ACID MIST AND BERYLLIUM EMISSION MEASUREMENTS

KILN/RAW MILL

FLORIDA ROCK INDUSTRIES
THOMPSON S. BAKER CEMENT PLANT
NEWBERRY, FLORIDA

PERMIT NO. AC01-267311/PSD-FL-228

JULY 21 AND 24, 2000

KOOGLER & ASSOCIATES
ENVIRONMENTAL SERVICES
4014 NW 13TH STREET
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KOOGLER & ASSOCIATES
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To the best of my knowledge, all applicable field and analytical procedures comply with the Florida Department of Environmental Protection requirements and all test data and plant operating data are true and correct.

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9/5/07

Date

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1.0 INTRODUCTION

Florida Rock Industries owns and operates a 2300 ton per day (clinker) dry process precalciner Portland cement plant on CR 235, two miles north of the city center of Newberry, Florida. On July 21 and 24, 2000, Koogler & Associates Environmental Services of Gainesville, Florida, conducted sulfuric acid mist and beryllium emission measurements on the kiln/raw mill stack in accordance with EPA Test Method 8 (40 CFR 60, Appendix A) for acid mist and Test Method 104 (40 CFR 61, Appendix B) for beryllium. The purpose of the testing was to establish emission rates for these two air pollutants as required by Permit AC01-267311/PSD-FL-228.

The Northeast District Office of the Florida Department of Environmental Protection (FDEP) in Jacksonville, the FDEP Northeast District Branch Office in Gainesville and FDEP in Tallahassee, Florida, were notified of the scheduled initial air emission performance tests and testing protocol at the cement plant.

During the acid mist test period, the kiln was operating at a preheater feed rate of 139.8 tons per hour and during the beryllium test period, the kiln was operating at a preheater feed rate of 138.3 tons per hour; both within 10 percent of the permitted feed rate of 149.9 tons per hour. Permit AC01-267311 limits the preheater feed rate to 149.9 tons per hour, which approximately corresponds to a permitted clinker production rate of 95.8 tons per hour.

The permit for the plant limits acid mist and beryllium emissions from the kiln/raw mill to rates established by Best Available Control Technology and specifies that the emission limits for these air pollutants be established based on "future stack tests". The emission measurements reported herein represent the initial emission measurements on the plant for acid mist and beryllium.

The emissions from the kiln/raw mill are controlled by electrostatic precipitators (ESPs). The measured mass emission rate of acid mist from the kiln/raw mill averaged 0.0003 pounds per hour and beryllium emissions averaged 0.06 pounds per hour.

2.0 SAMPLING POINT LOCATIONS

Four sample ports are located in the 112-inch diameter, 241-foot high stack exhausting the kiln/raw mill. The ports are 50.6 feet (5.4 stack diameters) below the top of the stack and 146.8 feet (15.7 diameters) above the point where the kiln/raw mill gases enter the stack. Based on the requirements of EPA Method 1 (40 CFR 60, Appendix A), 12 sample points were selected; three points through each of the four ports.

3.0 FIELD AND ANALYTICAL PROCEDURES

Sulfuric acid mist emission measurements were conducted on the kiln/raw mill stack using EPA Method 8 and beryllium emission measurements were conducted using EPA Method 104. The sampling point locations for the two EPA methods were established in accordance with EPA Method 1. Stack gas velocity measurements and stack gas moisture measurements were made in conjunction with the EPA Method 8 and 104 tests in accordance with EPA Methods 2 and 4. Measurements to determine the dry molecular weight of the stack gas were made in accordance with EPA Method 3. All EPA tests methods are described in 40 CFR 60, Appendix A or 40 CFR 61, Appendix B and have been adopted by reference by FDEP by Rule 62-297.401, F.A.C. There were no variations or exceptions to any of the referenced test methods.

4.0 SUMMARY OF RESULTS

The sulfuric acid mist emission measurements made on July 21, 2000, are summarized in Table 1. The acid mist emission rate from the kiln/raw mill ranged from non-detectable to 0.0009 pounds per hour and averaged 0.0003 pounds per hour. The stack gas flow rate from the kiln/raw mill averaged 127,703 standard cubic feet per minute, dry (193,072 acfm). The stack gas temperature averaged 219°F and the moisture content averaged 14.9 percent.

