

US EPA ARCHIVE DOCUMENT

AIR EMISSIONS CALCULATIONS (1995 BASE YEAR)

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PERMITTED VALUES BY GEORGIA AIR QUALITY PERMIT VS. ACTUAL

PARTICULATE: (DATA FROM '95 COMPLIANCE TESTING REPORT, DEECO, DATED JULY 7, '95)

RECOVERY BOILER: 194,280 lbs/hour BLS @ 5,935 BTU/lb BLS = 97.14 Tons BLS/hour
0.0030 gr/dscf @ 8% O₂ = 6.75 lb/hour emission rate

ALLOWABLE: $E = 55 \left(\frac{1,496,179,000 \text{ Lbs BLS}}{2000 \text{ Lbs}} \times \frac{\text{Ton}}{2000 \text{ Lbs}} \right)^{0.11} - 40 = 50.0894 \frac{\text{lbs}}{\text{hour}}$

$50.0894 \frac{\text{lbs}}{\text{hour}} \times 0,427 \text{ operating hours} \times \frac{\text{Ton}}{2000 \text{ lbs}} = 21.05 \text{ Tons Particulate Allowed Year}$

ACTUAL: $6.75 \frac{\text{lbs}}{\text{hour}} \left(\frac{1,496,179,000 \text{ Lbs BLS}}{\text{Year}} \times \frac{\text{hour}}{194,280 \text{ Lbs BLS}} \right) \times \frac{\text{Ton}}{2000 \text{ lbs}} = 25.99 \text{ Tons Emitted Year}$

POWER BOILER: 396,000 lbs/hour steam, 2.0 gpm #6 f.o.
0.068 lbs/MM BTU = 57.97 lbs/hour emission rate

ALLOWABLE: $0.10 \frac{\text{lbs}}{10^6 \text{ BTU}} \times \frac{3,7482}{10^6} \times 10^{12} \text{ BTU} \times \frac{\text{Ton}}{2000 \text{ lbs}} = 125.98 \text{ Tons Particulate Allowed Year}$

ACTUAL: $0.068 \frac{\text{lbs}}{10^6 \text{ BTU}} \times \frac{3,7482}{10^6} \times 10^{12} \text{ BTU} \times \frac{\text{Ton}}{2000 \text{ lbs}} = 85.00 \text{ Tons Emitted Year}$

SMELT DISSOLVING TANK: 196,287 lbs/hour BLS @ 5,963 BTU/lb = 90.14 Ton BLS/hour
0.182 lbs/ton BLS = 17.87 lb/hour emission rate

ALLOWABLE: $0.20 \frac{\text{lbs}}{\text{ton BLS}} \times \frac{1,496,179,000 \text{ Lbs BLS}}{\text{Year}} \times \frac{\text{Ton BLS}}{2000 \text{ Lbs BLS}} \times \frac{\text{Ton}}{2000 \text{ lbs}} = 74.81 \text{ Tons Allowed Year}$

ACTUAL: $0.182 \frac{\text{lbs}}{\text{ton BLS}} \times \frac{1,496,179,000 \text{ Lbs BLS}}{\text{Year}} \times \frac{\text{Ton BLS}}{2000 \text{ Lbs BLS}} \times \frac{\text{Ton}}{2000 \text{ lbs}} = 68.08 \text{ Tons Actual Year}$

CALCINER: 299 gpm lime mud @ 25.9% = 19.88 tons/hour lime
0.0498 gr/dscf @ 10% O₂ = 13.89 lbs/hour

$299 \frac{\text{gal}}{\text{min}} \times \frac{17 \text{ lbs mud}}{\text{gal}} \times \frac{25.9\%}{26.6\%} \times \frac{60 \text{ min}}{\text{hour}} \times 0.85 \text{ cyclone eff} \times \frac{\text{ton}}{2000 \text{ lbs}} = 19.88 \frac{\text{tons lime mud}}{\text{hour}}$

ALLOWABLE: $0.130 \frac{\text{gr}}{\text{dscf}} \times \frac{30,767 \text{ dscf}}{\text{min}} \times \frac{60 \text{ min}}{\text{hour}} \times \frac{\text{lb}}{7000 \text{ gr}} = 34.28 \frac{\text{lbs}}{\text{hour}} \text{ NSPS}$

