shows that all previous BACT determinations have been based on ESP control. Based on this fact, only the ESP control technology is considered further for BACT for PM(TSP)/PM10 emissions.

PM test data from RB4 has shown the existing ESP achieves low levels of PM emissions. The last three PM compliance tests on RB4 have resulted in PM emissions ranging from 0.009 gr/dscf to 0.037 gr/dscf, averaging 0.022 gr/dscf. Corresponding mass emission rates ranged from 15.0 to 57.6 lb/hr and averaged 36.9 lb/hr. Based on these test results, G-P is proposing a BACT emission level of 0.044 gr/dscf at 8 percent O<sub>2</sub> (110.9 lb/hr), which is equivalent to the federal NSPS for new recovery boilers. This allowable emission level will provide G-P with an adequate margin of safety above current actual emissions, which can reasonably be met at all times in the future.

Previous BACT determinations have resulted in PM emission limits ranging from 0.021 gr/dscf to 0.044 gr/dscf at 8 percent O<sub>2</sub>. A lower emission level of 0.021 gr/dscf at 8 percent O<sub>2</sub> was determined to be the lowest achievable emission rate for a recovery boiler for Georgia-Pacific Corporation located in Maine. Nearly all of these determinations have been for new recovery boilers.

G-P's RB4 and associated ESP was constructed in 1976 and is now 15 years old. The existing status of this recovery boiler and its age are important considerations in the BACT determination.

Table 6-1. Summary of BACT Determinations for PM Emissions from Recovery Boilers in Kraft Pulp Mills

Company Name	State	Permit Number	Permit Issued Date	Recovery Boiler Throughput	PM Emission Limit		Comments	Efficiency (%)
					(ppm)	(lb/hr)		
Alabama River Pulp Co.	AL	106-0010	22-Jan-90	5.50 MMlb/D bls	0.025 gr/dscf 8%O2	67.7	ESP	99.60%
Great Southern Paper	GA	2631-049-10296	08-Dec-89	3.05 MMlb/D bls	0.030 gr/dscf	46.00	ESP	99.58%
Weyerhaeuser Company	MS	1680-00044	24-Oct-89	5.00 MMlb/D bls	0.030 gr/dscf 8%O2	87.3	ESP	—
Boise Cascade Corporation	ME	A214-71-EA/R	18-Jul-89	4.00 MMlb/D bls	0.044 gr/dscf	65.00	ESP	—
Champion International	AL	707-0001	18-Jul-89	4.18 MMlb/D bls	0.027 gr/dscf 8%O2	61	ESP	99.80%
Union Camp Corporation	SC	1900-0046	01-May-89	1463 TPD of ADP	0.030 gr/dscf 8%O2	—	ESP	—
Union Camp Corporation	SC	1900-0046	01-May-89	822 TPD of ADP	0.036 gr/dscf 8%O2	—	ESP	—
Nekoosa Papers, Inc.	WI	88-DLJ-082	14-Apr-89	600 TPD of ADP	0.030 gr/dscf 8%O2	—	Dry Bottom ESP	—
Georgia-Pacific Corporation	ME	A215-71-BA/R	12-Apr-89	1450 TPD of ADP	0.021 gr/dscf	45.04	ESP, LAER	—
Louisiana Pacific Corp.	CA	HAC-216	22-Feb-89	830 TPD of ADP	0.025 gr/dscf	—	ESP	99.70%
James River Corporation	WA	PSD-88-3	14-Feb-89	770 MMBtu/hr	0.033 gr/dscf 8%O2	—	ESP w/heat recovery scrubbe	99.50%
James River Corporation	WA	PSD-88-3	14-Feb-89	523 MMBtu/hr	0.033 gr/dscf 8%O2	—	ESP w/heat recovery scrubbe	99.50%
Mead Coated Board	AL	211-0004	01-Oct-88	1500 TPD of ADP	0.044 gr/dscf	106	ESP & Incineration	99.30%
Willamette Industries	SC	1680-0043	29-Sep-88	840 TPD of ADP	0.030 gr/dscf 8%O2	—	ESP	99.60%
S.D. Warren Company	ME	A-29-71-CA/R	23-Jun-88	375 MMBtu/hr	0.021 gr/dscf	19.32	ESP	—
Consolidated Papers, Inc.	WI	86-AJH-001	14-Jan-87	1.40 MMlb/D bls	0.033 gr/dscf 8%O2	—	ESP	—

ADP = Air Dried Pulp measured at 10% moisture.

## 6.2.2 NITROGEN OXIDES

### 6.2.2.1 Pollutant Formation

NO<sub>x</sub> is formed in the recovery boiler during the combustion process. Nitrogen is present in both the fuel and in the combustion air and combines with oxygen in the combustion air to form primarily nitric oxide (NO). A small fraction of the NO is further oxidized to form nitrogen dioxide (NO<sub>2</sub>). NO<sub>x</sub> formed from the fuel nitrogen is termed "fuel" NO<sub>x</sub>, and that formed from the nitrogen in the combustion air is termed "thermal" NO<sub>x</sub>.

Black liquor fired in recovery boilers has low nitrogen content, typically less than 0.1 percent. As a result, fuel NO<sub>x</sub> is minimal from recovery boilers. Thermal NO<sub>x</sub> is the primary emission from a recovery boiler.

In general, kraft recovery boilers have relatively low NO<sub>x</sub> emissions. Low combustion temperatures and staged combustion (creating a reducing atmosphere in the lower portion of the boiler) inhibit the formation of NO<sub>x</sub>. The combustion temperature above the primary air injection is approximately 1,800°F. This relatively low combustion temperature is maintained by adjusting the furnace bed height and decreasing the primary air temperature.

Emission rates from different recovery boilers vary because of manufacturer differences, differences in firing configurations, and also because of different black liquor fuel qualities.

### 6.2.2.2 Alternative NO<sub>x</sub> Control Technologies

Combustion control is the only control technology used on recovery boilers to date. All BACT/LAER determinations issued within the past 5 years for NO<sub>x</sub> are summarized in Table 6-2. Review of this table shows that all determinations have been based on combustion control and boiler design and operation.

Table 6-2. Summary of BACT Determinations for NOx Emissions from Recovery Boilers in Kraft Pulp Mills

Company Name	State	Permit Number	Permit Issued Date	Recovery Boiler Throughput	NOx Emission Limit			Comments
					(ppm)	(lb/hr)	(lb/MMBtu)	
Alabama River Pulp Co.	AL	106-0010	22-Jan-90	5.50 MMlb/D bls	75 ppmv 8%O2	169.4	---	---
Seminole Kraft Corporation	FL	AC16-168607	05-Jan-90	4.10 MMlb/D bls	75 ppmv 8%O2	153.0	---	Combustion Control
Great Southern Paper	GA	2631-049-10296	08-Dec-89	3.05 MMlb/D bls	---	154	0.20	2 RB's and 2 ST's w/ similar emissions
Weyerhaeuser Company	MS	1680-00044	24-Oct-89	5.00 MMlb/D bls	70 ppmv 4%O2	180.3	---	Process Control
Boise Cascade Corporation	ME	A214-71-EA/R	18-Jul-89	4.00 MMlb/D bls	---	134	---	Combustion Control
Champion International	AL	707-0001	18-Jul-89	4.18 MMlb/D bls	75 ppmv 8%O2	170	---	---
Boise Cascade Corporation	MN	102A-89-OT-2	12-May-89	571 MMBtu/hr	80 ppmv 8%O2	86.9	---	Combustion Control
Union Camp	SC	1900-0046	01-May-89	1463 TPD of ADP	150 ppm, dry 8%O2	---	---	Boiler Design & Oper, LAER
Union Camp	SC	1900-0046	01-May-89	822 TPD of ADP	200 ppm 8%O2	---	---	Boiler Design & Oper
Nekoosa Papers, Inc.	WI	88-DLJ-082	14-Apr-89	600 TPD of ADP	95 ppmv 8%O2	---	---	---
Georgia-Pacific Corporation	ME	A215-71-BA/R	12-Apr-89	1450 TPD of ADP	80 ppmv	143.4	---	Combustion Control
Louisiana Pacific Corp.	CA	HAC-216	22-Feb-89	830 TPD of ADP	---	---	0.10	Boiler Design
James River Corporation	WA	PSD-88-3	14-Feb-89	770 MMBtu/hr	1.8 lb/ADUT	---	---	Design Operation
James River Corporation	WA	PSD-88-3	14-Feb-89	523 MMBtu/hr	1.8 lb/ADUT	---	---	Design Operation
Mead Coated Board	AL	211-0004	01-Oct-88	1500 TPD of ADP	112 ppmv	---	---	---
Willamette Industries	SC	1680-0043	29-Sep-88	840 TPD of ADP	150 ppmv	---	---	Boiler Design & Operation
S.D. Warren Company	ME	A-29-71-CA/R	23-Jun-88	375 MMBtu/hr	97.0 ppmv	50.83	---	Combustion Control
Consolidated Papers, Inc.	WI	86-AJH-001	14-Jan-87	1.40 MMlb/D bls	53 ppmv	27.5	---	---

ADP = Air Dried Pulp measured at 10% moisture.

A potentially applicable combustion technique for recovery boilers is flue gas circulation (FGR). In FGR, a portion of the combustion gases is recirculated back to the furnace burners or windbox. This has the effect of reducing available oxygen, thereby reducing the amount of oxygen that can combine with nitrogen to form  $\text{NO}_x$ . It also results in reducing the peak flame temperature by absorption of combustion heat by the essentially inert combustion gases.

FGR has not been applied to recovery boilers because of the high particulate loading in the combustion gases, which presents technical problems associated with erosion of fan blades and ductwork required with the FGR system. Based on these technical problems, and no demonstrated operating experience of FGR on a recovery boiler, this alternative was not considered further.

In addition to combustion controls,  $\text{NO}_x$  emissions potentially can be controlled by a post-combustion  $\text{NO}_x$  reduction system. This includes both selective catalytic reduction (SCR) and selective non-catalytic reduction (SNCR).

Performance of an SCR system downstream of a kraft recovery boiler is difficult to predict. Such a system has never been applied to a recovery boiler. This  $\text{NO}_x$  reduction system uses a vanadium pentoxide catalyst to promote the reaction of ammonia with the  $\text{NO}_x$ . The presence of sodium compounds in the gas stream, however, is likely to cause catalyst fouling and plugging problems. In addition, the formation of ammonia bisulfate as a result of sulfur compounds in the gas stream would lead to corrosion and plugging of downstream components, compounding the uncertainty associated with this  $\text{NO}_x$  reduction system.

An SNCR system does not rely on the use of a catalyst but relies mainly on the chemical/temperature reaction between ammonia and  $\text{NO}_x$ . A large amount of uncertainty is associated with the use of this  $\text{NO}_x$  reduction technology

downstream of a recovery boiler. Ammonia bisulfate deposits downstream of the boiler still are likely with SNCR and would present operational and maintenance problems. In addition, there is serious concern that the catalytic effects in the presence of sodium compounds might have an adverse effect on the reaction efficiency of the chemical reduction process.

Additional information regarding the technical and economic feasibility of applying SCR and SNCR to recovery boilers is contained in a recently published TAPPI Journal article. This article is reproduced in Appendix F.

SCR and SNCR have not been applied to recovery boilers and are considered technically unproven and infeasible at this time. In addition, applying these technologies to the existing G-P recovery boiler would require extensive and costly retrofitting. NO<sub>x</sub> emissions from recovery boilers generally are low. Based on these considerations, post-combustion control techniques for NO<sub>x</sub> were not considered further.

#### 6.2.2.3 Proposed BACT for NO<sub>x</sub>

Combustion control is the only feasible NO<sub>x</sub> control technique applicable to the existing G-P recovery boiler. An NO<sub>x</sub> emission limit of 100 ppmvd, corrected to 8 percent oxygen (202.9 lb/hr), on an annual average basis, is proposed as BACT. Review of information contained in the BACT/LAER Clearinghouse documents (Table 6-2) indicates that previous NO<sub>x</sub> BACT emission limits have ranged from 53 ppmvd to 200 ppmvd (at 8 percent O<sub>2</sub>). The most recent BACT determinations have been in the 70 to 80 ppmvd range. However, these are for new recovery boilers, which can be designed to achieve low NO<sub>x</sub> levels. Since, in G-P's case, the existing recovery boiler is being modified, including significant changes to the combustion air system, the achievable NO<sub>x</sub> is not known with the same degree of confidence as for a new boiler. Considering these site-specific aspects, the proposed NO<sub>x</sub> emission level compares favorably with the past BACT determinations.