The beryllium emission rate from the kiln/raw mill, measured on July 24, 2000, ranged from 0.01 to 0.12 pounds per hour and averaged 0.06 pounds per hour. These data are summarized in Table 2. The stack gas flow rate from the kiln/raw mill during the beryllium tests averaged 106,903 dry standard cubic feet per minute (165,420 acfm), the stack gas temperature averaged 231°F and the stack gas moisture averaged 16.3 percent.

These emission measurements represent the initial acid mist and beryllium emission measurements on the kiln/raw mill required by Permit AC01-267311. These data will be used by FDEP to establish emission limits for acid mist and beryllium for the kiln/raw mill.

Calculations, field and analytical data sheets, plant operating information, equipment calibration sheets and a list of project participants are included in the Appendix of this report.

TABLE 1
SULFURIC ACID MIST EMISSION TEST DATA

FLORIDA ROCK INDUSTRIES, INC
NEWBERRY, FLORIDA

SOURCE: Kiln/Raw Mill Stack

DATE: July 21, 2000

Run No.	Stack Flow Rate (SCFMD)	ACID MIST			
		Conc. (lbs/DSCF)	Emission Rate (Lbs/Hr)	Conc. (mg/DSCF)	Conc. (mg/ACF)
1	124,881	0.00E+00	0.000	0.0000	0.0000
2	126,717	2.88E-09	0.022	0.0013	0.0009
3	131,511	0.00E+00	0.000	0.0000	0.0000
Avg.	127,703	9.59E-10	0.007	0.0004	0.0003

TABLE 2
BERYLLIUM EMISSION TEST DATA

FLORIDA ROCK INDUSTRIES, INC.
NEWBERRY, FLORIDA

SOURCE: Kiln/Raw Mill Stack

DATE: July 24, 2000

Run No.	Process Weight Rate (Tons/hr)	Stack Gas Flow Rate (SCFMD)	Stack Gas Temperature (F)	Stack Gas Moisture (%)	Total Beryllium Conc. (gr/dscf)	Total Beryllium Emission Rate (Lbs/Hr)
1	135.0	93,275	246	17.0	0.0001	0.06
2	140.0	98,112	248	16.0	0.0001	0.12
3	140.0	129,320	200	16.0	0.0000	0.01
Average	138.3	106,903	231	16.3	0.0001	0.06

$35.31 \frac{ft^3}{m^3}$ $1\ \mu g = 1.54(10)^{-5}$ grain

$0.0001 \frac{gr}{dscf} \times \frac{1\ \mu g}{1.54(10)^{-5}\ gr} = 6.49 \frac{\mu g}{dscf}$

$\frac{6.49\ \mu g/ft^3}{1\ m^3/35.31\ ft^3} = 229.3 \frac{\mu g}{m^3}$

APPENDIX

ACID MIST TESTS

CALCULATIONS

SUMMARY OF ACID MIST EMISSION TEST DATA

Florida Rock Industries
Cement Kiln
July 21, 2000

Run No.	Stack Flow Rate (SCFMD)	ACID MIST Conc. (lbs/DSCF)	Emission Rate (Lbs/Hr)	Conc. (mg/DSCF)	Conc. (mg/ACF)
1	124,881	0.00E+00	0.000	0.0000	0.0000
2	126,717	2.88E-09	0.022	0.0013	0.0009
3	131,511	0.00E+00	0.000	0.0000	0.0000
Avg.	127,703	9.59E-10	0.007	0.0004	0.0003

SUMMARY OF SO2 EMISSION TEST DATA

Florida Rock Industries
Cement Kiln
July 21, 2000

Run No.	Stack Flow Rate (SCFMD)	SO2 Conc. (ppm)	SO2 Conc. at 0% CO2 (ppm)	SO2 Conc. at 0% O2 (ppm)	SO2 Emission Rate (lb/hr)	SO2 Emission Rate (lb/MMBtu
1	124,881	0.49			0.61	
2	126,717	0.68			0.86	
3	131,511	0.66			0.87	
Avg.	127,703	0.61			0.78	

GENERAL DATA

DATA FILE NAME: H2SO4

Company	: Florida Rock Industries				**********
Source/Unit	: Cement Kiln				12:18 PM
Date	: July 21, 2000		Cp	: 0.840	
Stack dia.	: 112.00 inch	OR :	Duct Length	: 0.00	inch
Oxygen Corr.	: 0.0 percent		Duct Width	: 0.00	inch
CO2 Corr.	: 0.0 percent		Std. Temp.	: 68	F

FUEL ANALYSIS DATA, (By F Factor or Fuel Use)

F Factor = F, Fuel Use = U F Process Wt.