$E = 4.1 \left(\frac{19.88 \text{ tons mud}}{\text{hour}} \right)^{0.67} = 30.39 \frac{\text{lbs}}{\text{hour}} \text{ Ca EPD, more restrictive}$

$30.39 \frac{\text{lbs}}{\text{hour}} \times 7,734 \text{ operating hours} \times \frac{\text{ton}}{2000 \text{ lbs}} = 117.52 \text{ Tons Allowable Year}$

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PERMITTED VALUES VS ACTUALS

PARTICULATE (CONT'D FROM PAGE 1)

CALCINER

$$\text{ACTUAL: } \frac{13.89 \text{ lbs}}{\text{hour}} \times 7,734 \text{ operating hours} \times \frac{\text{ton}}{2000 \text{ lbs}} = 53.71 \text{ Tons Actual Year}$$

SULFUR DIOXIDE:

RECOVERY BOILER: 509,233 acf/min @ 416°F

ALLOWABLE: 400 ppm target (5,702.3 tons/year on 1984 PSD submittal)

$$\frac{400 \text{ ppm}}{10^6} \times \frac{509,233 \text{ acf}}{\text{min}} \times \frac{528 \text{ ft}}{876 \text{ ft}} \times \frac{60 \text{ min}}{\text{hr}} \times \frac{64.07 \text{ lb SO}_2}{16 \text{ mole}} \times \frac{16 \text{ mole}}{359 \text{ ft}^3} \times \frac{528 \text{ ft}}{492 \text{ ft}} = 1,394.25 \frac{\text{lbs}}{\text{hr}} \text{ Allowed}$$

$$1,394.25 \frac{\text{lbs}}{\text{hour}} \times 8,427 \text{ operating hours} \times \frac{\text{ton}}{2000 \text{ lbs}} = 5,879.65 \text{ tons SO}_2 \text{ Allowed year}$$

$$\text{ACTUAL: From CEM data, see Ga Air Quality Permit Fee (\$5) calculations} = 411.78 \text{ tons Actual year}$$

POWER BOILER:

ALLOWABLE: 0.80 lbs/MM BTU heat input

$$\frac{0.80 \text{ lbs}}{\text{MM BTU}} \times 2.50164 \times 10^{12} \text{ BTU} \times \frac{\text{ton}}{2000 \text{ lbs}} = 1499.3 \text{ tons Allowed year}$$

ACTUAL: From CEM data

~~$$\frac{0.16 \text{ lbs}}{\text{MM BTU}} \times 2.50164 \times 10^{12} \text{ BTU} \times \frac{\text{ton}}{2000 \text{ lbs}} =$$~~

SMELT DISSOLVING TANK:

ALLOWABLE: No permit limit

$$\text{ACTUAL: } \frac{0.016 \text{ lb}}{\text{ton BLS}} \text{ (GaEPD emission factor)} \times 740,089.5 \frac{\text{tons BLS}}{\text{year}} \times \frac{\text{ton}}{2000 \text{ lbs}} = 5.98 \frac{\text{tons}}{\text{year}}$$

PERMITTED VALUES VS. ACTUAL

SULFUR DIOXIDE (CONT'D FROM PAGE 2)

CALCINER:

ALLOWABLE: No permit limit

ACTUAL: 0.28 lbs/hour @ 10.208 tons/hour CaO (1994 IEA Test Report)

$$\frac{0.28 \text{ lbs}}{\text{hour}} \times \frac{\text{hour}}{10.208 \text{ tons lime}} \times \frac{67,754 \text{ tons lime}}{\text{year}} \times \frac{\text{ton}}{2000 \text{ lbs}} = 0.929 \text{ tons SO}_2 \text{ Actual year}$$

NITROGEN OXIDES

RECOVERY BOILER: 194,280 lbs/hour BLS @ 5,995 BTU/lb BLS

ALLOWABLE: No permit limit

ACTUAL: Avg of 1.1637 lbs ton BLS

$$\frac{1.1637 \text{ lbs NO}_x}{\text{ton BLS}} \times \frac{740,089.5 \text{ tons BLS}}{\text{year}} \times \frac{\text{ton}}{2000 \text{ lbs}} = 435.28 \text{ tons NO}_x \text{ Actual year}$$