### 6.2.3 BACT FOR CO AND VOC

CO and VOC emissions are formed in a recovery boiler by incomplete combustion of the black liquor fuel. The black liquor is about 25 percent carbon. Organics in the black liquor that do not completely combust are emitted out the stack as VOC. Increasing combustion temperatures, increasing excess air and oxygen, and better fuel/air mixing during combustion minimize CO and VOC emissions.

Because of the mutually dependent formation characteristics of NO<sub>x</sub> and CO/VOC emissions from recovery boilers, it is not possible to consider BACT for these emissions independently. Nitrogen oxides are formed by the oxidation of nitrogen contained in the fuel and in the combustion air. Nitrogen oxide emissions are reduced by lowering combustion temperatures, minimizing excess combustion air and excess oxygen, and by staging the combustion process. Therefore, limiting NO<sub>x</sub> emissions by lowering combustion temperatures and excess combustion air are counterproductive relative to CO/VOC emissions.

The only feasible control of CO and VOC emissions from kraft recovery furnaces is through good combustion practices. These practices generally are geared towards control of NO<sub>x</sub>, SO<sub>2</sub>, and TRS, which are the primary pollutants emitted from recovery boilers. Previous BACT/LAER determinations for CO and VOC emissions from recovery boilers are summarized in Tables 6-3 and 6-4. All previous determinations have been based on good combustion practices. As a result, no other control technologies for control of CO and VOC will be considered.

The proposed BACT for G-P's RB4 is good combustion practices to minimize CO and VOC, while emphasizing control of NO<sub>2</sub>, SO<sub>2</sub>, and TRS. Previous BACTs for CO have ranged from 169 ppmvd to 1,000 ppmvd, with the most recent being 200 ppmvd. A recent determination also was made at 11.0 lb/ton air dried unbleached pulp (ADUP), equivalent to the AP-42 emission factor. G-P proposes a CO level of 400 ppmvd, at 8 percent O<sub>2</sub>, on an annual average



Table 6-3. Summary of BACT Determinations for CO Emissions from Recovery Boilers in Kraft Pulp Mills

Company Name	State	Permit Number	Permit Issued Date	Recovery Boiler Throughput	CO Emission Limit				Comments
					(ppm)	(lb/T)	(lb/hr)	lb/MMBtu)	
Alabama River Pulp Co.	AL	106-0010	22-Jan-90	5.50 MMlb/D bls	200 ppmv	—	275.0	—	—
Great Southern Paper	GA	2631-049-10296	08-Dec-89	3.05 MMlb/D bls	—	11.0 lb/T ADP	480	—	—
Weyerhaeuser Company	MS	1680-00044	24-Oct-89	5.00 MMlb/D bls	—	1.06 lb/T bls	110	—	Process Control
Boise Cascade Corporation	ME	A214-71-EA/R	18-Jul-89	4.00 MMlb/D bls	—	2.66 lb/T bls	222	—	Combustion Control
Champion International	AL	707-0001	18-Jul-89	4.18 MMlb/D bls	200 ppmv 8%O <sub>2</sub>	—	228.4	—	—
Boise Cascade Corporation	MN	102A-89-OT-2	12-May-89	571 MMBtu/hr	600 ppmdv 8%O <sub>2</sub>	—	396.4	—	Combustion Control
Union Camp	SC	1900-0046	01-May-89	1463 TPD of ADP	—	8.0 lb/T ADP	—	—	Boiler Design & Operation
Union Camp	SC	1900-0046	01-May-89	822 TPD of ADP	—	8.0 lb/T ADP	—	—	Boiler Design & Operation
Nekoosa Papers, Inc.	WI	88-DLJ-082	14-Apr-89	600 TPD of ADP	800 ppmdv 8%O <sub>2</sub>	—	—	—	—
Georgia-Pacific Corporation	ME	A215-71-BA/R	12-Apr-89	1450 TPD of ADP	215.0 ppmdv	—	235	—	Combustion Control
Louisiana Pacific Corp.	CA	HAC-216	22-Feb-89	830 TPD of ADP	250 ppm	—	—	—	Boiler Design
James River Corporation	WA	PSD-88-3	14-Feb-89	770 MMBtu/hr	—	—	629.0	0.82	Design & Operation
James River Corporation	WA	PSD-88-3	14-Feb-89	523 MMBtu/hr	—	—	629.0	1.20	Design & Operation
Mead Coated Board	AL	211-0004	01-Oct-88	1500 TPD of ADP	879 ppmv	879 ppmv	—	—	—
Willamette Industries	SC	1680-0043	29-Sep-88	840 TPD of ADP	—	2.0 lb/T ADP	—	—	Boiler Design & Operation
S.D. Warren Company	ME	A-29-71-CA/R	23-Jun-88	375 MMBtu/hr	169 ppmdv	—	83.33	0.22	Combustion Control
Consolidated Papers, Inc.	WI	86-AJH-001	14-Jan-87	1.40 MMlb/D bls	1000 ppmdv	—	317.6	—	—

ADP = Air Dried Pulp measured at 10% moisture.

Table 6-4. Summary of BACT Determinations for VOC Emissions from Recovery Boilers in Kraft Pulp Mills

Company Name	State	Permit Number	Permit Issued Date	Recovery Boiler Throughput	VOC Emission Limit				Comments
					(ppm)	(lb/T)	(lb/hr)	lb/MMBtu)	
Alabama River Pulp Co.	AL	106-0010	22-Jan-90	5.50 MMB/D bls	—	0.61 lb/T bls	70.20	0.048	—
Weyerhaeuser Company	MS	1680-00044	24-Oct-89	5.00 MMB/D bls	—	0.60 lb/T bls	62.5	—	Maximum Combustion Eff.
Boise Cascade Corporation	ME	A214-71-EA/R	18-Jul-89	4.00 MMB/D bls	—	0.044 lb/T bls	3.7	—	Combustion Control
Champion International	AL	707-0001	18-Jul-89	4.18 MMB/D bls	—	0.55 lb/T bls	48	0.048	—
Boise Cascade Corporation	MN	102A-89-OT-2	12-May-89	571 MMBtu/hr	2.8 ppmdv 8%O <sub>2</sub>	—	3	0.005	Combustion Control
Nekoosa Papers, Inc.	WI	88-DLJ-082	14-Apr-89	600 TPD of ADP	200 ppmdv 8%O <sub>2</sub>	—	—	—	—
Georgia-Pacific Corporation	ME	A215-71-BA/R	12-Apr-89	1450 TPD of ADP	—	0.7 lb/T ADP	41.1	—	Combustion Control
Louisiana Pacific Corp.	CA	HAC-216	22-Feb-89	830 TPD of ADP	40 ppmv	—	—	—	Boiler Design
James River Corporation	WA	PSD-88-3	14-Feb-89	770 MMBtu/hr	—	—	—	—	Design & Operation, LAER
James River Corporation	WA	PSD-88-3	14-Feb-89	523 MMBtu/hr	—	—	—	—	Design & Operation, LAER
Mead Coated Board	AL	211-0004	01-Oct-88	1500 TPD of ADP	—	—	—	0.03	—
Willamette Industries	SC	1680-0043	29-Sep-88	840 TPD of ADP	—	2.0 lb/T ADP	70.0	—	Boiler Design & Operation

ADP = Air Dried Pulp measured at 10% moisture.

basis. The proposed maximum 1-hour emission level is 800 ppmvd at 8 percent O<sub>2</sub>. These emission levels compare favorably with the previous BACT/LAER determinations.

Previous BACTs for VOC have been reported in various units. Most can be expressed in lb/ton BLS input. Determinations have ranged from 0.044 to 0.61 lb/ton BLS input, with the most recent being the higher figure. The determination made at 0.044 lb/ton BLS is considered to be too low and not achievable. G-P proposes a VOC level of 0.52 lb/ton BLS (54.6 lb/hr), which compares favorably with the previous BACT/LAER determinations.

### 6.3 NO. 4 SMELT DISSOLVING TANK

#### 6.3.1 BACT FOR PM

The existing SDT4 at G-P has an existing venturi scrubber for PM as well as TRS control. Currently, PM emissions are very low from the smelt tanks, averaging less than 10 lb/hr (total from both tanks) during the last two compliance tests. Previous BACT determinations for smelt dissolving tanks are presented in Table 6-5. All smelt tanks requiring BACTs have employed a type of wet scrubber (i.e., venturi, packed bed, etc.). Considering the existing source, the use of wet scrubbing and the already low PM emissions, the existing wet scrubbers on SDT4 are considered to be BACT for PM(TSP)/PM10 emissions.

Previous BACT determinations for smelt tanks have ranged from 0.12 to 0.20 lb/ton BLS input to the recovery boiler. G-P's proposed emission rate is 31.6 lb/hr, based on the Florida process weight table regulation. This is equivalent to 0.30 lb/ton BLS input. Although this level is somewhat higher than previous BACTs, it is reasonable considering the existing status of the equipment.

Table 6-5. Summary of BACT Determinations for PM Emissions from Smelt Tanks in Kraft Pulp Mills

Company Name	State	Permit Number	Permit Issued Date	Smelt Tank Throughput	PM Emission Limit		Comments	Efficiency (%)
					(lbs/T bls)	(lb/hr)		
Alabama River Pulp Co.	AL	106-0010	22-Jan-90	2,750 TPD bls	0.120	13.8	Wet Scrubber	--
Great Southern Paper	GA	2631-049-10296	08-Dec-89	1,525 TPD bls	0.120	7.6	Impact Scrubbers; 2 smelt tanks	93.40%
Weyerhaeuser Company	MS	1680-00044	24-Oct-89	2,500 TPD bls	0.120	12.5	Wet Scrubber	--
James River Corporation	ME	--	01-Sep-89	--	0.120	--	Pucon Fan/Packed Bed Scrubber	--
Champion International	AL	707-0001	18-Jul-89	2,100 TPD bls	0.120	10.5	Venturi Wet Scrubber	96.00%
Union Camp Corporation	SC	1900-0046	01-May-89	1,463 TPD ADP	0.200	--	Wet Scrubber, NSPS	--
Union Camp Corporation	SC	1900-0046	01-May-89	822 TPD ADP	0.200	--	Wet Scrubber, NSPS	--
Nekoosa Papers, Inc.	WI	88-DLJ-082	14-Apr-89	37,000 lb/hr Smelt	0.130	--	Wet Venturi Scrubber	--
Louisiana Pacific Corp.	CA	HAC-216	22-Feb-89	830 TPD ADP	0.200	--	Wet Scrubber, NSPS	--
James River Corporation	WA	PSD-88-3	14-Feb-89	--	0.120	--	Packed Bed Scrubber, monthly avg.	--
James River Corporation	WA	PSD-88-3	14-Feb-89	--	0.120	--	Packed Bed Scrubber, monthly avg.	--
Mead Coated Board	AL	211-0004	01-Oct-88	2,251 TPD bls	0.200	18.8	Wet Scrubber	95.70%
Willamette Industries	SC	1680-0043	29-Sep-88	840 T/D ADP	0.199	--	Wet Scrubber	96.00%
Consolidated Papers, Inc.	WI	86-AJH-001	14-Jan-87	27,600 lb/hr Smelt	0.120	--	Wet Scrubber	--

ADP = Air Dried Pulp measured at 10% moisture.

#### 6.4 NO. 4 LIME KILN

##### 6.4.1 BACT FOR PM

PM emissions from lime kilns in the pulp and paper industry historically have been controlled either by venturi scrubbers or ESPs. Previous BACT determinations, shown in Table 6-6, indicate about an equal spread between the two technologies. Both are capable of achieving low emission levels, although the venturi scrubber has higher energy requirements, consumes water, and produces a wastewater stream.

LK4 at G-P is an existing lime kiln with an existing wet venturi scrubber. Based on the existing nature of the scrubber and the demonstrated ability of venturi scrubbers to achieve low PM emission levels, the existing wet scrubber is considered to be BACT for PM(TSP)/PM10 emissions.

Previous BACT emission levels have ranged from 0.054 to 0.130 gr/dscf at 10 percent O<sub>2</sub>. G-P's proposed emission rate for PM is 31.42 lb/hr, which is equal to the current allowable emission rate for the LK4. This equates to a grain loading of 0.151 gr/dscf at actual stack conditions. LK4 is expected to be operated at an O<sub>2</sub> level between 4 and 8 percent. At 4 percent O<sub>2</sub>, the grain loading would be 0.098 gr/dscf, corrected to 10 percent O<sub>2</sub>; at 8 percent actual O<sub>2</sub> in the kiln, the grain loading would be 0.126 gr/dscf, corrected to 10 percent O<sub>2</sub>. These corrected grain loadings compare favorably with previous BACT determinations, considering the existing nature of the source.