Hydrogen,wt%	: 0.00	Run 1	: 135.5 Tons/hr
Carbon, wt%	: 0.00	Run 2	: 144
Sulfur, wt%	: 0.00	Run 3	: 140
Nitrogen,wt%	: 0.00		
Oxygen, wt%	: 0.00		
Btu/lb	: 0		

Type of Flow Meter : (1=Meter Box 2=Mass Flow Meter) 1

F-Factor : dscf/MMBtu;

FIELD DATA ------- METHOD 5	RUN 1	RUN 2	RUN 3
Meter Temp., Tm (F)	101	102	101
Stack Temp., Ts (F)	221	219	219
Sq.Rt. dP	0.73	0.74	0.76
dH (in. H2O)	2.44	1.72	1.85
Meter Vol.,Vm (ft3)	56.484	48.731	49.946
Meter Y	0.997	0.997	0.997
Bar. Press.,Pb (in.Hg.)	29.90	29.90	29.90
Vol. H2O, Vlc (ml)	197	168	172
Static Press.,Ps (in.H2O)	-0.25	-0.25	-0.25
Test Time (min.)	60.0	60.0	60.0
Nozzle Dia.,Dn (in.)	0.308	0.278	0.278
Oxygen, O2 (%)	9.7	11.7	11.4
Carbon Dioxide, CO2 (%)	17.6	17.1	16.8
Carbon Monoxide, CO (%)	0.0	0.0	0.0

Report Emission Criteria in ? l = lb/hr g = gr/dscf : L

Process Rate Units ? T = Ton/hr, L = Lbs/hr, C = Cans/min: T

Allowable Particulate Matter Emission Rate .....:

LABORATORY RESULTS	RUN 1	RUN 2	RUN 3	
GRAVIMETRIC ANALYSIS METHOD 5 :				
Front Half Wash (FHW)	0.00000	0.00000	0.00000	grams
Filterable Sample (MF)	0.00000	0.00000	0.00000	
Condensible Sample (BHW)	0.00000	0.00000	0.00000	

---------- M E T H O D S 6, 8, & 26 ----------

IS FIELD DATA THE SAME AS METHOD 5? (Y=YES, N=NO) Y

Type of Flow Meter : (1=Meter Box 2=Mass Flow Meter) 1

FIELD DATA	RUN 1	RUN 2	RUN 3
Meter Temp., Tm (F)	101	102	101
dH (in. H2O)	2.44	1.72	1.85
Meter Vol.,Vm (ft3)	56.484	48.731	49.946
Meter Y	0.997	0.997	0.997
Bar. Press.,Pb (in.Hg.)	29.90	29.90	29.90
O2 Correction (%)	0.0 %		
CO2 Correction (%)	0.0 %		
SO2 ANALYSIS METHOD 6 OR 8 :			
Sample Volume, ml	1000	1000	1000
Sample Aliquot, ml	20	20	20
Volume of Titer, ml	0.33	0.35	0.35
Volume of Titer Blank, ml	0.20	0.20	0.20
Normality of BaCl 0.0097500			

LABORATORY RESULTS (Continued)

ACID MIST ANALYSIS METHOD 8 :			
Sample Volume, ml	500	500	500
Sample Aliquot, ml	100	100	100
Volume of Titer, ml	0.20	0.23	0.20
Volume of Titer Blank, ml	0.20	0.20	0.20
Normality of BaCl 0.0097500			

HYDROGEN CHLOIDE (HCl) ANALYSIS METHOD 26 :			
Chloride Volume, mg	0.0000	0.0000	0.0000
Hydrogen Chloride (HCl) Volume, mg	0.0000	0.0000	0.0000