SMELT DISSOLVING TANK:

ALLOWABLE: No permit limit

ACTUAL: 2.86 lbs/hour @ 182,920 lbs/hr BLS (1994 IEA Test Report)

$$\frac{2.86 \text{ lbs NO}_x}{\text{hour}} \times \frac{\text{hour}}{182,920} \times \frac{1,496,179,000 \text{ lbs BLS}}{\text{year}} \times \frac{\text{ton}}{2000 \text{ lbs}} = 11.697 \text{ tons NO}_x \text{ Actual year}$$

POWER BOILER:

ALLOWABLE: 0.3 lbs/MM BTU heat input

$$\frac{0.30 \text{ lbs NO}_x}{10^6 \text{ BTU}} \times \frac{3.7482}{2.50164} \times 10^{12} \frac{\text{BTU}}{\text{year}} \times \frac{\text{ton}}{2000 \text{ lbs}} = 562.2 \text{ TONS NO}_x \text{ Allowed YEAR}$$

PERMITTED VALUES VS. ACTUAL

SULFUR DIOXIDE (CONT'D FROM PAGE 2)

CALCINER:

ALLOWABLE: No permit limit

ACTUAL: 0.28 lbs/hour @ 10.208 tons/hour CaO (1994 IEA Test Report)

$$\frac{0.28 \text{ lbs}}{\text{hour}} \times \frac{\text{hour}}{10.208 \text{ tons lime}} \times \frac{67,754 \text{ tons lime}}{\text{year}} \times \frac{\text{ton}}{2000 \text{ lbs}} = 0.929 \text{ tons SO}_2 \text{ Actual year}$$

NITROGEN OXIDES

RECOVERY BOILER: 194,280 lbs/hour BLS @ 5,995 BTU/lb BLS

ALLOWABLE: No permit limit

ACTUAL: Avg of 1.1637 lbs ton BLS

$$\frac{1.1637 \text{ lbs NO}_x}{\text{ton BLS}} \times \frac{740,089.5 \text{ tons BLS}}{\text{year}} \times \frac{\text{ton}}{2000 \text{ lbs}} = 435.28 \text{ tons NO}_x \text{ Actual year}$$

SMELT DISSOLVING TANK:

ALLOWABLE: No permit limit

ACTUAL: 2.86 lbs/hour @ 182,920 lbs/hr BLS (1994 IEA Test Report)

$$\frac{2.86 \text{ lbs NO}_x}{\text{hour}} \times \frac{\text{hour}}{182,920} \times \frac{1,496,179,000 \text{ lbs BLS}}{\text{year}} \times \frac{\text{ton}}{2000 \text{ lbs}} = 11.697 \text{ tons NO}_x \text{ Actual year}$$

POWER BOILER:

ALLOWABLE: 0.3 lbs/MM BTU heat input

$$\frac{0.30 \text{ lbs NO}_x}{10^6 \text{ BTU}} \times \frac{3.7482}{2.50164} \times 10^{12} \frac{\text{BTU}}{\text{year}} \times \frac{\text{ton}}{2000 \text{ lbs}} = 562.2 \text{ tons NO}_x \text{ Allowed year}$$

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PERMITTED VALUES VS. ACTUAL

TOTAL REDUCED SULFUR (CONT'D FROM PAGE 4)

$$5.533 \frac{\text{lbs TRS}}{\text{hour}} \times \frac{\text{hour}}{97.14 \text{ tons}} = 0.05696 \frac{\text{lbs}}{\text{ton}}$$

RECOVERY BOILER: 216,100 dscfm, 194,280 lbs BLS (97.14 tons BLS)