##### 6.4.2 BACT FOR NO<sub>x</sub>, CO, AND VOC

NO<sub>x</sub>, CO, and VOC emissions from lime kilns are combustion-related pollutants. There is no feasible method of controlling these emissions from lime kilns except good combustion practices, as demonstrated by the previous BACT determinations summarized in Tables 6-7 through 6-9. As discussed for recovery boilers, control of NO<sub>x</sub> emissions is generally counterproductive to control of CO and VOC emissions.

Table 6-6. Summary of BACT Determinations for PM Emissions from Lime Kilns in Kraft Pulp Mills

Company Name	State	Permit Number	Permit Issued Date	Lime Kiln Throughput	PM Emission Limit		Comments	Efficiency (%)
					(gr/dscf)*	(lb/hr)		
Alabama River Pulp Co.	AL	106-0010	22-Jan-90	465 TPD CaO	0.067	24.2	ESP, Oil firing	99.72%
Weyerhaeuser Company	MS	1680-00044	24-Oct-89	504 TPD CaO	0.130	—	ESP, Oil firing	—
Boise Cascade Corporation	ME	A214-71-EA/R	18-Jul-89	327 TPD CaO	0.067	24.0	Wet Venturi Scrubber	—
Champion International	AL	707-0001	18-Jul-89	300 TPD CaO	0.070	14.4	Venturi Wet Scrubber, N.G. fir	93.00%
Nekoosa Papers, Inc.	AR	946-A	14-Jul-89	440 TPD CaO	0.067	—	ESP, Oil firing	—
Union Camp Corporation	SC	1900-0046	01-May-89	265 TPD CaO	0.100	—	ESP	—
James River Corporation	WA	PSD-88-3	14-Feb-89	—	0.130	—	Venturi Scrubber, Oil firing	—
Mead Coated Board	AL	211-0004	01-Oct-88	1,200 TPD ADP	0.070	15.9	ESP, Oil firing	99.40%
Willamette Industries	SC	1680-0043	29-Sep-88	220 TPD CaO	0.054	—	ESP	99.30%
Consolidated Papers, Inc.	WI	86-AJH-001	14-Jan-87	300 TPD CaO	0.067	—	Venturi Scrubber, Oil firing	—
Brunswick Pulp & Paper Co.	GA	2931-063-9072	31-Jan-86	1,060 TPD Lime Mud	0.130	—	Scrubber, NSPS, Oil firing	99.30%

\* Corrected to 10% O2.

Table 6-7. Summary of BACT Determinations for NOx Emissions from Lime Kilns in Kraft Pulp Mills

Company Name	State	Permit Number	Permit Issued Date	Lime Kiln Throughput	NOx Emission Limit			Comments
					(ppm)	(lb/hr)	(lb/T CaO)	
Alabama River Pulp Co.	AL	106-0010	22-Jan-90	465 TPD CaO	100 ppmv 10%O2	30.1	1.55	—
Weyerhaeuser Company	MS	1680-00044	24-Oct-89	504 TPD CaO	300 ppmv 3.6%O2	60.9	2.90	Process Control
Boise Cascade Corporation	ME	A214-71-EA/R	18-Jul-89	327 TPD CaO	—	52.0	3.82	—
Champion International	AL	707-0001	18-Jul-89	300 TPD CaO	175 ppmv 10%O2	29.8	2.38	—
Nekoosa Papers, Inc.	AR	946-A	14-Jul-89	440 TPD CaO	—	66.5	3.63	Burner Design
Boise Cascade Corporation	MN	102A-89-OT-2	12-May-89	230 TPD CaO	220 ppm	42.5	4.43	—
Union Camp Corporation	SC	1900-0046	01-May-89	265 TPD CaO	—	—	—	Design & Operation
James River Corporation	WA	PSD-88-3	14-Feb-89	—	—	53.4	—	—
Mead Coated Board	AL	211-0004	01-Oct-88	1,200 TPD ADP	336 ppmv 10%O2	—	—	—
Willamette Industries	SC	1680-0043	29-Sep-88	220 TPD CaO	—	35.0	3.82	Design & Operation
Consolidated Papers, Inc.	WI	86-AJH-001	14-Jan-87	300 TPD CaO	240 ppmv	29.8	2.38	—

Table 6-8. Summary of BACT Determinations for CO Emissions from Lime Kilns Kraft Pulp Mills

Company Name	State	Permit Number	Permit Issued Date	Lime Kiln Throughput	CO Emission Limit			Comments
					(ppm)	(lb/hr)	(lb/T CaO)	
Alabama River Pulp Co.	AL	106-0010	22-Jan-90	465 TPD CaO	52 ppmv 10%O2	9.5	0.49	—
Weyerhaeuser Company	MS	1680-00044	24-Oct-89	504 TPD CaO	—	550.0	26.19	Process Control, SIP
Boise Cascade Corporation	ME	A214-71-EA/R	18-Jul-89	327 TPD CaO	—	39.0	2.86	—
Champion International	AL	707-0001	18-Jul-89	300 TPD CaO	200 ppmv 10%O2	20.8	1.66	—
Nekoosa Papers, Inc.	AR	946-A	14-Jul-89	440 TPD CaO	—	55.0	3.00	Proper Kiln Oper
Boise Cascade Corporation	MN	102A-89-OT-2	12-May-89	230 TPD CaO	240 ppm	23.7	2.47	Combustion Control
Union Camp Corporation	SC	1900-0046	01-May-89	265 TPD CaO	—	—	0.10 +	Design & Operation
James River Corporation	WA	PSD-88-3	14-Feb-89	—	—	408.4	—	—
Mead Coated Board	AL	211-0004	01-Oct-88	1,200 TPD ADP	52 ppmv 10%O2	—	—	—
Willamette Industries	SC	1680-0043	29-Sep-88	220 TPD CaO	—	3.5	0.38	Design & Operation
Consolidated Papers, Inc.	WI	86-AJH-001	14-Jan-87	300 TPD CaO	220 ppmv 10%O2	28.2	2.26	—

+ pounds per ton of ADP (air dried pulp).



Table 6-9. Summary of BACT Determinations for VOC Emissions from Lime Kilns in Kraft Pulp Mills

Company Name	State	Permit Number	Permit Issued Date	Lime Kiln Throughput	VOC Emission Limit			Comments
					(ppm)	(lb/hr)	(lb/T CaO)	
Alabama River Pulp Co.	AL	106-0010	22-Jan-90	465 TPD CaO	78.0 ppmv 10%O <sub>2</sub>	--	--	--
Weyerhaeuser Company	MS	1680-00044	24-Oct-89	504 TPD CaO	--	21.0	1.00	Max Combustion Eff., SIP
Boise Cascade Corporation	ME	A214-71-EA/R	18-Jul-89	327 TPD CaO	--	2.0	0.15	--
Champion International	AL	707-0001	18-Jul-89	300 TPD CaO	31 ppmv 10%O <sub>2</sub>	9.8	0.78	--
Boise Cascade Corporation	MN	102A-89-OT-2	12-May-89	230 TPD CaO	185 ppm	11.4	1.19	Combustion Control
Union Camp Corporation	SC	1900-0046	01-May-89	265 TPD CaO	--	--	--	Design & Operation
James River Corporation	WA	PSD-88-3	14-Feb-89	--	--	10.3	--	LAER
Mead Coated Board	AL	211-0004	01-Oct-88	1,200 TPD ADP	78.0 ppmv 10%O <sub>2</sub>	--	--	--
Willamette Industries	SC	1680-0043	29-Sep-88	220 TPD CaO	--	8.8	0.96	Design & Operation

Previous BACT determinations for NO<sub>x</sub> emissions from lime kilns have ranged from 100 to 336 ppmv at 10 percent O<sub>2</sub>. In terms of lime produced, determinations range from 1.55 to 4.32 lb/ton CaO. The proposed level for LK4 is 50.3 lb/hr, equivalent to 0.37 lb/MMBtu, 290 ppmvd (as NO<sub>2</sub>), and 2.59 lb/ton CaO. At an actual flue gas O<sub>2</sub> level of 4 percent, this would equate to 188 ppmvd, corrected to 10 percent O<sub>2</sub>. At an actual flue gas O<sub>2</sub> level of 8 percent, this would equate to 245 ppmvd, corrected to 10 percent O<sub>2</sub>. These corrected concentrations compare favorably with the previous BACT determinations.

For CO, previous BACT determinations have ranged from 52 to 240 ppmvd at 10 percent O<sub>2</sub> and from 0.48 to 26.16 lb/ton CaO. The proposed emission level for LK4 is 7.3 lb/hr, based on the AP-42 factor of 0.1 lb/ton ADUP. This is equivalent to 0.174 lb/ton CaCO<sub>3</sub> input to the kiln and 0.38 lb/ton CaO produced. Based on the kiln flue gases, this would result in the following:

- 44 ppmv
- 69 ppmvd
- 45 ppmvd at 10 percent O<sub>2</sub>
- 58 ppmvd at 10 percent O<sub>2</sub>

These CO concentration levels are near the lower end of the range of previous BACT determinations.

For VOC, previous BACT determinations have ranged from 31 to 185 ppmvd at 10 percent O<sub>2</sub> and from 0.24 to 1.2 lb/ton CaO. The proposed emission level for LK4 is 17.7 lb/hr, based on the NCASI factor of 0.13 lb/10<sup>6</sup> Btu heat input. This is equivalent to 0.427 lb/ton CaCO<sub>3</sub> input to the kiln and 0.91 lb/ton CaO produced. Based on the kiln flue gases, this would result in the following:

- 188 ppmv
- 294 ppmvd
- 190 ppmvd at 10 percent O<sub>2</sub>
- 249 ppmvd at 10 percent O<sub>2</sub>

These VOC concentration levels are within the range of previous BACT determinations.

## 7.0 ADDITIONAL IMPACT ANALYSIS

### 7.1 IMPACTS ON SOILS AND VEGETATION

As described in the air quality impact analysis, maximum concentrations in the vicinity of G-P are predicted to be below the PM10 AAQS. In addition, the increase in NO<sub>x</sub> and CO emissions is predicted to result in an insignificant impact. As a result, no detrimental effects on soils or vegetation should occur in the area.

### 7.2 IMPACTS ON VISIBILITY

The visibility analysis required by PSD regulations is directed primarily toward Class I areas. The nearest Class I area to the proposed facility is the Okefenokee National Wildlife Refuge, located more than 100 km from the G-P facility. As a result, no adverse impacts on the Class I area should occur.

G-P is proposing to modify several existing sources and increase emissions from these sources. Currently, these sources are in compliance with opacity regulations and should remain in compliance after the modification. As a result, no adverse impacts upon visibility are expected.

### 7.3 IMPACTS DUE TO ASSOCIATED POPULATION GROWTH

There will be a small, temporary increase in the number of workers during construction. There will be a minimal increase in permanent employment at G-P as a result of modifying the three existing sources. As a result, there will be no permanent impacts on air quality caused by associated population growth.