A. FIELD DATA SUMMARY

PLANT : Florida Rock Industries
Cement Kiln
DATE : July 21, 2000

	RUN 1	RUN 2	RUN 3
Vlc = Vol water collected in train, ml	197.0	168.0	172.0
Vm = Sample gas vol, meter cond., acf	56.484	48.731	49.946
Y = Meter calibration factor	0.9970	0.9970	0.9970
Pbar = Barometric pressure, in. Hg	29.90	29.90	29.90
Pstatic = Stack static pressure, in. H2O	-0.25	-0.25	-0.25
dH = Avg meter pressure diff, in. H2O	2.44	1.72	1.85
Tm = Absolute meter temp., degrees R	561.0	562.3	561.3
Vm(std) = Sample gas vol, Std. cond., dscf	53.285	45.788	47.028
Bws = Water vapor in gas stream, fraction	0.148	0.147	0.147
MF = Moisture factor (1 - Bws)	0.852	0.853	0.853
CO2 = Carbon Dioxide, dry, volume %	17.60	17.10	16.80
O2 = Oxygen, dry, volume %	9.70	11.70	11.40
N2 = Nitrogen, dry volume %	72.70	71.20	71.80
Md = Molecular weight of stack gas, dry	31.20	31.20	31.14
Ms = Molecular weight of stack gas, wet	29.25	29.26	29.21
Cp = Pitot tube coefficient	0.84	0.84	0.84
Sq.Rt. dP = Avg. square root of each dP	0.7278	0.7367	0.7632
Ts = Absolute stack temp., degrees R	681.3	679.3	678.5
A = Area of stack, ft2	68.42	68.42	68.42
Qstd = Volumetric flowrate, dscfm	124,881	126,717	131,511
An = Nozzle area, ft2	5.17E-04	4.22E-04	4.22E-04
0 = Sample time, minutes	60.00	60.00	60.00
%I = Isokinetic variation, percent	94.04	97.76	96.75

SOURCE TEST CALCULATIONS

PLANT : Florida Rock Industries
Cement Kiln

RUN NO.: 1
DATE : July 21, 2000

STD.TEMP, Tstd	= 68	F	STATIC PRESS.,Ps	= -0.25	in. H2O
METER TEMP, Tm	= 101	F	PITOT COFF., Cp	= 0.840	
STACK TEMP, Ts	= 221.3	F	STACK I.D.	= 112.00	inch
AVG.VEL.HEAD,dP	= 0.530	in. H2O	DUCT LENGTH	=	inch
METER ORIFICE,dH	= 2.44	in. H2O	DUCT WIDTH	=	inch
METER VOL., Vm	= 56.484	Cu.Ft.	STACK AREA, As	= 68.417	Sq.Ft.
METER COFF., Y	= 0.997		TEST TIME	= 60.00	min.
BAR. PRESS., Pb	= 29.90	in.Hg	NOZZLE DIA.	= 0.308	inch
COND.(Vlc)	= 197.0	ml	NOZZLE DIA., An	= 5.2E-04	Sq.Ft.

GAS ANALYSIS = 9.70 % O2 0.00 % CO
17.60 % CO2 72.70 % N2

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Vm(std) = [(T(std) + 460) / 29.92] x Vm x Y x (Pb + (dH / 13.6)) / (Tm + 460).....	=	53.285	dscf
Vw(std) =(8.9148 x 10e-5) x (Tstd + 460) x Vlc	=	9.273	scf
Bws = Vw(std) / (Vm(std) + Vw(std)).....	=	0.148	Lower Bws value used.
Bws @ Saturated Conditions = Vapor Press. of H2O @ Dew Point Temp. / (Ps, in.Hg.)	=	1.000	
%EA =(%O2 - 0.5%CO)/(0.264%N2 - (%O2-0.5%CO)) x 100	=	102.18	
Md =(.44 x %CO2)+(.32 x %O2)+[.28 x (%N2 + %CO)]	=	31.20	
Ms = (Md x (1-Bws)) + (18.0 x Bws).....	=	29.25	
P(stack) = Pbar + (Ps / 13.6)	=	29.88	in. Hg
vs = 85.49 x CP x (Sq.Rt.dP) x [Sq.Rt.(Ts + 460) / (Ms x P(stack))]	=	46.15	ft/sec
Qs = vs x As x 60	=	189,433	acf/min
Qs(std) = Qs x (1-Bws)x((Tstd + 460)/(Ts + 460)) x (P(stack)/29.92)	=	124,881	dscf/min
I = (Ts+460) x [(0.002669 x Vlc) + (Vm(std) / (T(std) + 460) / 29.92] x 100 / [Time x P(stack) x An x vs x 60]	=	94.04	%