ALLOWABLE: 5 ppm, dry volume basis corrected to 8% O₂

$$\frac{5 \text{ ppm}}{10^6} \times 216,100 \frac{\text{dscf}}{\text{min}} \times \frac{60 \text{ min}}{\text{hr}} \times \frac{16 \text{ mole}}{359 \text{ ft}^3} \times \frac{528^\circ}{492^\circ} \times \frac{34,082 \text{ lbs H}_2\text{S}}{16 \text{ mole}} \times \left(\frac{20.9 - 8.0}{20.9 - 5.5} \right) = 5.533 \frac{\text{lbs TRS}}{\text{hour}}$$

$$5.533 \frac{\text{lb TRS}}{\text{hr}} \times 8427 \frac{\text{operating hours}}{\text{year}} \times \frac{\text{Ton}}{2000 \text{ lbs}} = 23.31 \frac{\text{Tons Allowable}}{\text{Year}}$$

$$.0570 \frac{\text{lbs BLS}}{\text{ton}} \times 748,089.5 \frac{\text{tons BLS}}{\text{year}} \times \frac{\text{ton}}{2000 \text{ lbs}} = 21.31 \frac{\text{Tons Allowable}}{\text{Year}}$$

CARBON MONOXIDE

RECOVERY BOILER:

ALLOWABLE: NO PERMIT LIMIT

ACTUAL: 1.241 lbs CO/ton BLS

$$1.241 \frac{\text{lbs CO}}{\text{ton BLS}} \times 748,089.5 \frac{\text{tons BLS}}{\text{year}} \times \frac{\text{ton}}{2000 \text{ lbs}} = 464.19 \frac{\text{tons CO Actual}}{\text{Year}}$$

POWER BOILER:

ALLOWABLE: NO PERMIT LIMIT

ACTUAL: 0.5564 lb/MM BTU Heat Input

$$0.5564 \frac{\text{lb}}{10^6 \text{ BTU}} \times 3.7482 \times 10^{12} \times 2.5044 \times 10^{12} \text{ BTU} \times \frac{\text{ton}}{2000 \text{ lbs}} = 1,042.75 \times 695.96 \frac{\text{tons CO Actual}}{\text{Year}}$$

SMELT DISSOLVING TANK

ALLOWABLE: NO PERMIT LIMIT

ACTUAL:

$$0.00645 \frac{\text{lb}}{\text{ton}} \text{ BLS} \times 748,089.5 \frac{\text{tons BLS}}{\text{year}} \times \frac{\text{ton}}{2000 \text{ lbs}} = 2.41 \frac{\text{tons CO Actual}}{\text{Year}}$$

PERMITTED VALUES VS. ACTUALS

CARBON MONOXIDE (CONT'D FROM PAGE 5)

CACCINER:

ALLOWABLE: NO PERMIT LIMIT

ACTUAL: 0.238 lb/ton Cd

$$0.238 \frac{\text{lb CO}}{\text{ton Cd}} \times 62,754 \frac{\text{tons lime}}{\text{year}} \times \frac{\text{ton}}{2000 \text{ lbs}} = 8.06 \frac{\text{tons CO Actual}}{\text{year}}$$

VOLATILE ORGANIC COMPOUNDS

RECOVERY BOILER

ALLOWABLE: NO PERMIT LIMIT

ACTUAL: 0.0273 lbs/ton BLS

$$0.0273 \frac{\text{lbs VOC}}{\text{ton BLS}} \times 748,089.5 \frac{\text{tons BLS}}{\text{year}} \times \frac{\text{ton}}{2000 \text{ lbs}} = 10.21 \frac{\text{tons VOC Actual}}{\text{year}}$$

POWER BOILER

ALLOWABLE: NO PERMIT LIMIT

ACTUAL: 0.0215 lb/MM BTU

$$0.0215 \frac{\text{lb}}{\text{MMBTU}} \times 3.7482 \times 10^{12} \times 2.5064 \times 10^{12} \frac{\text{BTU}}{\text{year}} \times \frac{\text{ton}}{2000 \text{ lbs}} = 40.29 \times 26.90 \frac{\text{tons VOC Actual}}{\text{year}}$$

SMELT DISSOLVING TANK

ALLOWABLE: NO PERMIT LIMIT

$$\text{ACTUAL: } 0.0047 \frac{\text{lb}}{\text{ton}} \text{ BLS} \times 748,089.5 \frac{\text{tons BLS}}{\text{year}} \times \frac{\text{ton}}{2000 \text{ lbs}} = 2.76 \frac{\text{tons VOC Actual}}{\text{year}}$$

