

KBN ENGINEERING AND APPLIED SCIENCES, INC.

**NET EMISSIONS INCREASE ANALYSIS
FOR
CONTAINER CORPORATION OF AMERICA, INC.**

Prepared For:

**Container Corporation of America, Inc.
Fernandina Beach, Florida**

Prepared By:

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INTRODUCTION

This report was prepared by KBN for the purpose of determining whether the addition of the No. 8 Batch Digester and C-Line Brown Stock Washer to the CCA Fernandina Mill will require a PSD review prior to the issuance of air construction permits for these two emission sources.

The determination of whether PSD review is necessary was based on a conservative calculation of two factors as required under the Florida Administrative Code:

1. A determination was made of the actual emissions representative for the facility's operations in accordance with Rule 17-2.100(3) F.A.C.; and
2. A determination was made of the actual emission increases at the facility from the addition of the digester and washer. The facility was evaluated to determine if there will be any contemporaneous and creditable emission changes in conjunction with the addition of these two air sources.

Included in this Report is the following information:

1. Summary table of the calculations showing the projected total net emission increase or decrease from each affected source for each pollutant;
2. Summary table of the net emission increase for each pollutant as compared to the regulatory Significant Emission Rates found in Table 500-2, F.A.C.;
3. Calculations of the current actual emissions for each source, based on an average of emissions over a representative two-year period;
4. Calculations of the estimated emissions increase for each source resulting from the construction of the digester and washer; and
5. Calculation of the creditable emission reductions from Power Boiler No. 4.

The result of this analysis demonstrates that there will be no significant net emissions increase from the addition of the digester and washer at this facility. The analysis rigorously followed the procedures set forth in Rule 17-2.500(2)(e), F.A.C. Based on this analysis, PSD review is not required.

CCA Fernandina Mill--Proposed Batch Digester/Washer
Summary of Calculated Net Emissions Increases^a

Regulated Pollutant	Net Emissions Increase	Significant Emission Rates from Table 500-2 ^a (TPY)
Particulate (TSP)	-190.8 +44.6	25 Yes
Particulate (PM10)	-152.6 +33.4	15 Yes
Sulfur dioxide	29.4 +451.2	40 Yes
Nitrogen oxides	14.1 +210.0	40 Yes
Carbon monoxide	-305.5 +316.5	100 Yes
Volatile organic compounds	-31.8 +24.1	40 No
Lead	-0.03 + 0.03	0.6 No
Mercury	0.0014 + 0.0020	0.1 No
Beryllium	0.0008 + 0.0025	0.004 Yes
Fluorides	2.23 + 2.2312	3 No
Sulfuric acid mist	-3.0 +16.4	7 Yes
Total reduced sulfur	2.01 + 2.01	10 No
Asbestos	0.0	0.007 No
Vinyl Chloride	0.0	1 No

^aFlorida Administrative Code, Rule 17-2.500.

CCA Fernandina Mill--Proposed Batch Digester/Washer
Summary of Calculated Net Emission Increase Per Rule 17-2.500(2)(e)

Regulated Pollutant	Changes in Emissions (TPY)							TOTALS
	PB 4	PB 5 ✓	PB 7 ✓	RB 4 ✓	RB 5 ✓	SDT 4 ✓	SDT 5 ✓	
Particulate (TSP)	-235.4	4.8 ✓	5.3 ✓	20.6 ✓	7.2 ✓	4.8 ✓	1.9 ✓	Yes -190.8 ⁺ 44.6
Particulate (PM10)	-186.0	3.0 ✓	3.5 ✓	15.5 ✓	5.4 ✓	4.3 ✓	1.7 ✓	Yes -152.6+33.4
Sulfur dioxide	-421.8	67.1	263.6 ✓	53.0 ✓	64.7 ✓	1.3 ✓	1.5 ✓	Yes 29.4+451.2
Nitrogen oxides	-195.9	11.5 ✓	143.8 ✓	24.6 ✓	30.1 ✓	--	--	Yes 14.1+210.0
Carbon monoxide	-622.0	0.9 ✓	22.0 ✓	132.1 ✓	161.5 ✓	--	--	Yes -305.5+316.5
Volatile organic compounds	-55.9	0.13 ✓	0.7 ✓	10.5 ✓	12.8 ✓	--	--	No -31.8+24.1
Lead	-0.06	0.00022 ✓	0.0063 ✓	0.013 ✓	0.010 ✓	--	--	No -0.03+0.03
Mercury	-0.0006	0.00006 ✓	0.0019 ✓	-- ✓	-- ✓	--	--	No 0.0014+0.0020
Beryllium	-0.0017	0.000015 ✓	0.00072 ✓	0.00100 ✓	0.00077 ✓	--	--	Yes 0.0008+0.0025
Arsenic	-0.016	0.00006 ✓	0.01 ✓	0.0035 ✓	0.0026 ✓	--	--	? 0.000+0.016
Fluorides	-0.00117	0.00016 ✓	2.23 ✓	-- ✓	--	--	--	No 2.23+2.2312
Sulfuric acid mist	-19.4	3.1 ✓	12.1 ✓	0.69 ✓	0.53 ✓	--	--	Yes -3.0+16.4
Total reduced sulfur	--	--	--	0.36	0.40 ✓	0.51 ✓	0.03	No 2.01 ^a +2.01
Asbestos	--	--	--	--	--	--	--	No 0.0
Vinyl Chloride	--	--	--	--	--	--	--	No 0.0

^aIncludes 0.71 TPY TRS from proposed brown stock washer.