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**APPENDIX A**

**CALCULATION OF CURRENT ACTUAL EMISSIONS**

**No. 4 Recovery Boiler**

**No. 4 Smelt Dissolving Tank**

**No. 4 Lime Kiln**

No. 4 Recovery Boiler/No. 4 Smelt Dissolving Tank  
Historic Operating Data

Year	Operating Hours (hr/yr)	Black Liquor at 65% Solids (tons/yr)
1984	8,470	1,052,440
1985	8,620	1,051,098
1986	8,328	1,046,098
1987	8,336	1,083,880
1988	8,554	1,137,148
1989	8,663	1,167,271
1990	8,263	1,133,292

No. 4 Lime Kiln  
Historic Operating Data

Year	CaCO <sub>3</sub> (tons/yr)	CaO (tons/yr)	Operating Hours (hr/yr)
1985		120,450	8,736
1986	255,263	108,699	8,178
1987	258,280	108,351	7,904
1988	253,046	108,864	8,064
1989	306,569	118,498	8,439
1990	292,156	111,638	8,046

Digester System  
Historic Operating Data

Air-Dried Unbleached Pulp (tons/yr)
486,853
456,893
473,081
485,716
498,795
529,869
509,377



Current Actuals

I. No. 4 Recovery Boiler

A. PM(TSP)

From annual operation data, based on stack test data and annual operating hours:

$$1989--46.0 \text{ lb/hr} \times 8,663 \text{ hr/yr} + 2,000 \text{ lb/ton} = 199.2 \text{ TPY}$$

$$1990--33.8 \text{ lb/hr} \times 8,263 \text{ hr/yr} + 2,000 \text{ lb/ton} = \underline{139.6 \text{ TPY}}$$

$$\text{Average} = 169.4 \text{ TPY}$$

B. PM10

Based on AP-42, Section 10.1, for nondirect contact recovery boiler with ESP: 75% of PM is PM10.

$$169.4 \text{ TPY} \times 0.75 = 127.1 \text{ TPY}$$

C. SO<sub>2</sub>

Based on continuous SO<sub>2</sub> monitoring data and hours of operation. Ideal gas law is used to calculate emissions:

$$PV = mRT$$

$$m = PV/RT$$

1989: Stack test - 10,683,110 dscf/hr

Average SO<sub>2</sub> = 9.4 ppm

$$m = \frac{2,116.8 \text{ lb}}{\text{ft}^2} \times \frac{10,683,110 \text{ ft}^3}{\text{hr}} \times \frac{64 \text{ lb}_m \cdot \text{ }^\circ\text{R}}{1,545 \text{ ft} \cdot \text{lb}_f} \times \frac{1}{528^\circ\text{R}} \times \frac{9.4}{10^6}$$

$$= 16.7 \text{ lb/hr}$$

$$16.7 \text{ lb/hr} \times 8,663 \text{ hr/yr} + 2,000 \text{ lb/ton} = 72.3 \text{ TPY}$$

1990: Stack test - 11,935,964 dscf/hr

Average SO<sub>2</sub> = 7.0 ppm

$$m = 2,116.8 \times 11,935,964 \times 64/1,545 + 528 \times 7.0/10^6$$
$$= 13.9 \text{ lb/hr}$$

$$13.9 \text{ lb/hr} \times 8,263 \text{ hr/yr} + 2,000 = 57.4 \text{ TPY}$$

$$1989-1990 \text{ Average} = (72.3 + 57.4) / 2 = 64.9 \text{ TPY}$$

D. NO<sub>x</sub>

From 1980 NCASI paper on NO<sub>x</sub> emissions, three nondirect contact recovery boilers averaged 1.95 lb/ton ADUP.

Black liquor fired in No. 4 Recovery Boiler

1989--1,167,271 tons BL  
1990--1,133,292 tons BL  
Average--1,150,282 tons BL

Black liquor is approximately 65% solids:

$$1,150,282 \text{ tons} \times 0.65 \times 2,000 \text{ lb/ton} = 1.495 \times 10^9 \text{ lb/yr BLS}$$

Equivalent pulp production based on mill factor of  
3,050 lb BLS/ton ADUP:

$$1.495 \times 10^9 \text{ lb/yr} + 3,050 \text{ lb/ton} \\ = 490,164 \text{ tons ADUP}$$

$$\text{NO}_x = 490,164 \text{ tons ADUP} \times 1.95 \text{ lb/ton} + 2,000 \text{ lb/ton} = 477.9 \text{ TPY}$$

Very limited  $\text{NO}_x$  test data were obtained recently for RB4.

RB4 Test Data: average 75 ppmvd

Average flow rate (1989-1990) = 11,309,537 dscf/hr

$$m = 2,116.8 \times 11,309,537 \times 46/1,545 + 528 \times 75/10^6 \\ = 101.2 \text{ lb/hr}$$

$$\text{Average operating hours (1989-1990)} = (8,663 + 8,263) + 2 = 8,463 \text{ hr/yr}$$

$$\text{Average annual emissions} = 101.2 \text{ lb/hr} \times 8,463 + 2,000 = 428.2 \text{ TPY}$$

This figure is very close to figure based on AP-42; therefore, use  
emissions based on AP-42 factor: 477.9 TPY

E. CO

Emission factor from AP-42, Table 10.1-1: 11 lb/ton ADUP

$$490,164 \text{ tons ADUP} \times 11 \text{ lb/ton} + 2,000 = 2,695.9 \text{ TPY}$$

Limited test data from RB4 indicates an average of 600 ppmvd  
for CO.

$$m = 2,116.8 \times 11,309,537 \times 28/1,545 + 528 \times 600/10^6 \\ = 493.0 \text{ lb/hr}$$

$$\text{Average annual emissions} = 493.0 \text{ lb/hr} \times 8,463 + 2,000 \\ = 2,086.1 \text{ TPY}$$

Since this emission rate is somewhat lower than AP-42 would  
indicate, the lower emissions were used.

F. VOC

Based on NCASI Technical Bulletin No. 112, February 1981, three nondirect contact recovery boilers were tested. VOC emissions averaged 0.26 lb/1000 lb BLS fired.

$$1.495 \times 10^9 \text{ lb/yr BLS} \times 0.26 \text{ lb/1000 lb BLS} + 2,000 = 194.4 \text{ TPY}$$

G. Trace Metals

From "Application of Combustion Modifications to Industrial Combustion Equipment," EPA-600/7-79-015a. Represents one test from recovery boiler. Beryllium emissions based on G-P data.

1. Lead

Factor is 3,900 lb/10<sup>12</sup> dscf

No. 4 Recovery Boiler gas flow rate from stack tests conducted on 2/28/89 and 2/26/90:

$$1989--10,683,110 \text{ dscf/hr} \times 3,900 \text{ lb/10}^{12} \text{ dscf} = 0.042 \text{ lb/hr}$$
$$0.042 \text{ lb/hr} \times 8,663 \text{ hr/yr} + 2,000 = 0.182 \text{ TPY}$$

$$1990--11,935,964 \text{ dscf/hr} \times 3,900/10^{12} = 0.047 \text{ lb/hr}$$
$$0.047 \text{ lb/hr} \times 8,263 + 2,000 = 0.194 \text{ TPY}$$

$$\text{Average--}(0.182 + 0.194) + 2 = 0.19 \text{ TPY}$$

2. Mercury

Below detectable limits.

3. Beryllium

G-P has tested the ESP ash from RB4 for Be content. The ash had a Be content of 0.7 ppm. This is considered as a good estimate of the Be content of the PM leaving the ESP.

From PM(TSP) calculations, annual emissions are 169.4 TPY. Therefore, Be emissions are 169.4 TPY x 0.7/10<sup>6</sup> = 0.00012 TPY

4. Fluorides

Below detectable limits.

H. Sulfuric Acid Mist

Based on NCASI Technical Bulletin No. 106, April 1980. Average sulfuric acid concentration in exhaust gases of recovery boiler are reported as 0.81 ppm. Calculate based on flow rates and ideal gas law.

$$1989--398,178 \text{ acfm} \times 60 \text{ min/hr} \times 2,116.8 \times 98/1,545 \times 1/866^{\circ}\text{R}$$
$$\times 0.81/10^6 = 3.00 \text{ lb/hr}$$
$$3.00 \text{ lb/hr} \times 8,663 + 2,000 = 13.0 \text{ TPY}$$

$$\begin{aligned} 1990--396,919 \times 60 \times 2,116.8 \times 98/1,545 \times 1/857 \times 0.81/10^6 \\ = 3.02 \text{ TPY} \\ 3.02 \text{ lb/hr} \times 8,263 + 2,000 = 12.5 \text{ TPY} \end{aligned}$$

$$\text{Average--}(13.0 + 12.5) + 2 = 12.8 \text{ TPY}$$

I. TRS

Actual emissions based on continuous TRS monitoring and gas flow rates, similar to SO<sub>2</sub> calculations:

$$1989--\text{Average TRS} = 1.6 \text{ ppm}$$

$$\begin{aligned} m = 2,116.8 \times 10,683,110 \times 34/1,545 \times 1/528 \times 1.6/10^6 \\ = 1.51 \text{ lb/hr} \end{aligned}$$

$$1.51 \text{ lb/hr} \times 8,663 + 2,000 = 6.5 \text{ TPY}$$

$$1990--\text{Average TRS} = 2.3 \text{ ppm}$$

$$\begin{aligned} m = 2,116.8 \times 11,935,964 \times 34/1,545 \times 1/528 \times 2.3/10^6 \\ = 2.42 \text{ lb/hr} \end{aligned}$$

$$2.42 \text{ lb/hr} \times 8,263 + 2,000 = 10.0 \text{ TPY}$$

$$\text{Average: } (6.5 + 10.0) + 2 = 8.3 \text{ TPY}$$

II. No. 4 Smelt Dissolving Tank

A. PM(TSP)

From annual operating data, based on stack test and operating hours:

$$1989--9.88 \text{ lb/hr} \times 8,663 \text{ hr/yr} + 2,000 = 42.8 \text{ TPY}$$

$$1990--6.43 \text{ lb/hr} \times 8,263 \text{ hr/yr} + 2,000 = \underline{26.6 \text{ TPY}}$$

$$\text{Average} = 34.7 \text{ TPY}$$

B. PM10

No. 4 Smelt Dissolving Tank is controlled by wet scrubber. Based on AP-42, Table 10.1-7, PM10 is 89.5% of PM emissions.

$$34.7 \text{ TPY} \times 0.895 = 31.1 \text{ TPY}$$

C. SO<sub>2</sub>

AP-42 factor is 0.2 lb/ton ADUP, uncontrolled.

SO<sub>2</sub> control for the wet scrubber is estimated at 50%.

$$\begin{aligned} \text{Total SO}_2 \text{ emissions} &= 490,164 \text{ tons} \times 0.2 \text{ lb/ton} \times 0.5 + 2,000 \\ &= 24.5 \text{ TPY} \end{aligned}$$

- D. TRS  
Based on recent stack test and operating hours for 1989 and 1990.  
1989--1.26 lb/hr x 8,663 + 2,000 = 5.5 TPY  
1990--1.26 lb/hr x 8,263 + 2,000 = 5.2 TPY  
Average = 5.3 TPY

III. No. 4 Lime Kiln

- A. PM(TSP)  
From Annual Operating Reports, based on stack tests and hours of operation:  
  
1989--20.88 lb/hr x 8,439 hr/yr + 2,000 = 88.1 TPY  
1990--24.08 lb/hr x 8,046 hr/yr + 2,000 = 96.9 TPY  
Average = 92.5 TPY
- B. PM10  
No. 4 Lime Kiln has a Venturi scrubber for PM control. According to AP-42, Table 10.1-4, PM10 is 98.3% of PM emissions.  
  
92.5 TPY x 0.983 = 90.9 TPY
- C. SO<sub>2</sub>  
AP-42 factor (Table 10.1-1) is 0.3 lb/ton ADUP for an uncontrolled lime kiln. Wet scrubber is conservatively estimated to achieve 50% SO<sub>2</sub> removal. Based on equivalent pulp production from No. 4 Lime Kiln:  
  
Average 1989-1990--115,068 tons CaO + 0.24 tons CaO/ton ADUP  
= 479,450 tons ADUP  
479,450 tons ADUP x 0.3 lb/ton x 0.5 + 2,000 = 36.0 TPY
- D. NO<sub>x</sub>  
Based on NCASI Technical Bulletin No. 107, April 1980: average emission factor for four lime kilns tested burning oil was 0.37 lb/10<sup>6</sup> Btu.  
  
Average heat input to lime kiln:  
1989--5,325,000 gal x 145,780 Btu/gal = 7.76 x 10<sup>11</sup> Btu  
1990--5,677,700 gal x 145,780 Btu/gal = 8.28 x 10<sup>11</sup> Btu  
Average = 8.02 x 10<sup>11</sup> Btu  
  
NO<sub>x</sub> = 8.02 x 10<sup>11</sup> Btu x 0.37 lb/10<sup>6</sup> Btu + 2,000 = 148.4 TPY
- E. CO  
AP-42 factor is 0.1 lb/ton (Table 10.1-1).  
479,450 tons ADUP x 0.1 lb/ton + 2,000 = 24.0 TPY

F. VOC

Based on NCASI Technical Bulletin No. 358, September 1981:  
average emission factor for three lime kilns was 0.13 lb/10<sup>6</sup> Btu

$$\text{VOC} = 8.02 \times 10^{11} \text{ Btu} \times 0.13 \text{ lb}/10^6 \text{ Btu} + 2,000 = 52.1 \text{ TPY}$$

G. TRS

From stack tests and TRS monitor data:

1989--Average TRS = 6.3 ppm

$$2,116.8 \times 1,360,206 \text{ dscf/hr} \times 34/1,545 \times 1/528 \times 6.3/10^6 \\ = 0.76 \text{ lb/hr}$$

$$0.76 \text{ lb/hr} \times 8,439 \text{ hr/yr} + 2,000 = 3.2 \text{ TPY}$$

1990--Average TRS = 7.0 ppm

$$2,116.8 \times 1,462,763 \text{ dscf/hr} \times 34/1,545 \times 1/528 \times 7.0/10^6 \\ = 0.90 \text{ lb/hr}$$

$$0.90 \text{ lb/hr} \times 8,046 \text{ hr/yr} + 2,000 = 3.6 \text{ TPY}$$

**APPENDIX B**

**FUTURE MAXIMUM EMISSIONS**

**No. 4 Recovery Boiler**

**No. 4 Smelt Tank**

**No. 4 Lime Kiln**

I. No. 4 Recovery Boiler

A. PM(TSP)

Maximum emissions based on NSPS of 0.044 gr/dscf at 8% O<sub>2</sub>.