PERMITTED VALUES VS ACTUALS

VOLATILE ORGANIC COMPOUNDS (CONT'D FROM PAGE 6)

CALCINER

ALLOWABLE: NO PERMIT LIMIT

ACTUAL: $0.0127 \frac{\text{lbs VOC}}{\text{ton Cd}} \times 67,754 \frac{\text{tons Cd}}{\text{year}} \times \frac{\text{ton}}{2000 \text{ lbs}} = 0.43 \frac{\text{tons VOC}}{\text{year}}$ Actual

PROCESS VENTS

ALLOWABLE: NO PERMIT LIMIT

ACTUAL: 301.96 tons VOC as C / year

FUGITIVES:

WEAR GAS: $1.0154 \frac{\text{LB}}{\text{ADMT}} \times 42.71 \frac{\text{ADMT}}{\text{Hour}} \times 32 \text{ Hours} \times \frac{\text{TON}}{2000 \text{ lbs}} = 0.694$

STRONG GAS: $20.3077 \frac{\text{LB}}{\text{ADMT}} \times 42.71 \frac{\text{ADMT}}{\text{Hour}} \times 23 \text{ Hours} \times \frac{\text{TON}}{2000 \text{ lbs}} = 9.974$

PARTS CLEANING FUGITIVES: 2.59 TONS/YEAR

WASTEWATER LAGOON: 107.98 TONS/YEAR

ACTIVE CHIP PILE: 203.29 TONS/YEAR
404.53 TONS Actual / Year

PERMITTED VALUES VS. ACTUALSTOTAL REDUCED SULFUR (AS H₂S)RECOVERY FURNACE (1995 Compliance Testing)

$$Fd = 216,100 \frac{\text{DSCF}}{\text{MIN}} \times \frac{60 \text{ MIN}}{\text{HOUR}} \times \frac{\text{HOUR}}{199,280 \text{ lbs BLS}} = 66.74 \frac{\text{DSCF}}{\text{lb BLS}}$$

$$EH = Cd Fd \frac{20.9}{(20.9 - \% O_2)} \quad \text{where } Cd = (2.59 \times 10^{-9} \cdot M) \text{ DSCF/LB} = 1 \text{ ppm}$$

M = pollutant molecular weight = 34.07 for H₂S

$$\therefore EH = (2.59 \times 10^{-9})(34.07)(66.74) \left(\frac{20.9}{20.9 - \% O_2} \right) = \left(\frac{1.231 \times 10^{-4}}{20.9 - \% O_2} \right) (\text{ppm TRS})$$

ER = EH * BS where BS = total BLS fired in month

CEM

JANUARY: 1.8 ppm TRS @ 5.53% O₂

$$ER = \frac{(1.231 \times 10^{-4})(1.8)}{(20.9 - 5.53)} \times 145,522,000 \frac{\text{lbs BLS}}{\text{month}} \times \frac{\text{Ton}}{2000 \text{ lbs}} = 1.049 \text{ tons TRS Actual} \quad 2.914 \text{ tons L}$$

FEBRUARY: 1.8 ppm TRS @ 5.81% O₂

$$ER = \frac{(1.231 \times 10^{-4})(1.8)}{(20.9 - 5.81)} \times 119,757,000 \frac{\text{lbs BLS}}{\text{month}} \times \frac{\text{Ton}}{2000 \text{ lbs}} = 0.879 \text{ tons TRS Actual} \quad 2.492 \text{ tons L}$$

MARCH: 2.15 ppm TRS @ 5.90% O₂

$$ER = \frac{(1.231 \times 10^{-4})(2.15)}{(20.9 - 5.90)} \times 114,607,000 \frac{\text{lbs BLS}}{\text{month}} \times \frac{\text{Ton}}{2000 \text{ lbs}} = 1.011 \text{ tons TRS Actual} \quad 2.809 \text{ tons L}$$

APRIL: 3.13 ppm TRS @ 5.49% O₂

$$ER = \frac{(1.231 \times 10^{-4})(3.13)}{(20.9 - 5.49)} \times 154,365,000 \frac{\text{lbs BLS}}{\text{month}} \times \frac{\text{Ton}}{2000 \text{ lbs}} = 1.930 \text{ tons TRS Actual} \quad 3.083 \text{ tons}$$