Jan 1986

Date Sys
Prior to
C of proposed change

Jan 1991

Commence
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CURRENT ACTUAL EMISSIONS

Current actual emission calculations are based on actual mill operating data over the past 2 years (1988 and 1989). Emission sources operating during this period were consistently well within permitted emission limits. These sources include:

1. Power Boiler No. 5, ✓
2. Power Boiler No. 7, ✓
3. Recovery Boiler No. 4, ✓
4. Recovery Boiler No. 5, ✓
5. Smelt Dissolving Tank No. 4, ✓
6. Smelt Dissolving Tank No. 5, and ✓
7. Lime Kiln No. 4 (Startup date: December 1989).

I. Power Boiler No. 5

A. Particulate Matter (TSP)

Based on annual emissions for particulate matter as reported in the Annual Operating Reports, which were based on stack test data and operating hours.

1988--31.1 TPY
1989--63.0 TPY
Average: 47.1 TPY

B. PM10

No. 5 Power Boiler is controlled with an ESP. AP-42 does not contain particle size information for bark-fired boiler equipped with an ESP. Therefore, use AP-42 factor for coal-fired boiler with an ESP: 67% of PM is PM10.

$$47.1 \text{ TPY} \times 0.67 = 31.6 \text{ TPY}$$

C. Sulfur Dioxide

1. Fuel Oil Burning

Usages of No. 6 fuel oil in No. 5 Power Boiler were 3.527×10^6 gal in 1988 and 2.999×10^6 gal in 1989. Fuel analyses for both years showed that actual sulfur content in fuel oil was 2.5%. Using AP-42 emission factor of 157 S pounds per 1,000 gal of fuel for utility boiler where S is the percent of sulfur content in fuel oil:

$$\text{SO}_2 \text{ emission factor} = 157S \text{ lb}/10^3 \text{ gal}; S = 2.5\%$$

No. 6 oil burning in No. 5 Power Boiler:

1988 -- 3.527×10^6 gal
1989 -- 2.999×10^6 gal
Average -- 3.263×10^6 gal

$$\text{SO}_2 = 3.263 \times 10^6 \text{ gal} \times 157(2.5)/10^3 \text{ gal}/2,000 = 640.4 \text{ TPY}$$

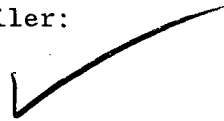
2. Bark Burning

Bark burning in No. 5 Power Boiler:

1988 -- 357,000 TPY

1989 -- 347,495 TPY

Average -- 352,248 TPY



AP-42 emission factor for bark burning is 0.4 lb/ton dry bark

Wet bark is 50% moisture.

Dry Bark = 352,248 x 0.5 = 176,124 TPY

SO₂ = 176,124 TPY x 0.4 lb/ton / 2,000 = 35.2 TPY

3. Total

Total average SO₂ annual emission is sum of SO₂ due to oil and bark burning:

640.4 TPY + 35.2 TPY = 675.6 TPY

D. Nitrogen Oxides

1. Fuel Oil Burning

AP-42: 67 lb/10³ gal

3.263x10⁸ gal x 67/10³ / 2,000 = 109.3 TPY

2. Bark Burning

From AP-42: 2.8 lb/ton bark

352,248 TPY x 2.8 lb/ton / 2,000 = 493.1 TPY

3. Total

109.3 + 493.1 = 602.4 TPY

E. Carbon Monoxide

1. Fuel Oil Burning

AP-42: 5 lb/10³ gal

3.263x10⁸ gal x 5/10³ / 2,000 = 8.2 TPY

2. Bark Burning

From NCASI Technical Bulletin No. 109, September 1980, four wood-waste boilers were tested continuously for CO emissions. Boilers B and D operated at about 300,000 lb/hr steam, which is similar to Power Boiler No. 5 operation. The 1-hour CO tests ranged from 0.042 to 0.604 lb/10⁸ Btu and averaged 0.27 lb/10⁸ Btu. This average value was used as the emission factor to calculate actual CO emissions:

352,248 TPY bark x 2,000 lb/ton x 4,250 Btu/lb

= 2.994 x 10¹² Btu/yr

2.994x10¹² Btu/yr x 0.27 lb/10⁸ Btu / 2,000

= 404.2 TPY

3. Total

8.2 + 404.2 = 412.4 TPY

F. Volatile Organic Compounds (non-methane)

1. Fuel Oil Burning

AP-42: 0.76 lb/10³ gal

$$3.263 \times 10^8 \text{ gal} \times 0.76 \text{ lb}/10^3 \text{ gal} / 2,000 = 1.2 \text{ TPY}$$

2. Bark Burning

AP-42: 1.4 lb/ton bark

$$352,248 \text{ TPY} \times 1.4 \text{ lb}/\text{ton} / 2,000 = 246.6 \text{ TPY}$$

3. Total

$$1.2 + 246.6 = 247.8 \text{ TPY}$$

G. Trace Elements (Lead, Mercury, Beryllium, Arsenic, Fluorides)

1. Fuel Oil Burning

From "Toxic Air Polluted Emission Factors--A Compilation for Selected Air Toxic Compounds and Sources," EPA-450/2-88-006.

a. Lead

Factor is 8.9 lb/10¹² Btu (uncontrolled)

Fuel usage = 3.263x10⁸ gal

Heating value = 145,000 Btu/gal

Heat input = 3.263x10⁸ x 145,000

$$= 0.473 \times 10^{12} \text{ Btu}/\text{yr}$$

Pb = 0.473x10¹² Btu/yr x 8.9 lb/10¹² Btu / 2,000

$$= 0.0021 \text{ TPY}$$

b. Mercury

Factor is 2.4 lb/10¹² Btu (controlled by ESP)

$$\text{Hg} = 0.473 \times 10^{12} \times 2.4/10^{12} / 2,000 = 0.00057 \text{ TPY}$$

c. Beryllium

Factor is 0.59 lb/10¹² Btu (controlled by ESP)

$$\text{Be} = 0.473 \times 10^{12} \times 0.59/10^{12} / 2,000 = 0.00014 \text{ TPY}$$

d. Arsenic

Factor is 2.28 lb/10¹² Btu (controlled by ESP)

$$\text{As} = 0.473 \times 10^{12} \times 2.28/10^{12} / 2,000 = 0.00054 \text{ TPY}$$

e. Fluorides

From "Emissions Assessment of Conventional Stationary Combustion Systems, Vol V: Industrial Combustion Sources," EPA-600/7-81-003a.