Maximum air flow from boiler: 210,000 dscfm at 2.8% O<sub>2</sub>.

Equate maximum level at 8% O<sub>2</sub> to actual O<sub>2</sub>.

$$C_{\text{corr}} = C_{\text{act}} [(21-x)/(21-y)]$$

$$x = \text{corrected O}_2 = 8\%$$

$$y = \text{actual O}_2 = 2.8\%$$

$$C_{\text{corr}} = C_{\text{act}} [(21-8)/(21-2.8)]$$

$$= 0.714 C_{\text{act}}$$

$$C_{\text{act}} = 1.40 C_{\text{corr}}$$

$$C_{\text{act}} = 1.40 (0.044) = 0.0616 \text{ gr/dscf at } 2.8\% \text{ O}_2$$

$$1.40 (0.044) = 0.0616$$

$$\text{PM} = \frac{210,000 \text{ ft}^3}{\text{min}} \times \frac{0.0616 \text{ gr}}{\text{ft}^3} \times \frac{1 \text{ lb}}{7,000 \text{ gr}} \times \frac{60 \text{ min}}{\text{hr}} = 110.9 \text{ lb/hr}$$

83.2 lb/hr, 364.4 TPY

$$110.9 \text{ lb/hr} \times 8,760 \text{ hr/yr} + 2,000 \text{ lb/ton} = 485.7 \text{ TPY}$$

B. PM10

To be conservative, PM10 emissions are assumed equal to PM(TSP) emissions.

C. SO<sub>2</sub>

Annual SO<sub>2</sub> emissions will be limited to 75 ppm (dry) at 8% O<sub>2</sub>.

Actual flow from boiler = 210,000 dscfm at 2.8% O<sub>2</sub>.

Equate maximum level at 8% O<sub>2</sub> to actual O<sub>2</sub>.

$$C_{\text{corr}} = C_{\text{act}} [(21-x)/(21-y)]$$

$$x = \text{corrected O}_2 = 8\%$$

$$y = \text{actual O}_2 = 2.8\%$$

$$C_{\text{corr}} = C_{\text{act}} [(21-8)/(21-2.8)]$$

$$= 0.714 C_{\text{act}}$$

$$C_{\text{act}} = 1.40 C_{\text{corr}}$$

$$C_{\text{act}} = 1.40 (75.0) = 105.0 \text{ ppmvd at } 2.8\% \text{ O}_2$$

$$37.5 = 52.5$$

$$m = PV/RT$$

$$\text{SO}_2 = \frac{2,116.8 \text{ lb}_f}{\text{ft}^2} \times \frac{210,000 \text{ ft}^3}{\text{min}} \times \frac{105.0}{10^6} \times \frac{64 \text{ lb}_m \cdot ^\circ\text{R}}{1,545 \text{ ft} \cdot \text{lb}_f} \times \frac{1}{528^\circ\text{R}} \times \frac{60 \text{ min}}{\text{hr}}$$

52.5



$$= 219.7 \text{ lb/hr}$$

$$219.7 \text{ lb/hr} \times 8,760 + 2,000 = 962.3 \text{ TPY}$$

- D.  $\text{NO}_x$   
Annual  $\text{NO}_x$  emissions will be limited to 100 ppmvd at 8%  $\text{O}_2$ .  
Calculation is similar to that for  $\text{SO}_2$ .

$$C_{\text{act}} = 1.40 (100.0) = 140.0 \text{ ppmvd at } 2.8\% \text{ O}_2$$

$$\begin{aligned} \text{NO}_x &= 2,116.8 \times 210,000 \times 140.0/10^6 \times 46/1,545 \times 1/528 \times 60 \\ &= 210.6 \text{ lb/hr} \end{aligned}$$

$$210.6 \text{ lb/hr} \times 8,760 + 2,000 = 922.4 \text{ TPY.}$$

- E. CO  
Annual CO emissions will be limited to 400 ppmvd at 8%  $\text{O}_2$ .

$$C_{\text{act}} = 1.40 (400.0) = 560 \text{ ppmvd at } 2.8\% \text{ O}_2$$

$$\begin{aligned} \text{CO} &= 2,116.8 \times 210,000 \times 560/10^6 \times 28/1,545 \times 1/528 \times 60 \\ &= 512.7 \text{ lb/hr} \end{aligned}$$

$$512.7 \text{ lb/hr} \times 8,760 + 2,000 = 2,245.6 \text{ TPY.}$$

For modeling purposes, maximum hourly CO emissions are estimated at twice the average emissions, or 800 ppmvd at 8%  $\text{O}_2$  and 1,025.4 lb/hr.

- F. VOC  
Factor is 0.26 lb/1,000 lb BLS fired  
Maximum =  $210,000 \times 0.26/1,000 = 54.6 \text{ lb/hr}$   
Annual Average =  $54.6 \text{ lb/hr} \times 8,760 + 2,000 = 239.1 \text{ TPY}$

- G. Trace Metals  
From "Application of Combustion Modifications to Industrial Combustion Equipment," EPA-600/7-79-015a. Represents one test from recovery boiler. Be emissions based on G-P data.

1. Lead  
Factor is  $3,900 \text{ lb}/10^{12} \text{ dscf}$

$$\begin{aligned} &\text{Maximum flow rate equal to } 12,600,000 \text{ dscf/hr} \\ \text{Proposed emissions} &= 12,600,000 \text{ dscf/hr} \times 3,900 \text{ lb}/10^{12} \text{ dscf} \\ &= 0.049 \text{ lb/hr} \\ &0.049 \text{ lb/hr} \times 8,760 \text{ hr/yr} + 2,000 \text{ lb/ton} \\ &= 0.21 \text{ TPY} \end{aligned}$$

2. Mercury  
Below detectable limits

3. Beryllium  
G-P has tested ESP ash for Be and found it contains  
0.7 ppm Be. Based on maximum PM(TSP) emissions, maximum Be  
emissions are calculated as follows:

$$110.9 \text{ lb/hr} \times 0.7/10^6 = 0.000078 \text{ lb/hr}$$

$$0.000078 \text{ lb/hr} \times 8,760 + 2,000 = 0.00034 \text{ TPY}$$

4. Fluorides  
Below detectable limits

H. Sulfuric Acid Mist  
Based on NCASI Technical Bulletin No. 106, H<sub>2</sub>SO<sub>4</sub> is 0.81 ppm in  
stack gases. Maximum actual flow rate for RB4 is 427,560 acfm.

$$\frac{427,560 \text{ ft}^3}{\text{min}} \times \frac{60 \text{ min}}{\text{hr}} \times \frac{2,116.8 \text{ lb}_f}{\text{ft}^2} \times \frac{98 \text{ lb}_m\text{-}^\circ\text{R}}{1,545 \text{ ft-lb}_f} \times \frac{1}{860^\circ\text{R}} \times \frac{0.81}{10^6}$$

$$= 3.24 \text{ lb/hr}$$

$$3.24 \text{ lb/hr} \times 8,760 + 2,000 = 14.2 \text{ TPY}$$

I. TRS  
Maximum emissions will be 17.5 ppm (dry) at 8% O<sub>2</sub>.  
Maximum flow from boiler = 210,000 dscfm at 2.8% O<sub>2</sub>.  
Equate maximum level at 8% O<sub>2</sub> to actual O<sub>2</sub>.

$$C_{\text{corr}} = C_{\text{act}}[(21-x)/(21-y)]$$

x = corrected O<sub>2</sub> = 8%  
y = actual O<sub>2</sub> = 2.8%

$$C_{\text{corr}} = C_{\text{act}}[(21-8)/(21-2.8)]$$

$$= 0.714 C_{\text{act}}$$

$$C_{\text{act}} = 1.40 C_{\text{corr}}$$

$$C_{\text{act}} = (1.40)(17.5) = 24.5 \text{ ppm}$$

$$m = PV/RT$$

$$\text{TRS} = \frac{2,116.8 \text{ lb}_f}{\text{ft}^2} \times \frac{210,000 \text{ ft}^3}{\text{min}} \times \frac{24.5}{10^6} \times \frac{34 \text{ lb}_m\text{-}^\circ\text{R}}{1,545 \text{ ft-lb}_f} \times \frac{1}{528^\circ\text{R}} \times \frac{60 \text{ min}}{\text{hr}}$$

$$= 27.2 \text{ lb/hr}$$

$$27.2 \text{ lb/hr} \times 8,760 + 2,000 = 119.1 \text{ TPY}$$

II. No. 4 Smelt Dissolving Tank

A. PM(TSP)

Maximum based on process weight table:  $E = 17.31 P^{0.16}$

Maximum smelt input = 85,890 lb/hr = 42.95 TPH

$E = 17.31 (42.95)^{0.16} = 31.6 \text{ lb/hr}$

$31.6 \text{ lb/hr} \times 8,760 + 2,000 = 138.4 \text{ TPY}$

B. PM10

PM10 is 89.5% of PM emissions.

$31.6 \text{ lb/hr} \times 0.895 = 28.3 \text{ lb/hr}$

$138.4 \text{ TPY} \times 0.895 = 123.9 \text{ TPY}$

C. SO<sub>2</sub>

Factor is 0.2 lb/ton ADUP and 50% control with scrubber

Equivalent pulp production = 210,000 lb/hr BLS + 3,050 lb/ton  
= 68.85 tons/hr ADUP

Maximum =  $68.85 \text{ tons/hr} \times 0.2 \text{ lb/ton} \times 0.50 = 6.9 \text{ lb/hr}$

Annual =  $6.9 \text{ lb/hr} \times 8,760 + 2,000 = 30.2 \text{ TPY}$

D. TRS

Based on emission regulation of 0.0480 lb/3,000 lb BLS

$210,000 \text{ lb/hr BLS} \times 0.0480/3,000 = 3.36 \text{ lb/hr}$

$3.36 \text{ lb/hr} \times 8,760 + 2,000 = 14.7 \text{ TPY}$

III. No. 4 Lime Kiln

A. PM(TSP)

Maximum emissions will not exceed current allowable--31.42 lb/hr; 137.24 TPY

B. PM10

PM10 is 98.3% of PM emissions

$31.42 \text{ lb/hr} \times 0.983 = 30.9 \text{ lb/hr}$

$137.24 \text{ TPY} \times 0.983 = 134.9 \text{ TPY}$

C. SO<sub>2</sub>

Based on AP-42 factor of 0.3 lb/ton ADUP, with 50% control with scrubber.