SOURCE TEST CALCULATIONS

PLANT : Florida Rock Industries
Cement Kiln

RUN NO.: 2
DATE : July 21, 2000

STD.TEMP, Tstd	=	68 F	STATIC PRESS.,Ps	=	-0.25 in. H2O
METER TEMP, Tm	=	102.25 F	PITOT COFF., Cp	=	0.840
STACK TEMP, Ts	=	219.3 F	STACK I.D.	=	112.00 inch
AVG.VEL.HEAD,dP	=	0.543 in. H2O	DUCT LENGTH	=	inch
METER ORIFICE,dH	=	1.72 in. H2O	DUCT WIDTH	=	inch
METER VOL., Vm	=	48.731 Cu.Ft.	STACK AREA, As	=	68.417 Sq.Ft.
METER COFF., Y	=	0.997	TEST TIME	=	60.00 min.
BAR. PRESS., Pb	=	29.90 in.Hg	NOZZLE DIA.	=	0.278 inch
COND.(Vlc)	=	168.0 ml	NOZZLE DIA., An	=	4.2E-04 Sq.Ft.

GAS ANALYSIS = 11.70 % O2 0.00 % CO
17.10 % CO2 71.20 % N2

****

Vm(std) = [T(std) + 460 / 29.92] x Vm x Y x (Pb + (dH / 13.6)) / (Tm + 460).....	=	45.788	dscf
Vw(std) =(8.9148 x 10e-5) x (Tstd + 460) x Vlc	=	7.908	scf
Bws = Vw(std) / (Vm(std) + Vw(std)).....	=	0.147	Lower Bws value used.
Bws @ Saturated Conditions = Vapor Press. of H2O @ Dew Point Temp. / (Ps, in.Hg.)	=	1.000	
%EA =(%O2 - 0.5%CO)/(0.264%N2 - (%O2-0.5%CO)) x 100	=	164.86	
Md =(.44 x %CO2)+(.32 x %O2)+[.28 x (%N2 + %CO)]	=	31.20	
Ms = (Md x (1-Bws)) + (18.0 x Bws).....	=	29.26	
P(stack) = Pbar + (Ps / 13.6)	=	29.88	in. Hg
vs = 85.49 x CP x (Sq.Rt.dP) x [Sq.Rt.(Ts + 460) / (Ms x P(stack))]	=	46.64	ft/sec
Qs = vs x As x 60	=	191,439	acf/min
Qs(std) = Qs x (1-Bws)x((Tstd + 460)/(Ts + 460)) x (P(stack)/29.92)	=	126,717	dscf/min
I = (Ts+460) x [(0.002669 x Vlc) + (Vm(std) / (T(std) + 460) / 29.92] x 100 / [Time x P(stack) x An x vs x 60]	=	97.76	%

SOURCE TEST CALCULATIONS

PLANT : Florida Rock Industries
Cement Kiln

RUN NO.: 3
DATE : July 21, 2000

STD.TEMP, Tstd	=	68 F	STATIC PRESS.,Ps	=	-0.25 in. H2O
METER TEMP, Tm	=	101.25 F	PITOT COFF., Cp	=	0.840
STACK TEMP, Ts	=	218.5 F	STACK I.D.	=	112.00 inch
AVG.VEL.HEAD,dP	=	0.582 in. H2O	DUCT LENGTH	=	inch
METER ORIFICE,dH	=	1.85 in. H2O	DUCT WIDTH	=	inch
METER VOL., Vm	=	49.946 Cu.Ft.	STACK AREA, As	=	68.417 Sq.Ft.
METER COFF., Y	=	0.997	TEST TIME	=	60.00 min.
BAR. PRESS., Pb	=	29.90 in.Hg	NOZZLE DIA.	=	0.278 inch
COND.(Vlc)	=	172.0 ml	NOZZLE DIA., An	=	4.2E-04 Sq.Ft.