Factor is 2.7 pg/J = 6.27 lb/10¹² Btu (uncontrolled)

$$\text{F} = 0.473 \times 10^{12} \times 6.27/10^{12} / 2,000 = 0.0015 \text{ TPY}$$

2. Bark Burning

All factors based on EPA-600/7-81-003a, for a controlled wood-fired stoker boiler.

a. Lead

Factor is 50 pg/J = 116 lb/10¹² Btu

$$2.994 \times 10^{12} \text{ Btu}/\text{yr} \times 116 \text{ lb}/10^{12} \text{ Btu} / 2,000 = 0.174 \text{ TPY}$$

- b. Mercury
Not measured--no emission factor available.
- c. Beryllium
Factor is <1 pg/J, or <2.3 lb/ 10^{12} Btu
 2.994×10^{12} Btu/yr \times 2.3 lb/ 10^{12} Btu / $2,000$
= 0.0034 TPY
- d. Arsenic
Factor is 12 pg/J = 27.9 lb/ 10^{12} Btu
 2.994×10^{12} Btu/yr \times 27.9 lb/ 10^{12} Btu / $2,000$
= 0.042 TPY
- e. Fluorides
Not measured--no emission factor available.

3. Totals

- a. Lead: $0.0021 + 0.174 = 0.176$ TPY
- b. Mercury: $0.00057 + 0 = 0.00057$ TPY
- c. Beryllium: $0.00014 + 0.0034 = 0.0035$ TPY
- d. Arsenic: $0.00054 + 0.042 = 0.042$ TPY
- e. Fluorides: $0.0015 + 0 = 0.0015$ TPY

H. Sulfuric Acid Mist

Sulfuric acid mist is estimated as 3% of sulfur emissions
 $SO_2 = 675.6$ TPY
Sulfur = $675.6 \times 32 / 64 = 337.8$ TPY
Sulfuric acid mist = $337.8 \times 98 / 32 \times 0.03 = 31.0$ TPY

II. Power Boiler No. 7

A. PM (TSP)

From Annual Emissions Reports, based on actual stack test and operating hours:

1988 -- 40.38 TPY
1989 -- 91.36 TPY
Average -- 65.87 TPY

B. PM10

Power Boiler No. 7 is a pulverized coal-fired boiler equipped with ESP control. Based on AP-42, 67% of PM emissions are PM10.
 $65.87 \times 0.67 = 44.13$ TPY

C. Sulfur Dioxide

Power Boiler No. 7 burns compliance coal. Average sulfur content was 1.1 lb/ 10^6 Btu in 1988 and 1989. Total coal burned in the boiler was 248,621 tons in 1989 and 230,644 tons in 1988, for an average of 239,633 TPY.
The coal averages $12,500$ Btu/lb.
 $239,633$ TPY \times $2,000$ \times $12,500$ Btu/lb = 5.99×10^{12} Btu/yr
 5.99×10^{12} Btu \times 1.1 lb/ 10^6 Btu / $2,000$ = $3,294.5$ TPY

D. Nitrogen Oxides

AP-42 emission factor for dry-bottom pulverized coal boiler:
21 lb/ton.

Based on coal at 12,500 Btu/lb, this results in 0.84 lb/10⁶ Btu.
Boiler is limited to 0.6 lb/10⁶ Btu by NSPS. Therefore, use NSPS
limit: $5.99 \times 10^{12} \text{ Btu} \times 0.6 \text{ lb}/10^6 \text{ Btu} / 2,000 = 1,797.0 \text{ TPY}$

E. Carbon Monoxide

Based on compliance test, boiler limited to 93.60 lb/hr CO.

Boiler oxygen monitor is set to maintain this level. This equates
to emission rate of 0.092 lb/10⁶ Btu.

$5.99 \times 10^{12} \text{ Btu} \times 0.092 \text{ lb}/10^6 \text{ Btu} / 2,000 = 275.5 \text{ TPY}$

F. Volatile Organic Compounds

From AP-42 factor, dry-bottom pulverized coal boiler: 0.07 lb/ton
 $239,633 \text{ TPY} \times 0.07 \text{ lb}/\text{ton} / 2,000 = 8.39 \text{ TPY}$

G. Lead, Mercury, Beryllium, Arsenic, Fluorides

From EPA-450/2-88-006: Emission factors for trace elements are
based on boilers equipped with ESP control.