Equivalent pulp production:

$19.44 \text{ tons/hr} \times 0.90 + 0.24 \text{ tons CaO/ton ADUP} = 72.9 \text{ tons/hr ADUP}$   
= 638,604 tons/yr

Maximum =  $72.9 \text{ tons/hr} \times 0.3 \text{ lb/ton} \times 0.50 = 10.9 \text{ lb/hr}$

$638,604 \text{ tons/yr} \times 0.3 \times 0.5 + 2,000 = 47.9 \text{ TPY}$

D. NO<sub>x</sub>

Based on emission factor of 0.37 lb/10<sup>6</sup> Btu

Maximum =  $136 \times 10^6 \text{ Btu/hr} \times 0.37/10^6 = 50.3 \text{ lb/hr}$

$50.3 \text{ lb/hr} \times 8,760 + 2,000 = 220.3 \text{ TPY}$

E. CO  
AP-42 factor is 0.1 lb/ton  
Maximum = 72.9 tons/hr x 0.1 lb/ton = 7.3 lb/hr  
7.3 lb/ton x 8,760 + 2,000 = 32.0 TPY

F. VOC  
Based on emission factor of 0.13 lb/10<sup>6</sup> Btu  
Maximum = 136x10<sup>6</sup> Btu/hr x 0.13 lb/10<sup>6</sup> Btu = 17.7 lb/hr  
17.7 lb/hr x 8,760 + 2,000 = 77.5 TPY

G. TRS  
Maximum emissions will be 20 ppm (dry) at 10% O<sub>2</sub>.  
Actual flow from lime kiln = 24,200 dscfm at 4.0% O<sub>2</sub>.  
Equate maximum level at 10% O<sub>2</sub> to actual O<sub>2</sub>:

$$C_{\text{corr}} = C_{\text{act}} [(21-x)/(21-y)]$$

x = corrected O<sub>2</sub> = 10%  
y = actual O<sub>2</sub> = 4%

$$C_{\text{corr}} = C_{\text{act}} [(21-10)/(21-4)]$$
$$= 0.647 C_{\text{act}}$$

$$C_{\text{act}} = 1.55 C_{\text{corr}}$$

$$C_{\text{act}} = (1.55)(20) = 31.0 \text{ ppm}$$
$$m = PV/RT$$

$$\text{TRS} = \frac{2,116.8 \text{ lb}_f}{\text{ft}^2} \times \frac{24,200 \text{ ft}^3}{\text{min}} \times \frac{31.0}{10^6} \times \frac{34 \text{ lb}_m \cdot ^\circ\text{R}}{1,545 \text{ ft} \cdot \text{lb}_f} \times \frac{1}{528^\circ\text{R}} \times \frac{60 \text{ min}}{\text{hr}}$$

$$= 4.0 \text{ lb/hr}$$

$$4.0 \text{ lb/hr} \times 8,760 + 2,000 = 17.5 \text{ TPY}$$

**APPENDIX C**

**NET INCREASE IN ACTUAL EMISSIONS**

NET INCREASE IN ACTUAL EMISSIONS

I. No. 4 Recovery Boiler

A. PM(TSP)

Based on improved firing in recovery boiler and repairs and upgrade of the electrostatic precipitator, there will be no increase in actual PM(TSP) or PM10 emissions, even at the increased production rate. Provided below are the results of the last three compliance tests conducted on the boiler.

<u>Date</u>	<u>PM(TSP)</u> <u>(lb/hr)</u>
3/2/88	56.9
	16.4
	<u>19.7</u>
Average	31.0
2/28/89	57.6
	48.4
	<u>32.1</u>
Average	46.0
2/26/90	29.3
	57.2
	<u>15.0</u>
Average	33.8

B. PM10

As in the case of PM(TSP), there will be no increase in PM10 emissions.

C. SO<sub>2</sub>

It is not expected that actual SO<sub>2</sub> emissions from the No. 4 Recovery Boiler will change from the current level. The boiler vendor actually predicts a decrease in SO<sub>2</sub> emissions. To be conservative, an increase in SO<sub>2</sub> is calculated based on the current ppm level and the increase in air flow through the boiler.

Current average SO<sub>2</sub> level; 1989-1990: (9.4 + 7.0) ÷ 2 = 8.2 ppm  
 Future flow through boiler = 210,000 dscfm  
 Future actual SO<sub>2</sub> emissions:

$$SO_2 = \frac{2.116.8 \text{ lb}_f}{\text{ft}^2} \times \frac{210,000 \text{ ft}^3}{\text{min}} \times \frac{8.2}{10^6} \times \frac{64 \text{ lb}_m \cdot ^\circ\text{R}}{1,545 \text{ ft} \cdot \text{lb}_f} \times \frac{1}{528^\circ\text{R}} \times \frac{60 \text{ min}}{\text{hr}}$$

$$= 17.2 \text{ lb/hr}$$

$$17.2 \text{ lb/hr} \times 8,760 + 2,000 = 75.3 \text{ TPY}$$

Current actual emissions = 64.9 TPY  
Increase in SO<sub>2</sub> = 75.3 - 64.9 = 10.4 TPY

- D. NO<sub>x</sub>  
Equivalent maximum pulp production  
= 210,000 lb/hr BLS x 8,760 hr/yr + 3,050 lb BLS/ton ADUP  
= 603,148 tons/yr ADUP

Increase in pulp production over current actuals:  
603,148 - 490,164 = 112,984 tons/yr ADUP

Emission factor is 1.95 lb/ton ADUP

Increase in NO<sub>x</sub> emissions:  
112,984 tons ADUP x 1.95 lb/ton + 2,000 = 110.2 TPY

- E. CO  
Base increase on increase in air flow through boiler and current actual emissions.

Current actual emissions = 2,086.1 TPY  
Future actual emissions = 2,086.1 x 12,600,000/11,309,537 dscfh  
= 2,324.1 TPY  
Increase = 2,324.1 - 2,086.1 = 238.0 TPY

- F. VOC  
Emission factor is 0.26 lb/1,000 lb BLS  
Increase in BLS fired:  
Current-- 1.495x10<sup>9</sup> lb  
Future-- 1.840x10<sup>9</sup> lb  
Increase-- 0.345 x 10<sup>9</sup> lb

Increase in VOC emissions:  
0.345x10<sup>9</sup> lb/yr x 0.26 lb/1,000 lb BLS + 2,000 = 44.9 TPY

- G. Trace Metals

1. Lead

Emission factor is 3,900 lb/10<sup>12</sup> dscf

Change in air flow:

Current--11,309,537 dscf/hr (1989-1990 average)

Future--12,600,000 dscf/hr

Increase--1,290,463 dscf/hr

1,290,463 x 3,900/10<sup>12</sup> = 0.0050 lb/hr  
0.0050 lb/hr x 8,463 hr/yr + 2,000 = 0.021 TPY

2. Mercury

No emission factor--no increase in emissions.

3. Beryllium  
Base increase on increase in PM(TSP) emissions and Be content of 0.7 ppm. Since there is no increase in actual PM(TSP) emissions, there is no increase in Be emissions.

4. Fluorides  
No emission factor--no increase in emissions.

H. Sulfuric Acid Mist  
Emission factor is 0.81 ppm.

$$1,290,463 \times 2,116.8 \times 0.81/10^6 \times 98/1,545 \times 1/528 = 0.27 \text{ lb/hr}$$
$$0.27 \text{ lb/hr} \times 8,463 \text{ hr/yr} + 2,000 = 1.14 \text{ TPY}$$

I. TRS  
Maximum future TRS emissions will be 17.5 ppm, dry, at 8% O<sub>2</sub>, as required by NSPS. Based on increase in air flow:

$$1,290,463 \times 2,116.8 \times 17.5/10^6 \times 34/1,545 \times 1/528 = 1.99 \text{ lb/hr}$$
$$1.99 \text{ lb/hr} \times 8,463 \text{ hr/yr} + 2,000 = 8.4 \text{ TPY}$$

II. No. 4 Smelt Dissolving Tank

A. PM(TSP)  
PM(TSP) emissions are expected to increase in proportion to increase in capacity.  
PM(TSP) compliance tests were run at the following conditions:

1989--9.9 lb/hr at 189,639 lb BLS/hr  
1990--6.5 lb/hr at 173,130 lb BLS/hr

Average--0.045 lb/1,000 lb BLS  
Increase in BLS fired =  $0.345 \times 10^9$  lb/yr

$$0.345 \times 10^9 \text{ lb/yr} \times 0.045 \text{ lb/1,000 lb} + 2,000 = 7.8 \text{ TPY}$$

B. PM10  
 $7.8 \text{ TPY} \times 0.895 = 7.0 \text{ TPY}$

C. SO<sub>2</sub>  
Emission factor is 0.2 lb/ton ADUP, plus 50% control for wet scrubber.

$$112,984 \text{ ton ADUP} \times 0.2 \text{ lb/ton} \times 0.50 + 2,000 = 5.6 \text{ TPY}$$

D. TRS  
Base increase on proportion of increase in equivalent pulp production. Current actual emissions are 5.3 TPY.  
 $5.3 \text{ TPY} \times 603,148/490,164 = 6.5 \text{ TPY}$

$$\text{Increase} = 6.5 - 5.3 = 1.2 \text{ TPY}$$



III. No. 4 Lime Kiln

A. PM(TSP)

Due to an upgrade of the lime kiln, there will be no increase in PM emissions. Provided below are results of the last three compliance tests conducted on the lime kiln.

	<u>5/26/88</u>	<u>3/20/89</u>	<u>5/31/90</u>
	27.2 lb/hr	19.1 lb/hr	24.1 lb/hr
	28.2 lb/hr	23.4 lb/hr	23.5 lb/hr
	<u>22.3 lb/hr</u>	<u>20.1 lb/hr</u>	<u>24.6 lb/hr</u>
Average	25.9 lb/hr	20.9 lb/hr	24.1 lb/hr

B. PM10

As in the case of PM(TSP), PM10 emissions will not increase.

C. SO<sub>2</sub>

Emissions factor is 0.3 lb/ton, with 50% control for wet scrubber.

Current average lime production = 115,068 tons/yr  
 Future maximum lime production = 19.44 tons/hr = 170,294 tons/yr  
 Increase = 170,294 - 115,068 = 55,226 tons/yr CaO  
 Increase in equivalent pulp  
 = 55,226 tons/yr + 0.24 tons CaO/ton ADUP  
 = 230,108 tons/yr ADUP  
 230,108 tons ADUP x 0.3 lb/ton x 0.50 + 2,000 = 17.3 TPY

D. NO<sub>x</sub>

Emission factor is 0.37 lb/10<sup>6</sup> BTU  
 Current actual heat input = 8.02x10<sup>11</sup> Btu  
 Future maximum heat input = 136 x 10<sup>6</sup> Btu/hr x 8,760 hr/yr  
 = 11.91 x 10<sup>11</sup> Btu  
 Increase is 11.91 - 8.02 = 3.89 x 10<sup>11</sup> Btu

3.89x10<sup>11</sup> Btu x 0.37 lb/10<sup>6</sup> Btu + 2,000 = 72.0 TPY

E. CO

Factor is 0.1 lb/ton ADUP  
 230,108 ton ADUP x 0.1 lb/ton + 2,000 = 11.5 TPY

F. VOC

Factor is 0.13 lb/10<sup>6</sup> Btu  
 3.89x10<sup>11</sup> Btu x 0.13 lb/10<sup>6</sup> Btu + 2,000 = 25.3 TPY

G. TRS

Due to better O<sub>2</sub> Control in kiln, should be no increase in TRS emissions.

Average TRS from last two years:

1989--6.3 ppm

1990--7.0 ppm

**APPENDIX D**

**CALCULATION OF OLD LEVEL OF ACTUAL SO<sub>2</sub> EMISSIONS**

**NO. 4 RECOVERY BOILER**

No. 4 Recovery Boiler - SO<sub>2</sub>

I. 1985

Average SO<sub>2</sub> = 158.6 ppm  
Hours of operation = 8,620 hr/yr  
Air flow during stack test = 10,823,696 dscf/hr

$$\text{SO}_2 = \frac{10,823,696 \text{ ft}^3}{\text{hr}} \times \frac{2,116.8 \text{ lb}_f}{\text{ft}^2} \times \frac{64 \text{ lb}_m\text{-}^\circ\text{R}}{1,545 \text{ ft}\text{-lb}_f} \times \frac{1}{528^\circ\text{R}} \times \frac{158.6}{10^6}$$
$$= 285.1 \text{ lb/hr}$$

$$285.1 \text{ lb/hr} \times 8,620 \text{ hr/yr} + 2,000 = 1,228.8 \text{ TPY}$$

II. 1986

Average SO<sub>2</sub> = 94 ppm  
Hours of operation = 8,328 hr/yr  
Air flow during stack test = 10,973,938 dscf/hr

$$\text{SO}_2 = 10,973,938 \times 2,116.8 \times 64/1,545 \times 1/528 \times 94/10^6$$
$$= 171.3 \text{ lb/hr}$$

$$171.3 \text{ lb/hr} \times 8,328 + 2,000 = 713.3 \text{ TPY}$$

III. Average 1985-1986

$$(1,228.8 + 713.3) + 2 = 971.1 \text{ TPY}$$

**APPENDIX E**

**THRESHOLD SCREENING TECHNIQUE**



State of North Carolina  
Department of Natural Resources and Community Development  
Division of Environmental Management  
512 North Salisbury Street • Raleigh, North Carolina 27611

James G. Martin, Governor  
S. Thomas Rhodes, Secretary

July 22, 1985

R. Paul Wilms  
Director

Mr. Lewis Nagler  
Air Management Branch  
EPA Region IV  
345 Courtland Street  
Atlanta, Georgia 30365

Dear Mr. Nagler:

Subject: A Screening Method for PSD

A simple screening procedure which is applicable to PSD has been developed by the North Carolina Air Quality Section. The "Screening Threshold" method is designed to rapidly and objectively eliminate from the emissions inventory those sources which are beyond the PSD impact area yet within the screening area, but are not likely to have significant interaction with the PSD source. Sources which are flagged by this procedure may then be evaluated with conventional screening techniques, or else be included in refined modeling.