GAS ANALYSIS = 11.40 % O2 0.00 % CO
16.80 % CO2 71.80 % N2

****

Vm(std) = [T(std) + 460 / 29.92] x Vm x Y x (Pb + (dH / 13.6)) / (Tm + 460).....	=	47.028	dscf
Vw(std) =(8.9148 x 10e-5) x (Tstd + 460) x Vlc	=	8.096	scf
Bws = Vw(std) / (Vm(std) + Vw(std)).....	=	0.147	Lower Bws value used.
Bws @ Saturated Conditions = Vapor Press. of H2O @ Dew Point Temp. / (Ps, in.Hg.)	=	1.000	
%EA =(%O2 - 0.5%CO)/(0.264%N2 - (%O2-0.5%CO)) x 100	=	150.89	
Md =(.44 x %CO2)+(.32 x %O2)+[.28 x (%N2 + %CO)]	=	31.14	
Ms = (Md x (1-Bws)) + (18.0 x Bws).....	=	29.21	
P(stack) = Pbar + (Ps / 13.6)	=	29.88	in. Hg
vs = 85.49 x CP x (Sq.Rt.dP) x [Sq.Rt.(Ts + 460) / (Ms x P(stack))]	=	48.32	ft/sec
Qs = vs x As x 60	=	198,344	acf/min
Qs(std) = Qs x (1-Bws)x((Tstd + 460)/(Ts + 460)) x (P(stack)/29.92)	=	131,511	dscf/min
I = (Ts+460) x [(0.002669 x Vlc) + (Vm(std) / (T(std) + 460) / 29.92] x 100 / [Time x P(stack) x An x vs x 60]	=	96.75	%

B. PARTICULATE DATA SUMMARY

PLANT : Florida Rock Industries
Cement Kiln
DATE : July 21, 2000

	RUN 1	RUN 2	RUN 3
Sample Weight (FHW + MF + BHW), mg	0.00	0.00	0.00
Meter Volume, standard cond., Vm(std)	53.285	45.788	47.028
Carbon Dioxide, percent	17.60	17.10	16.80
Oxygen, percent	9.70	11.70	11.40
Sample Concentration :			
gr/scf	0.0000	0.0000	0.0000
gr/dscf	0.0000	0.0000	0.0000
gr/dscf @ 0 % CO2	0.0000	0.0000	0.0000
gr/dscf @ 0 % O2	0.0000	0.0000	0.0000
ppm * MW (dry gas).....	0.0	0.0	0.0
ppm * MW @ 0% CO2	0.0	0.0	0.0
ppm * MW @ 0% O2	0.0	0.0	0.0

C. ACID MIST DATA SUMMARY

PLANT : Florida Rock Industries
Cement Kiln
DATE : July 21, 2000

Normality of BaCl2 : 0.0097500

FILTERABLE ACID MIST :

Sample Volume, ml	500	500	500
Sample Aliquot, ml	100	100	100
Volume of Titer, ml	0.20	0.23	0.20
Volume of Titer Blank, ml	0.20	0.20	0.20
Volume of Acid Mist Meter (dscf)	53.285	45.788	47.028
Vm(std) = [(T(std) + 460) / 29.92] x Vm(SO2) x Y(SO2) x (Pb + (dH / 13.6)) / (Tm + 460)			
Qs = Volumetric flowrate, acfm	189,433	191,439	198,344
Qstd = Volumetric flowrate, dscfm	124,881	126,717	131,511
Total lb Acid Mist ..... [1.0811E-4 x (Vt - Vtb) x N x Vsol] / Vol(aloq)	0.00E+00	1.32E-07	0.00E+00
Total Acid Mist lb/hr ..... [Acid Mist (lb) / Vm std (ft^3)] x Qs std x 60	0.00	0.02	0.00
Acid Mist (lb/MMBtu) ..... [Acid Mist (lb) / Vm std (ft^3)] x F-Factor			
Acid Mist Concentration lb/dscf .....[Acid Mist Concentration (lb) / Vm std (ft^3)]	0.00E+00	2.88E-09	0.00E+00
Acid Mist Concentration mg/dscf ..... [Acid Mist Concentration lb/ft^3 * 453,600 mg/lb]	0.0000	0.0013	0.0000
Acid Mist Concentration mg/acf ..... [Acid Mist Concentation mg/ft^3 * Qs(std) / Qs]	0.0000	0.0009	0.0000