1. Lead

Factor is 25 lb/10¹² Btu

$5.99 \times 10^{12} \text{ Btu} \times 25 \text{ lb}/10^{12} \text{ Btu} / 2,000 = 0.075 \text{ TPY}$

2. Mercury

Factor is 8 lb/10¹² Btu

$5.99 \times 10^{12} \text{ Btu} \times 8 \text{ lb}/10^{12} \text{ Btu} / 2,000 = 0.024 \text{ TPY}$

3. Beryllium

Factor is 3.0 lb/10¹² Btu

$5.99 \times 10^{12} \text{ Btu} \times 3.0 \text{ lb}/10^{12} \text{ Btu} / 2,000 = 0.0090 \text{ TPY}$

4. Arsenic

Factor is 40.1 lb/10¹² Btu

$5.99 \times 10^{12} \text{ Btu} \times 40.1 \text{ lb}/10^{12} \text{ Btu} / 2,000 = 0.12 \text{ TPY}$

5. Fluorides

From EPA-600/7-81-003a, for a dry-bottom coal-fired boiler
(controlled)

Factor is 4 ng/J or 9,296 lb/10¹² Btu

$5.99 \times 10^{12} \text{ Btu} \times 9,296 \text{ lb}/10^{12} \text{ Btu} / 2,000 = 27.84 \text{ TPY}$

H. Sulfuric Acid Mist

Estimate at 3% of sulfur emissions.

$\text{SO}_2 = 3,294.5 \text{ TPY}$

Sulfur = $3,294.5 \times 32/64 = 1,647.3 \text{ TPY}$

Sulfuric Acid Mist = $1,647.3 \text{ TPY} \times 98/32 \times 0.03 = 151.3 \text{ TPY}$

III. Recovery Boiler No. 4

A. PM(TSP)

From annual emissions report, based on actual stack testing and operating hours:

1988 - 342 TPY
1989 - 194 TPY
Average - 268 TPY

B. PM10

Based on AP-42, Section 10.1, for non-direct contact recovery boiler with ESP: 75% of PM is PM10.
268 TPY x 0.75 = 201 TPY

C. Sulfur Dioxide

From NCASI draft technical bulletin, SO₂ emissions from 13 non-direct contact recovery boilers averaged 4.2 lb SO₂ per ton of pulp.

Pulp production: 1988 -- 689,388 TPY
1989 -- 696,909 TPY
Average -- 693,149 TPY

Liquor swapping currently adds an additional 95 TPD equivalent pulp production, or 34,675 TPY.

Therefore, total equivalent pulp production = 693,149 + 34,675 = 727,824 TPY

727,824 tons pulp x 4.2 lb/ton / 2,000 = 1,528.4 TPY

Prorate total emissions between the two recovery boilers based on black liquor solids (BLS) fired.

	<u>No. 4 RB</u>	<u>No. 5 RB</u>	<u>Total</u>	
1988	- 332,770	406,718	739,488	TPY
1989	- <u>340,337</u>	<u>415,967</u>	<u>756,304</u>	TPY
Average	- 336,554	411,343	747,896	TPY
	(45.0%)	(55.0%)		

Recovery Boiler No. 4: 1,528.4 TPY x 0.45 = 687.8 TPY

D. Nitrogen Oxides

From 1980 NCASI paper on NO_x emissions, NO_x emissions from three non-direct contact recovery boilers averaged 1.95 lb/ton ADUP.

Total NO_x = 727,824 TPY x 1.95 lb/ton / 2,000 = 709.6 TPY

Recovery Boiler No. 4 NO_x = 709.6 TPY x 0.45 = 319.3 TPY

E. Carbon Monoxide

Emission factor from AP-42: 11 lb/ton ADUP
Total CO = 693,149 TPY x 11 lb/ton / 2,000 = 3,812.3 TPY
Prorate total to Recovery Boiler No. 4 based on BLS fired:
3,812.3 TPY x 0.45 = 1,715.5 TPY

F. Volatile Organic Compounds

Based on NCASI Technical Bulletin No. 112, February 1981, three non-direct contact evaporator recovery boilers were tested. VOC ranged from 0.66 to 1.1 lb per ton pulp and averaged 0.83 lb/ton pulp.

Total VOC = 727,824 tons/yr pulp x 0.83/ton / 2,000 = 302.0 TPY

Recovery Boiler No. 4: 302.0 TPY x 0.45 = 135.9 TPY

G. Lead, Mercury, Beryllium, Arsenic, Fluorides

From "Application of Combustion Modifications to Industrial Combustion Equipment," EPA-600/7-79-015a. Represents one test from recovery boiler.

1. Lead

Factor is 3,900 lb/10¹² dscf
Recovery Boiler No. 4 gas flow rate from stack test on 5/8/90 of 175,147 dscfm
175,147 dscfm x 60 min/hr x 3,900 lb/10¹² dscf = 0.041 lb/hr
From Annual Emissions Report, Recovery Boiler No. 4 operated 8,450 hrs 1989, and 8,047 hrs in 1988, or an average of 8,249 hr/yr.
Pb = 0.041 lb/hr x 8,249 hr/yr / 2,000 = 0.17 TPY

2. Mercury

Below detectable limit.

3. Beryllium

Factor is 300 lb/10¹² dscf
175,147 dscfm x 60 x 300/10¹² = 0.0032 lb/hr
0.0032 lb/hr x 8,249 hr/yr / 2,000 = 0.013 TPY

4. Arsenic

Factor is <1,000 lb/10¹² dscf
175,147 x 60 x 1,000/10¹² = 0.011 lb/hr
0.011 lb/hr x 8,249 hr/yr / 2,000 = 0.045 TPY

5. 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.

$$\frac{175,147 \text{ ft}^3}{\text{min}} \times \frac{60 \text{ min}}{\text{hr}} \times \frac{2,116.8 \text{ lb}_f}{\text{ft}^2} \times \frac{98 \text{ lb}_m \cdot ^\circ\text{R}}{1,545 \text{ ft} \cdot \text{lb}_f} \times \frac{1}{528^\circ\text{R}} \times \frac{0.81}{10^6}$$

$$= 2.16 \text{ lb/hr}$$

$$2.16 \text{ lb/hr} \times 8,249 \text{ hr/yr} / 2,000 = 8.91 \text{ TPY}$$

I. Total Reduced Sulfur (TRS)

From annual emission reports, average TRS was 1.6 ppm in 1988 and 0.81 ppm in 1989, or average of 1.21 ppm.