MAY: 2.62 ppm TRS @ 5.43% O₂

$$ER = \frac{(1.231 \times 10^{-4})(2.62)}{(20.9 - 5.43)} \times 123,732,000 \frac{\text{lbs BLS}}{\text{month}} \times \frac{\text{Ton}}{2000 \text{ lbs}} = 1.290 \text{ tons TRS Actual} \quad 2.461 \text{ tons}$$

JUNE: 3.19 ppm TRS @ 4.86% O₂

$$ER = \frac{(1.231 \times 10^{-4})(3.19)}{(20.9 - 4.86)} \times 110,013,000 \frac{\text{lbs BLS}}{\text{month}} \times \frac{\text{Ton}}{2000 \text{ lbs}} = 1.347 \text{ tons TRS Actual} \quad 2.111 \text{ tons}$$

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PERMITTED VALUES VS ACTUALS

TOTAL REDUCED SULFUR

RECOVERY FURNACE

JULY: 3.49 ppm TRS @ 5.30 % O₂

ER = $\frac{(1.231 \times 10^{-4})(3.49)}{(20.9 - 5.3)} \times 147,429,000 \frac{\text{lbs BLS}}{\text{month}} \times \frac{\text{Ton}}{2000 \text{ lbs}} = 2.030 \text{ tons Actual} \quad 2.908 \text{ tons L}$

AUGUST: 3.66 ppm TRS @ 5.71 % O₂

ER = $\frac{(1.231 \times 10^{-4})(3.66)}{(20.9 - 5.71)} \times 115,841,000 \frac{\text{lbs BLS}}{\text{month}} \times \frac{\text{Ton}}{2000 \text{ lbs}} = 1.718 \text{ tons Actual} \quad 2.347 \text{ tons L}$

SEPTEMBER: 2.76 ppm TRS @ 5.43 % O₂

ER = $\frac{(1.231 \times 10^{-4})(2.76)}{(20.9 - 5.43)} \times 117,690,000 \frac{\text{lbs BLS}}{\text{month}} \times \frac{\text{Ton}}{2000 \text{ lbs}} = 1.292 \text{ tons Actual} \quad 2.341 \text{ tons L}$

OCTOBER: 3.40 ppm TRS @ 5.67 % O₂

ER = $\frac{(1.231 \times 10^{-4})(3.4)}{(20.9 - 5.67)} \times 86,926,000 \frac{\text{lbs BLS}}{\text{month}} \times \frac{\text{Ton}}{2000 \text{ lbs}} = 1.194 \text{ tons Actual} \quad 1.756 \text{ tons L}$

NOVEMBER: 3.44 ppm TRS @ 5.67 % O₂

ER = $\frac{(1.231 \times 10^{-4})(3.44)}{(20.9 - 5.67)} \times 120,739,000 \frac{\text{lbs BLS}}{\text{month}} \times \frac{\text{Ton}}{2000 \text{ lbs}} = 1.659 \text{ tons Actual} \quad 2.411 \text{ tons L}$

DECEMBER: 3.39 ppm @ 5.52 % O₂

ER = $\frac{(1.231 \times 10^{-4})(3.39)}{(20.9 - 5.52)} \times 139,558,000 \frac{\text{lbs BLS}}{\text{month}} \times \frac{\text{Ton}}{2000 \text{ lbs}} = 1.893 \text{ tons Actual} \quad 2.793 \text{ tons L}$

ACTUALS:

JAN	-	1.049
FEB	-	0.879
MAR	-	1.011
APR	-	1.930
MAY	-	1.290
JUN	-	1.347
JUL	-	2.030
AUG	-	1.718
SEP	-	1.292
OCT	-	1.194
NOV	-	1.659
DEC	-	1.893
TOTAL:		17.292

LIMITS:

JAN	-	2.914
FEB	-	2.442
MAR	-	2.809
APR	-	3.083
MAY	-	2.461
JUN	-	2.111
JUL	-	2.908
AUG	-	2.347
SEP	-	2.341
OCT	-	1.756
NOV	-	2.411
DEC	-	2.793
TOTAL:		30.376

WASTE & WATER TREATMENT

100 GPD