Page I-C-18 of the PSD Workshop Manual does state "A simple screening model technique can be used to justify the exclusion of certain emissions...Such exclusions should be justified and documented." The "Screening Threshold" method is documented in the attachment.

We would very much appreciate your comments and ultimate approval. Please feel free to direct any questions or comments to me in writing or by phone at (919) 733-7015.

Sincerely,

A handwritten signature in cursive script that reads "Eldewins Haynes".

Eldewins Haynes, Meteorologist  
Air Permit Unit

Attachment

cc: Mr. Ogden Gerald  
Mr. Mike Sewell  
Mr. Sammy Amerson  
Mr. Jerry Clayton  
Mr. Richard Laster  
Regional Air Engineers

*Pollution Prevention Pays*

"Screening Threshold" Method for PSD Modeling  
North Carolina Air Quality Section

This method is best suited for situations where a PSD source has several sources outside its impact area, but within its screening area. The object is to find an effective means to minimize the number of such sources in a model, yet to include all sources which are likely to have a significant impact inside the impact area.

As a first-level screening technique, it is suggested to include those sources within the screening area when

$$Q = 20D$$

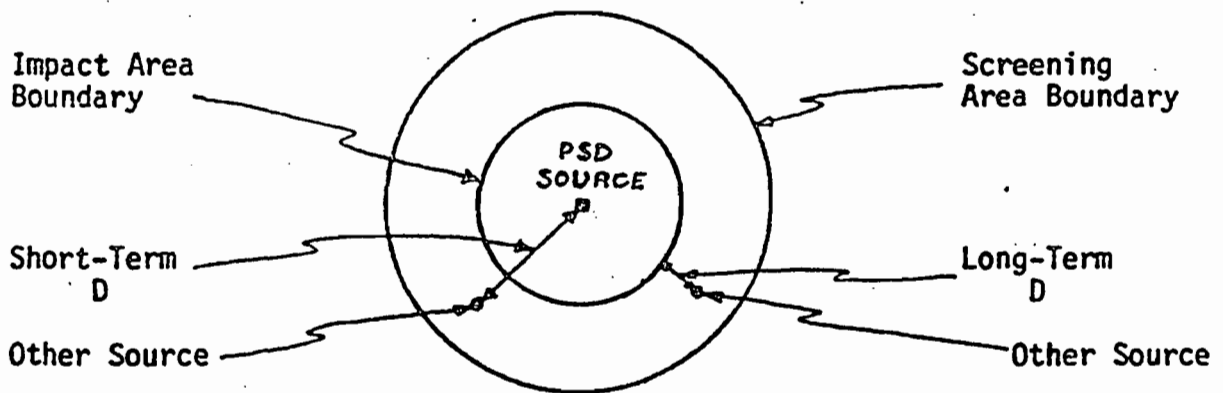
where Q is the maximum emission rate, in tons/year, of the source in the screening area; and D is a distance, in kilometers, from either:

- a. the source in the screening area to the nearest edge of the impact area, for long-term analyses

or

- b. the source in the screening area to the PSD source defining the impact area, for short-term analyses.

The figure below illustrates the difference between the long-term D and the short-term D.



This method does not preclude the use of alternate screening techniques or of more sophisticated screening techniques given the approval of the review agency. Also, this method does not prevent the review agency from specifying additional sources of interest in the modeling analysis.

The justification for this "Screening Threshold Method" rests upon the following assumptions:

- a. effective stack height = 10 meters
- b. stability class D (neutral)
- c. 2.5 meter/second wind speed
- d. mixing height = 300 meters
- e.  $Q = 20D$  = critical emission rate for a given pollutant
- f. one-hour concentrations derived from figure 3-5D in Turner's WADE or from PTDIS.
- g. 3-hour and 24-hour concentrations estimated using "Vol. 10R". Annual impacts are 1/7 of 24 hour impacts.

The results, for various distances, are shown in the table below:

<u>D</u> <u>(km)</u>	<u>Q</u> <u>(T/yr)</u>	<u>1-hr Cgnc.</u> <u>(ug/m<sup>3</sup>)</u>	<u>3-hr Cgnc.</u> <u>(ug/m<sup>3</sup>)</u>	<u>24-hr Cgnc.</u> <u>(ug/m<sup>3</sup>)</u>	<u>Annual Cgnc.</u> <u>(ug/m<sup>3</sup>)</u>
0.5	10	47	42	19	2.7
1.0	20	32	29	13	1.9
1.5	30	27	24	10	1.4
2.0	40	23	21	9	1.3
3	60	18	16	7	1.0
4	80	17	15	7	1.0
5	100	14	13	6	1
6	120	13	12	5	1
10	200	10	9	4	1
20	400	7	6	3	1
30	600	6	6	3	1
40	800	6	6	3	1
50	1000	7	6	3	1

The "Screening Threshold" method is conservative. Most sources either have effective stack heights greater than 10 meters; or they have several short stacks spread out over an industrial complex. Thus, actual modeled concentrations will most likely be lower than the "Screening Threshold" would indicate in the table above. One implication of the table is that all major sources within 5 km of the subject PSD source or within 5 km of the PSD source's impact area should be scrutinized before being exempted from the final emissions inventory.

The "Screening Threshold" method is in qualitative agreement with the suggestions on page I-C-18 of the Prevention of Significant Deterioration Workshop Manual (1980). On that page, it is suggested that a 100 T/Y source 10 km outside the impact area may be excluded from the analysis. The above table would exclude a 100 T/Y source more than 5 km beyond the impact area for long-term analyses or more than 5 km away from the PSD source for short-term analyses; if the source is inside the impact area, it must be included regardless of the "Screening

Threshold". The PSD Workshop Manual also states on page I-C-18 that a 10,000 T/Y source 40 km outside the impact area would probably have to be included in the increment analysis. By the "Screening Threshold" method, the critical distance  $D = Q/20 = 10,000/20 = 500$  km. Thus a 10,000 T/Y source within 500 km would always be included for short-term and long-term analyses if within the screening area.

This "Screening Threshold" method is quick, inexpensive to execute, conservative, and consistent with the intent of the PSD Workshop Manual.



**APPENDIX F**

**TAPPI JOURNAL ARTICLE  
ON NO<sub>x</sub> CONTROL RECOVERY BOILERS**

## An analysis of best available control technology options for kraft recovery furnace NO<sub>x</sub> emissions

Peter H. Anderson and James C. Jackson

*A "top down" review of the best available control technology requires a thorough investigation of all control alternatives and a detailed analysis of the technological feasibility of each option.*

As part of a major modernization project at its mill in International Falls, Minn., Boise Cascade Corp. was required to obtain a prevention of significant deterioration (PSD) air permit. The mill expansion involves the addition or modification of several unit operations, including a kraft recovery furnace, lime kiln, package boilers, and associated ancillary operations.

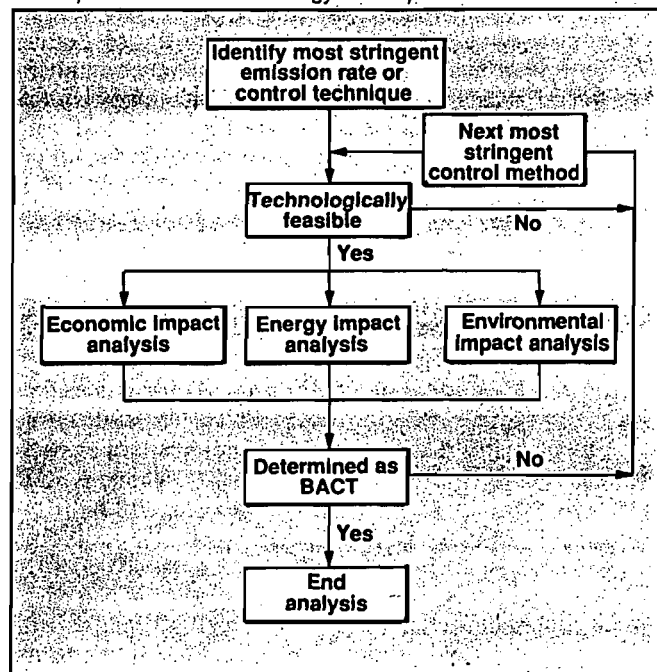
In accordance with the provisions of the PSD regulations, a best available control technology (BACT) review was required for each proposed new or modified emission unit at which a net emission increase in each of the affected PSD pollutants would occur. This criterion excludes existing emission units that, as a result of the modification, increase emissions of an affected PSD pollutant only due to an increase in the hours of operation or in the production rate.

The BACT requirement is intended to ensure that the control system incorporated into the design of a proposed facility reflects the latest in control technology for the particular industry, in keeping with local air quality, energy, economic, and other environmental considerations.

PSD BACT evaluations require the implementation of a "top down" approach. The first step in the top down approach is to determine, for the emission unit in question, the most stringent control available for a similar or identical source or source category. If it can be shown that this level of control is technologically infeasible for the emission unit, then the next most stringent level of control is determined and similarly evaluated. This process continues until the BACT level under consideration cannot be eliminated because of any substantial or unique technological, environmental, economic, or energy objections. Figure 1 presents a schematic of this process.

To illustrate the complexity of conducting a top down

1. "Top down" control technology review process



BACT analysis, the following discussion presents the review completed by Boise Cascade to determine the BACT for nitrogen oxide (NO<sub>x</sub>) emissions from its modified recovery furnace. The Boise Cascade mill expansion includes increasing the capacity of an existing recovery furnace. More specifically, the furnace modifications include an additional liquor spray, stationary firing, additional soot blowers, a third level of combustion air, increased feed water and green liquor transfer capacity, indirect liquor heating, a distributed control system, and replacement of an existing electrostatic precipitator.

Anderson is a senior program manager, ENSR Consulting and Engineering, 35 Nagog Pk., Acton, Mass. 01720. Jackson is region manager, environmental affairs, Boise Cascade Corp., 444 Cedar Street, St. Paul, Minn. 55101.

## Nitrogen oxides

Nitrogen oxides are formed during the combustion process by either the thermal oxidation of nitrogen in the combustion air or the reduction and subsequent oxidation of fuel-bound nitrogen. Virtually all  $\text{NO}_x$  emissions originate as nitric oxide (NO) when both molecular nitrogen and oxygen dissociate into atomic form in the flame and subsequently combine into NO. A minor fraction of the NO is further oxidized to form nitrogen dioxide ( $\text{NO}_2$ ). Since the primary fuel (black liquor) and the auxiliary fuel (natural gas) have low nitrogen contents, the formation of  $\text{NO}_x$  from fuel-bound nitrogen is minimal. Most of the  $\text{NO}_x$  originates as thermal  $\text{NO}_x$ . The rate of formation of thermal  $\text{NO}_x$  is a function of the residence time, free oxygen, and peak flame temperature. Therefore, most  $\text{NO}_x$  combustion control techniques are aimed at minimizing one or more of these variables.

Thermal  $\text{NO}_x$  formation can be reduced by limiting the amount of air in the combustion zone. Effective  $\text{NO}_x$  control in conventional steam generating boilers has been demonstrated with various types of airflow controls, including biased firing, off-stoichiometric combustion, and low excess air firing. Recovery furnaces are similarly designed with a staged air feed system that employs primary, secondary, and, in more recent designs, tertiary air feed locations. While this system is inherent in the recovery furnace design to ensure proper operation (i.e., maintaining reducing conditions in the smelt bed while simultaneously providing for complete combustion), it also results in conditions that limit thermal  $\text{NO}_x$  formation. Thus the design and proper operation of the recovery furnace inherently results in relatively low  $\text{NO}_x$  emissions.

As part of the BACT analysis, alternative technologies that may produce lower  $\text{NO}_x$  emission rates were evaluated. Other than good combustion control, however, there presently are no other control technologies in commercial operation for controlling  $\text{NO}_x$  emissions from recovery furnaces. For this reason, Boise Cascade proposed combustion optimization as the best available control technology.