$$175,147 \times 60 \times 2,116.8 \times (34/1,545) \times (1/528) \times 1.21/10^6$$

$$= 1.12 \text{ lb/hr}$$

$$1.12 \text{ lb/hr} \times 8,249 \text{ hr/yr} / 2,000 = 4.62 \text{ TPY}$$

IV. Recovery Boiler No. 5

A. PM(TSP)

From Annual Emissions Reports, based on actual stack testing and operating hours:

1989 - 152 TPY
1988 - 35.4 TPY
 Avg. - 93.7 TPY

B. PM10

Based on AP-42, Section 10.1, for non-direct contact recovery boiler with ESP: 75% of PM is PM10.
 93.7 TPY x 0.75 = 70.3 TPY

C. Sulfur Dioxide

From Recovery Boiler No. 4 calculations:
 1,528.4 TPY x 0.55 = 840.6 TPY

D. Nitrogen Oxides

Based on Recovery Boiler No. 4 calculations:
 Recovery Boiler No. 5 NO_x = 709.6 TPY x 0.55 = 390.3 TPY

E. Carbon Monoxide

Based on Recovery Boiler No. 4 calculations:
 3,812.3 TPY x 0.55 = 2,096.8 TPY

F. Volatile Organic Compounds

Based on Recovery Boiler No. 4 calculations:
 $302.0 \text{ TPY} \times 0.55 = 166.1 \text{ TPY}$

G. Lead, Mercury, Beryllium, Arsenic, Fluorides

From "Application of Combustion Modifications to Industrial Combustion Equipment," EPA-600/7-79-015a. Represents one test from recovery boiler.

1. Lead

Factor is $3,900 \text{ lb}/10^{12} \text{ dscf}$
Recovery Boiler No. 5 gas flow rate from stack test 1/10/90 = $139,548 \text{ dscfm}$
 $139,548 \text{ dscfm} \times 60 \text{ min/hr} \times 3,900 \text{ lb}/10^{12} \text{ dscf} = 0.033 \text{ lb/hr}$
From Annual Emissions Report, Recovery Boiler No. 5 operated 8,434 hrs in 1989 and 7,661 hrs in 1988, or an average of 8,048 hr/yr.
 $\text{Pb} = 0.033 \text{ lb/hr} \times 8,048 \text{ hr/yr} / 2,000 = 0.13 \text{ TPY}$

2. Mercury

Below detectable limit.

3. Beryllium

Factor is $300 \text{ lb}/10^{12} \text{ dscf}$
 $139,548 \text{ dscfm} \times 60 \times 300/10^{12} = 0.0025 \text{ lb/hr}$
 $0.0025 \text{ lb/hr} \times 8,048 \text{ hr/yr} / 2,000 = 0.010 \text{ TPY}$

4. Arsenic

Factor is $<1,000 \text{ lb}/10^{12} \text{ dscf}$
 $139,548 \times 60 \times 1,000/10^{12} = 0.0084 \text{ lb/hr}$
 $0.0084 \text{ lb/hr} \times 8,048 \text{ hr/yr} / 2,000 = 0.034 \text{ TPY}$

5. 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.

$$\frac{139,548 \text{ ft}^3}{\text{min}} \times \frac{60 \text{ min}}{\text{hr}} \times \frac{2,116.8 \text{ lb}_f}{\text{ft}^2} \times \frac{98 \text{ lb}_m \text{ } ^\circ\text{R}}{1,545 \text{ ft-lb}_f} \times \frac{1}{528^\circ\text{R}} \times \frac{0.81}{10^6}$$

= 1.72 lb/hr

$$1.72 \text{ lb/hr} \times 8,048 \text{ hr/yr} / 2,000 = 6.92 \text{ TPY}$$

I. Total Reduced Sulfur

From Annual Emission Reports, average TRS was 1.82 ppm in 1989 and 1.7 ppm in 1988, or average of 1.76 ppm.

$$139,548 \times 60 \times 2116.8 \times (34/1545) \times (1/528) \times 1.76/10^6 \\ = 1.30 \text{ lb/hr}$$

$$1.30 \text{ lb/hr} \times 8,048 \text{ hr/yr} / 2,000 = 5.23 \text{ TPY}$$

V. Smelt Dissolving Tank No. 4

A. PM

From Annual Emission Reports, based on stack test and operating hours:

1989 - 24.7 TPY

1988 - 99.4 TPY

Avg. - 62.1 TPY

B. PM10

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

$$62.1 \text{ TPY} \times 0.895 = 55.6 \text{ TPY}$$

C. SO₂

AP-42 factor is 0.2 lb/ton ADUP, uncontrolled. Conservatively, we have assumed 50% control for the wet scrubber.

$$\text{Total SO}_2 \text{ emissions} = 727,824 \text{ tons} \times 0.2 \text{ lb/ton} \times 0.5 / 2,000 \\ = 36.4 \text{ TPY}$$

From Recovery Boiler No. 4 calculations, 45% of production through this boiler: $36.4 \text{ TPY} \times 0.45 = 16.4 \text{ TPY}$

D. TRS

From Annual Emission Reports, based on stack test and operating hours for 1989; based on permit limits for 1988:

1989 - 4.35 TPY

1988 - 8.90 TPY

Avg. - 6.63 TPY

VI. Smelt Dissolving Tank No. 5

A. PM

From Annual Emission Reports, based on stack test and operating hours:

1989 - 24.0 TPY

1988 - 25.3 TPY

Avg. - 24.7 TPY

B. PM10

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

$$24.7 \text{ TPY} \times 0.895 = 22.1 \text{ TPY}$$

C. SO₂

From Smelt Dissolving Tank No. 4 calculations:
36.4 x 0.55 = 20.0 TPY

D. TRS

Based on stack test in 1988 and actual hours of operation in 1988 and 1989:

Stack test result = 0.11 lb/hr
Operating hours--1988 - 7,661 hrs
 1989 - 8,434 hrs
Avg. - 8,048 hrs

$$\text{Average TRS emissions} = 0.11 \text{ lb/hr} \times 8,048 \text{ hr/yr} / 2,000 = 0.44 \text{ TPY}$$

VII. Lime Kiln No. 4

Since new lime kiln started operation in December 1989, there is no historical operating data. Therefore, actual emissions are assumed equal to permitted emissions:

PM -- 43.5 lb/hr, 190.0 TPY
PM10 -- 38.5 lb/hr, 168.2 TPY
SO₂ -- 26.8 lb/hr, 117.1 TPY
NO_x -- 187.7 lb/hr, 819.9 TPY
CO -- 78.8 lb/hr, 29.8 TPY
VOC -- 15.2 lb/hr, 44.7 TPY
TRS -- 2.63 lb/hr, 11.5 TPY

NET EMISSIONS INCREASE
DUE TO NEW BATCH DIGESTER AND BROWN STOCK WASHER

Net emission increases were calculated using the criteria in FAC 17-2.500 (2)(e). In all instances, future actual emissions will remain within the current permitted levels.

I. Power Boiler No. 5

PB No. 5, a combination oil/bark/woodwaste-fired boiler, will experience an increase in steam production, but future operation will remain within existing permitted levels. All of the increase is assumed to be from oil burning. The increase is calculated as 22.92 barrels per day of oil for 355 days per year, or 341,737 gallons per year.

A. Particulate Matter (TSP)

AP-42 factor is $(10S+3)$ lb/1000 gal. (uncontrolled)

$10(2.5)+3 = 28$ lb/1000 gal

$341,737$ gal/yr \times 28 lb/1000 gal / $2000 = 4.8$ TPY

B. PM10

No. 5 Power Boiler is controlled with an ESP. AP-42 contains particle size information for oil-fired boiler equipped with ESP. The data show that 63% of PM is PM10.

4.8 TPY \times $0.63 = 3.0$ TPY

C. Sulfur Dioxide

Fuel analyses show that actual sulfur content in the fuel oil was 2.5% the last two years. Using AP-42 emission factor of 157 S pounds per 1,000 gal of fuel for utility boiler where S is the percent of sulfur content in fuel oil:

SO_2 emission factor = $157S$ lb/10³ gal, $S = 2.5\%$

$SO_2 = 341,737$ gal \times $157(2.5)/10^3$ gal / $2,000 = 67.1$ TPY

D. Nitrogen Oxides

AP-42: 67 lb/10³ gal

$341,737$ gal \times $67/10^3$ / $2,000 = 11.5$ TPY

E. Carbon Monoxide

AP-42: 5 lb/10³ gal

$341,737$ gal \times $5/10^3$ / $2,000 = 0.9$ TPY

- F. Volatile Organic Compounds (non-methane)
AP-42: 0.76 lb/10³ gal
341,737 gal x 0.76 lb/10³ gal / 2,000 = 0.13 TPY
- G. Trace Elements (Lead, Mercury, Beryllium, Arsenic, Fluorides)
From "Toxic Air Polluted Emission Factors--A Compilation for Selected Air Toxic Compounds and Sources," EPA-450/2-88-006.
1. Lead
Factor is 8.9 lb/10¹² Btu (uncontrolled)
Increased fuel usage = 341,737 gal
Heating value = 145,000 Btu/gal
Heat input = 341,737 x 145,000
 = 0.05x10¹² Btu/yr
Pb = 0.05x10¹² Btu/yr x 8.9 lb/10¹² Btu / 2,000
 = 0.00022 TPY
 2. Mercury
Factor is 2.4 lb/10¹² Btu (controlled by ESP)
Hg = 0.05x10¹² x 2.4/10¹² / 2,000 = 0.00006 TPY
 3. Beryllium
Factor is 0.59 lb/10¹² Btu (controlled by ESP)
Be = 0.05x10¹² x 0.59/10¹² / 2,000 = 0.000015 TPY
 4. Arsenic
Factor is 2.28 lb/10¹² Btu (controlled by ESP)
As = 0.05x10¹² x 2.28/10¹² / 2,000 = 0.00006 TPY
 5. Fluorides
From "Emissions Assessment of Conventional Stationary Combustion Systems, Vol V: Industrial Combustion Sources," EPA-600/7-81-003a.
Factor is 2.7 pg/J = 6.27 lb/10¹² Btu (uncontrolled)
F = 0.05x10¹² x 6.27/10¹² / 2,000 = 0.00016 TPY
- H. Sulfuric Acid Mist
Sulfuric acid mist is estimated as 3% of sulfur emissions
SO₂ = 67.1 TPY
Sulfur = 67.1 x 32/64 = 33.55 TPY
Sulfuric acid mist = 33.55 x 98/32 x 0.03 = 3.1 TPY

II. Power Boiler No. 7

Power Boiler No. 7 will experience an 8.0% increase in steam production, which results in approximately 56.0 additional tons of coal being burned per day. Actual emissions will increase by 8.0%.