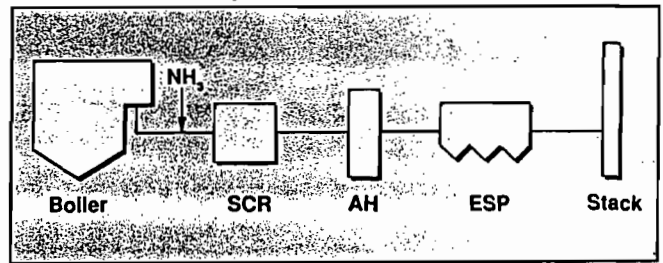
### Alternative $\text{NO}_x$ control methods

Other than burner design and proper combustion control, more stringent methods of controlling  $\text{NO}_x$  from combustion sources include selective catalytic reduction (SCR), selective noncatalytic reduction (SNCR), and flue gas recirculation (FGR). Based on the review completed at the time, none of these techniques has been applied to control  $\text{NO}_x$  emissions from recovery furnaces. In addition, application of these three techniques to the International Falls mill would require substantial retrofitting of the existing furnace. However, because these technologies have been demonstrated to control  $\text{NO}_x$  emissions from conventional steam generating boilers, the regulatory agencies required that they be evaluated.

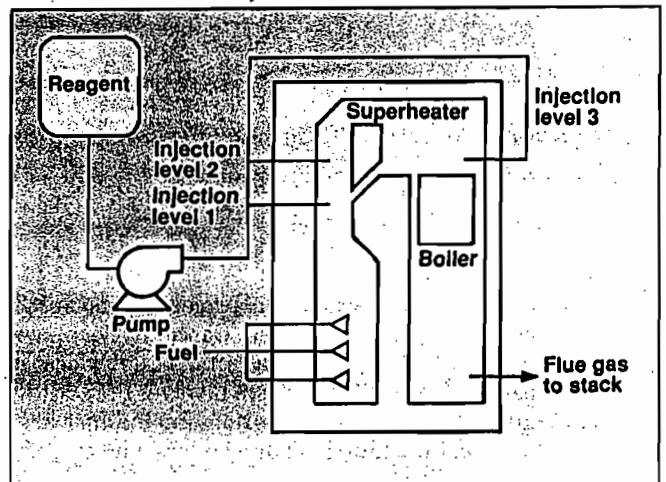
#### Selective catalytic reduction

Selective catalytic reduction is considered to be the most stringent postcombustion  $\text{NO}_x$  control technology for steam generating boilers. With the SCR process, ammonia ( $\text{NH}_3$ ) is injected into the flue gas, whereupon intimate

2. Schematic of SCR system



3. Schematic of SNCR system



mixing occurs between the ammonia and  $\text{NO}_x$ . The mixture then passes through a catalyst bed that promotes reduction of NO to  $\text{N}_2$ . The function of the catalyst is to effectively lower the activation energy of the NO decomposition reaction. The required temperature range for NO reduction using SCR is 533–727°K. Lower temperatures yield slow reaction rates; higher temperatures result in a shortened catalyst life and can lead to the oxidation of  $\text{NH}_3$  and formation of additional  $\text{NO}_x$ . Figure 2 presents a schematic of an SCR system.

With respect to the use of SCR, there were not only significant economic impacts but also technical arguments for not applying this  $\text{NO}_x$  control technique to the Boise Cascade recovery furnace. The principal SCR method of  $\text{NO}_x$  reduction involves the use of a very specialized catalyst. This catalyst is subject to fouling and poisoning by contaminants in the gas stream (e.g., particulate matter, sulfuric acid, and hydrochloric acid). As mentioned above, the catalyst has an optimum temperature range of 533–727°K, with highest efficiencies achieved at the higher end of the range. Given the temperature range restriction, the SCR catalyst would have to be installed upstream of the air heater (AH) and electrostatic precipitator (ESP). In this location the catalyst would be subject to high particulate loading, which would jeopardize its use.

Another option that was considered was to place the catalyst downstream of the ESP and reheat the flue gas to raise its temperature to the optimal level for effective SCR operation. For this specific application SCR has two important drawbacks. First, the acid components of the

flue gas still remain after passing through the ESP. Second, reheating the exhaust gas by either replacing the furnace combustion air preheater or by auxiliary reheat incurs substantial energy penalties.

Another major factor limiting the application of SCR to recovery furnaces is ammonia ( $\text{NH}_3$ ) breakthrough or slip. Ammonia slip is the amount of unreacted ammonia passing through the system. The reaction chemistry of  $\text{NH}_3$  with other chemical substances in the flue gas will greatly influence the amount of  $\text{NO}_x$  reduction that can be achieved, as well as result in the generation of additional contaminants that can cause decreased heat recovery and severe problems with operation and maintenance.

Because of the presence of acid gases in the furnace exhaust stream, residual  $\text{NH}_3$  will react with sulfuric acid ( $\text{H}_2\text{SO}_4$ ) and hydrochloric acid ( $\text{HCl}$ ) to form ammonium salts. Ammonium sulfate [ $(\text{NH}_4)_2\text{SO}_4$ ], ammonia bisulfate ( $\text{NH}_4\text{HSO}_4$ ) and ammonium chloride ( $\text{NH}_4\text{Cl}$ ) are three salts formed. Ammonium sulfate and ammonium bisulfate are undesirable because they can foul low temperature heat exchange equipment below acceptable standards of protection.

Ammonium chloride is a dry, neutral pH, white salt that forms at low temperatures ( $394^\circ\text{K}$  or less). Given the presence of hydrochloric acid in the exhaust gas stream, it is likely that it would react with the free  $\text{NH}_3$  to form ammonium chloride. However, because of the low temperature required for its formation ( $394^\circ\text{K}$  or less), this salt would likely be generated downstream of the heat recovery and particulate control equipment. Because of the submicron size of the salt, a visible plume could form at the stack outlet that could exceed acceptable opacity standards.

For these reasons, SCR was determined not to be technologically viable and was eliminated from further consideration as BACT for  $\text{NO}_x$  emissions from the recovery furnace.

#### Selective noncatalytic reduction

Selective noncatalytic reduction is a postcombustion method of  $\text{NO}_x$  control that involves the noncatalytic decomposition of  $\text{NO}_x$  present in the flue gas to nitrogen and water using a reducing agent (e.g., ammonia or urea). The process was originally applied to combustion sources in Japan. Removal of  $\text{NO}_x$  varies considerably for this technology, depending on inlet  $\text{NO}_x$  concentrations, fluctuating flue gas temperatures, and the presence of interfering chemical substances in the gas stream. Although the technology has been applied to various combustion sources, including gas- and oil-fired steam boilers, coal-fired utility boilers, process heaters, municipal incinerators, wood-fired boilers, oil field steam generators, and flat glass melting furnaces, it has not been applied to kraft recovery furnaces.

The process is based on a gas-phase homogeneous reaction between ammonia ( $\text{NH}_3$ ) or urea [ $\text{CO}(\text{NH}_2)_2$ ] and  $\text{NO}_x$  within a specified temperature range ( $1,144$ – $1,477^\circ\text{K}$ ). While these temperatures exist within a recovery furnace, achieving sufficient reaction time at this temperature may not be possible. In addition, the effect of injection of ammonia or urea on the important recovery furnace processes of smelt reduction and black liquor combustion has not been investigated. Figure 3 presents a schematic of an SNCR system.

Several problematic issues exist for this technology.

These include reagent breakthrough (slip), maintaining optimum reaction temperature, maintaining optimum reagent/ $\text{NO}_x$  molar ratios and mixing, and corrosion and fouling of heat transfer equipment.

The reagent breakthrough problem is complicated because it depends on a number of interrelated factors, including flue gas concentrations ( $\text{NO}_x$ ,  $\text{H}_2\text{O}$ ,  $\text{O}_2$ ,  $\text{SO}_3$ , chlorides, and particulates), the time-temperature relationship of the flue gas, the effectiveness of the reagent and flue gas mixing, and the type of heat recovery equipment used. Because of this complexity, reagent breakthrough must be evaluated on a case-by-case basis, and few generalizations can be made. The problems associated with excess ammonia in the presence of acid gases have been discussed above under the SCR technology.

Achieving the required reaction temperature represents one of the main design problems for each application. The necessary temperature window is found in different areas of the combustion source, depending on its design and operating load. Under ideal conditions, a recovery furnace is designed to run at steady state conditions. However, practical experience reveals that there can be wide fluctuations in operation that would result in excursions from the required reaction temperature and therefore affect  $\text{NO}_x$  removal efficiency.

Concern over maintaining the proper reagent/ $\text{NO}_x$  molar ratio is related to the issues of fluctuating furnace operations, varying flue gas temperatures, and  $\text{NO}_x$  emission rates. To sustain continuous high levels of  $\text{NO}_x$  removal, as well as to avoid excessive slip during swings in furnace operation, reagent feed forward and feedback injection control systems must be incorporated into the design. In cases where there is a gradual change in operating mode, these controls can be quite effective in minimizing slip. However, under conditions where there are rapid and wide fluctuations in furnace operation, the responsiveness of such control systems can be exceeded quickly, to the point of either supplying too much reagent (resulting in excessive slip) or too little reagent (resulting in high  $\text{NO}_x$  emissions). These concerns also apply to the SCR technology.

In addition to the technical problems associated with applying SNCR to control  $\text{NO}_x$  emissions from a recovery furnace, substantial economic impacts can be associated with its use. As part of the BACT analysis, Boise Cascade evaluated the economic impact of applying ammonia injection. For purposes of calculating the costs, expressed in terms of annual dollars per ton of  $\text{NO}_x$  controlled, several assumptions were made. Although  $\text{NO}_x$  removal efficiencies of 70% may be achievable on process operations that burn clean fuels with small fluctuations in temperature, such as gas-fired base-loaded industrial steam boilers, it would be unrealistic to assume such a high level of control for an untested application. Conservative  $\text{NO}_x$  removal efficiencies of 20–50% have been adopted in permits for resource recovery facilities. Based on this information, a  $\text{NO}_x$  removal efficiency of 35% was used to perform the economic analysis.

With an estimated annual operating cost of approximately one million dollars and 133.5 tons of  $\text{NO}_x$  controlled per year, ammonia injection for this specific application had a cost effectiveness of US\$ 7700 per ton. This unreasonable cost, coupled with the technical problems

already cited, led to SNCR being eliminated from consideration as the BACT for NO<sub>x</sub> emissions from the recovery furnace.

#### Flue gas recirculation

Flue gas recirculation involves extracting a portion of the flue gas and returning it to the furnace through the burner or windbox. The primary effect of FGR is to reduce the peak flame temperature through absorption of the combustion heat by the relatively inert flue gas. Furthermore, the addition of flue gas reduces the oxygen concentration in the combustion air, effecting a reduction in NO<sub>x</sub> formation by decreasing the oxygen available to react with the nitrogen.

Flue gas recirculation has not been applied to recovery furnaces due to the high particulate levels in the furnace. In combustion sources that generate high particulate loadings, erosion of fan blades and ductwork becomes a critical design constraint when considering the application of FGR. For these reasons, plus the fact that FGR has not been demonstrated in practice on a recovery furnace, FGR was determined to be not technologically feasible.

#### Conclusion

Following lengthy negotiations with the State agency as well as the U.S. Environmental Protection Agency, Boise Cascade received its PSD permit. In the final analysis, proper combustion control was determined to be the BACT for NO<sub>x</sub> emissions from the recovery furnace. Selective catalytic reduction (SCR), selective noncatalytic reduction (SNCR), and flue gas recirculation (FGR) were determined to be technologically infeasible. The following sections summarize the NO<sub>x</sub> emission limits and operating conditions established for the recovery furnace.

#### Emission Limitations

Emissions of NO<sub>x</sub> were set at 80 ppm vd (parts per million

by volume, dry basis) corrected to 8% oxygen and 86.9 lb/h as a 30-day rolling average. The low emission rate was set, in part, to ensure that there would be no visibility impact on a nearby Class I area. This site-specific constraint should be recognized when establishing permit limits for other recovery furnaces.

#### Fuel type and usage limitation

The furnace was limited to firing only black liquor and natural gas. Amount was limited by fuel burning capability and unit design.

#### Continuous emissions monitoring

Boise Cascade is required to continuously monitor nitrogen oxides, sulfur dioxide, carbon monoxide, and total reduced sulfur compound emissions, as well as opacity from the recovery furnace. Continuous emissions monitoring reports are to be submitted to the State quarterly.

In summary, a "top down" BACT review is a time-consuming and complicated process. It requires a thorough investigation of all available control alternatives and a detailed analysis of each option to evaluate technical feasibility, as well as environmental, energy, and economic impacts. It also requires intimate knowledge of local issues that must be factored into the site-specific analysis. Although regulatory agencies require a national and international review of potential control technologies, each BACT determination is made on a case-by-case basis. This provision of the PSD regulations should be used to ensure that a reasoned approach is taken to determine the best available control technology for a specific application. □

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