Pollutant	Current Actual Emissions (TPY)	Increase in Actual Emissions (TPY)
PM(TSP)	65.87	5.3
PM10	44.13	3.53
SO ₂	3,294.5	263.6
NO _x	1,797.0	143.76
CO	275.5	22.04
VOC	8.39	0.67 ^{0.7}
Pb	0.075	0.006
Hg	0.024	0.0019
Be	0.0090	0.00072
As	0.12	0.010
Fl	27.84	2.23
H ₂ SO ₄	151.3	12.1

III. Recovery Boiler No. 4

The actual net increase in fuel input to the recovery boilers will be the equivalent of 155 tons per day of pulp. This is a 7.7% increase above current operating rates.

- A. PM(TSP)
 - Current actual = 268 TPY ✓
 - 268 x 0.077 = 20.6 TPY
- B. PM10
 - 20.6 x 0.7^{OK} = 15.5 TPY ✓
- C. SO₂
 - 687.8 x 0.077 = 53.0 TPY ✓
- D. NO_x
 - 319.3 x 0.077 = 24.6 TPY ✓
- E. CO
 - 1,715.5.9 x 0.077 = 132.1 TPY ✓
- F. VOC
 - 135.9 x 0.077 = 10.5 TPY ✓
- G. Trace Metals
 - Pb--0.17 x 0.077 = 0.013 TPY
 - Hg--N/A
 - Be--0.013 x 0.077 = 0.0010 TPY
 - As--0.045 x 0.077 = 0.0035 TPY
 - Fl--N/A
- H. Sulfuric Acid Mist
 - 8.91 x 0.077 = 0.69 TPY ✓
- I. TRS
 - 4.62 x 0.077 = 0.36 TPY ✓

IV. Recovery Boiler No. 5

Similar to Recovery Boiler No. 4, operation of Recovery Boiler No. 5 will increase 7.7% over present operation.

- A. PM(TSP)
93.7 x 0.077 = 7.2 TPY ✓
- B. PM10
7.2 x 0.75 = 5.4 TPY ✓
- C. SO₂
840.6 x 0.077 = 64.7 TPY ✓
- D. NO_x
390.3 x 0.077 = 30.1 TPY ✓
- E. CO
2,096.8 x 0.077 = 161.5 TPY ✓
- F. VOC
166.1 x 0.077 = 12.8 TPY ✓
- G. Trace Metals
Pb--0.13 x 0.077 = 0.010 TPY ✓
Hg--N/A
Be--0.010 x 0.077 = 0.00077 TPY ✓
As--0.034 x 0.077 = 0.0026 TPY ✓
Fl--N/A ✓
- H. Sulfuric Acid Mist
6.92 x 0.077 = 0.53 TPY ✓
- I. TRS
5.23 x 0.077 = 0.40 TPY ✓

V. Smelt Dissolving Tank No. 4 and No. 5

The smelt tanks will experience the same increase over current operating rates as the recovery boilers (7.7%).

Pollutant	<u>SDT No. 4 (TPY)</u>		<u>SDT No. 5 (TPY)</u>	
	Current	Increase	Current	Increase
PM	62.1	4.8	24.7	1.9
PM10	55.6	4.3	22.1	1.7
SO ₂	16.4	1.3	20.0	1.5
TRS	6.63	0.51	0.44	0.03

VI. Lime Kiln No. 4

Since there is no historic operating data from the new lime kiln, the present and future actual emissions are assumed to be the current permitted allowables.

EMISSION REDUCTIONS -- POWER BOILER NO. 4

Base actual emissions on last 2 years (1985 - 1986) of sustained boiler operation.

A. Particulate Matter (TSP)

1986 - Stack tests of 2/18/86 and 10/28/86 - 65.8 lb/hr avg
Operating days = 264

$PM = 264 \text{ days} \times 24 \text{ hr/day} \times 65.8 \text{ lb/hr} / 2,000 \text{ lb/ton}$
 $= 208.5 \text{ TPY}$

1985 - Base on 1985 stack test - 75.9 lb/hr
Operating days = 288

$PM = 288 \times 24 \times 75.9 / 2,000 = 262.3 \text{ TPY}$

Avg. = 235.4 TPY

B. PM10

Power Boiler No. 4 was controlled with mechanical collectors and fly ash injection. AP-42 states that PM10 is 79% of PM emissions.
 $235.4 \text{ TPY} \times 0.79 = 186.0 \text{ TPY}$

C. SO₂

1. Bark/Wood

Avg. = 78,367 tons/yr burned
Dry basis--moisture 50% -- $78,367 \times 0.5 = 39,183.5 \text{ tons}$
AP-42: 0.4 lb/ton dry
 $39,183.5 \text{ tons} \times 0.4 \text{ lb/ton} / 2,000 = 7.8 \text{ TPY}$

2. Fuel Oil

1986 - 764,000 gal @ 2.5% S
1985 - 4,384,000 gal @ 1.97% S
AP-42: SO₂ = 157 S lb/1,000 gal

$1986 - 764,000 \times 157(2.5)/1,000 / 2,000 = 149.9 \text{ TPY}$
 $1985 - 4,384,000 \times 157(1.97)/1,000 / 2,000 = 678.0 \text{ TPY}$
Avg. - 414.0 TPY

3. Total

$7.8 \text{ TPY} + 414.0 \text{ TPY} = 421.8 \text{ TPY}$

D. Nitrogen Oxides

1. Fuel Oil Burning

AP-42: 67 lb/10³ gal
Average of 2.574x10⁶ gal/yr burned
 $2.574 \times 10^6 \text{ gal} \times 67/10^3 / 2,000 = 86.2 \text{ TPY}$

2. Bark Burning

From AP-42: 2.8 lb/ton bark

$$78,367 \text{ TPY} \times 2.8 \text{ lb/ton} / 2,000 = 109.7 \text{ TPY}$$

3. Total

$$86.2 + 109.7 = 195.9 \text{ TPY}$$

E. Carbon Monoxide

1. Fuel Oil Burning

AP-42: 5 lb/10³ gal

$$2.574 \times 10^8 \text{ gal} \times 5 / 10^3 / 2,000 = 6.4 \text{ TPY}$$

2. Bark Burning

From NCASI Technical Bulletin No. 109, September 1980, four wood-waste boilers were tested continuously for CO. Boilers A and C operated at about 140,000 lb/hr steam, which is similar to Power Boiler No. 4 operation. The 1-hour CO tests ranged from 0.31 to 4.0 lb/10⁸ Btu and averaged 1.84 lb/10⁸ Btu. This average factor was used to calculate actual CO emissions:

$$78,367 \text{ tons bark} \times 2,000 \text{ lb/ton} \times 4,250 \text{ Btu/lb} \\ = 0.67 \times 10^{12} \text{ Btu/yr}$$

$$0.67 \times 10^{12} \text{ Btu/yr} \times 1.84 \text{ lb/10}^8 \text{ Btu} / 2,000 = 616.4 \text{ TPY}$$

3. Total

$$6.4 + 616.4 = 622.8 \text{ TPY}$$

F. Volatile Organic Compounds

1. Fuel Oil Burning

AP-42: 0.76 lb/10³ gal

$$2.574 \times 10^8 \text{ gal} \times 0.76 \text{ lb/10}^3 \text{ gal} / 2,000 = 1.0 \text{ TPY}$$

2. Bark Burning

AP-42: 1.4 lb/ton bark

$$78,367 \text{ TPY} \times 1.4 \text{ lb/ton} / 2,000 = 54.9 \text{ TPY}$$

3. Total

$$1.0 + 54.9 = 55.9 \text{ TPY}$$

G. Lead, Mercury, Beryllium, Arsenic, Fluorides

1. Fuel Oil Burning

From "Toxic Air Pollutant Emission Factors - A Compilation for Selected Air Toxic Compounds and Sources," EPA-450/2-88-006.

a. Lead

Factor is 8.9 lb/10¹² Btu (uncontrolled)

Fuel usage = 2.574 x 10⁸ gal

Heating value = 145,000 Btu/gal

Heat input = 2.574 x 10⁸ x 145,000

$$= 0.373 \times 10^{12} \text{ Btu/yr}$$

$$\begin{aligned} \text{Pb} &= 0.373 \times 10^{12} \text{ Btu/yr} \times 8.9 \text{ lb}/10^{12} \text{ Btu} / 2,000 \\ &= 0.0017 \text{ TPY} \end{aligned}$$

b. Mercury

Factor is 3.2 lb/10¹² Btu (controlled by multiclone)
 $\text{Hg} = 0.373 \times 10^{12} \times 3.2/10^{12} / 2,000 = 0.00060 \text{ TPY}$

c. Beryllium

Factor is 2.65 lb/10¹² Btu (controlled by multiclone)
 $\text{Be} = 0.373 \times 10^{12} \times 2.65/10^{12} / 2,000 = 0.00049 \text{ TPY}$

d. Arsenic

Factor is 9.31 lb/10¹² Btu (controlled by multiclone)
 $\text{As} = 0.373 \times 10^{12} \times 9.31/10^{12} / 2,000 = 0.00174 \text{ TPY}$

e. Fluorides

From "Emissions Assessment of Conventional Stationary Combustion Systems, Vol V: Industrial Combustion Sources," EPA-600/7-81-003a.

Factor is 2.7 pg/J = 6.27x10¹² Btu (uncontrolled)
 $\text{Fl} = 0.373 \times 10^{12} \times 6.27/10^{12} / 2,000 = 0.00117 \text{ TPY}$

2. Bark Burning

All factors based on EPA-600/7-81-003a, for a controlled wood-fired stoker boiler. Emission factor is increased by 50% to account for only multiclone control on boiler.

a. Lead

Factor is 50 pg/J = 116 lb/10¹² Btu x 1.5
= 174 lb/10¹² Btu
 $0.67 \times 10^{12} \text{ Btu/yr} \times 174 \text{ lb}/10^{12} \text{ Btu} / 2,000 = 0.058 \text{ TPY}$

b. Mercury

Not measured--no emission factor.

c. Beryllium

Factor is <1 pg/J, or <2.3 lb/10¹² Btu x 1.5
= 3.5 lb/10¹² Btu
 $0.67 \times 10^{12} \text{ Btu/yr} \times 3.5 \text{ lb}/10^{12} \text{ Btu} / 2,000 = 0.00117 \text{ TPY}$

d. Arsenic

Factor is 12 pg/J = 27.9 lb/10¹² Btu x 1.5
= 41.9 lb/10¹² Btu
 $0.67 \times 10^{12} \text{ Btu/yr} \times 41.9 \text{ lb}/10^{12} \text{ Btu} / 2,000 = 0.014 \text{ TPY}$

e. Fluorides

Not measured--no emission factor available.

3. Totals

a. Lead: 0.0017 + 0.058 = 0.060 TPY
b. Mercury: 0.00060 + 0 = 0.00060 TPY
c. Beryllium: 0.00049 + 0.00117 = 0.00166 TPY
d. Arsenic: 0.00174 + 0.014 = 0.0157 TPY
e. Fluorides: 0.00117 + 0 = 0.00117 TPY

H. Sulfuric Acid Mist

Sulfuric acid mist is estimated at 3% of sulfur emissions

$SO_2 = 421.8$ TPY

Sulfur = $421.8 \times 32/64 = 210.9$ TPY

Sulfuric acid mist = $210.9 \times 98/32 \times 0.03 = 19.4$ TPY