D. SULFUR DIOXIDE DATA SUMMARY

PLANT : Florida Rock Industries
Cement Kiln
DATE : July 21, 2000

Normality of BaCl2 ..... 0.0097500

SO2 ANALYSIS :

Sample Volume, ml	1000	1000	1000
Sample Aliquot, ml	20	20	20
Volume of Titer, ml	0.33	0.35	0.35
Volume of Titer Blank, ml	0.20	0.20	0.20
Volume of SO2 Meter	53.285	45.788	47.028
Vm(std) = [(T(std) + 460) / 29.92] x Vm(SO2) x Y(SO2) x (Pb + (dH / 13.6)) / (Tm + 460)			
Qstd = Volumetric flowrate, dscfm	124,881	126,717	131,511
Total lb SO2 ..... [7.061E-5 x (Vt - Vtb) x N x Vsol] / Vol(aloq)	4.30E-06	5.16E-06	5.16E-06
Total SO2 lb/hr ..... [SO2 (lb) / Vm std (ft^3)] x Qs std (ft^3/min) x 60 (min/hr)	0.61	0.86	0.87
SO2 (lb/MMBtu) ..... [SO2 (lb) / Vm std (ft^3)] x F (dscf/MMBtu)			
SO2 (ppm) ..... [Mass SO2 (lb) x 385 / 64E+6 (ft^3/lb)] / Vm(std)	0.49	0.68	0.66
SO2 (ppm) @ 0.0 % CO2 Corr. ..... ppm x 0.0 % Corr. / % CO2 in Stack			
SO2 (ppm) 0.0% O2 Corr. ..... ppm x (20.9% - 0.0% O2 Corr.) /(20.9% - % O2 Stack)			
Heat Input (MMBtu/hr) ..... (Process Weight (ton/hr) x Heating Value (Btu/gal) x Fuel Use Rate (gal/ton) / 1E6			
SO2 (lb/MMBtu) ..... SO2 (lb/hr) / Heat Input (MMBtu/hr)			

EMISSION RATE CALCULATIONS

PLANT :Florida Rock Industries
Cement Kiln

RUN NO.: 1
STANDARD TEMP. : 68 F DATE : July 21, 2000

Front Half Wash (FHW)	0.00000 grams	Vm(std)	53.285 ft3
Mass Filter (MF)	0.00000 grams	Vw(std)	9.273 ft3
Back Half Wash (BHW)	0.00000 grams	Qs(std)	124,881 dscfm
Vm(std) SO2	53.285 dscf	Bws	0.148
CO2 CORR 0.0 %		CO2	17.60 %
O2 CORR. 0.0 %		O2	9.70 %

F-FACTOR

10E6 x [3.64(%H) + 1.53(%C) + 0.57(%S) + 0.14(%N) - 0.46(%O2)] / (Btu/lb) x [(Tstd + 460)/528] ..... dscf/MMBtu

FUEL USE

Use Rate (gal/ton) * Process Wt. (ton/hr) ..... gal/hr
Heat Input = (Process Weight (ton/hr) x Heating .... MMBtu/hr
Value (Btu/gal) x Fuel Use Rate (gal/ton) / 1E6

TOTAL PARTICULATE

15.432 x (FHW + MF + BHW) / [(Vm(std) + Vw(std)] ...	0.0000	gr/scf
15.432 x (FHW + MF + BHW) / (Vm(std)	0.0000	gr/dscf
gr/dscf x (12 / %CO2)	0.0000	@ 0% CO2
gr/dscf x [(20.9 - Oxygen corr.) / (20.9 - %O2)] ...	0.0000	@ 0% O2
0.00857 x Qs(std) x gr/dscf	0.00	lb/hr
F-Fac x 1.4286E-4 x [20.9 / (20.9-%O2)] x gr/dscf ..		lb/MMBtu
Particulate (lb/hr) / Heat Input (MMBtu/hr)		lb/MMBtu

TOTAL ACID MIST

[1.0811E-4 x (Vt - Vtb) x N x Vsol] / Vol(aloq)	0.00E+00	lb Acid Mist
[Acid Mist (lb) / Vm std (ft^3)] x Qs std x 60 ...	0.00	lb/hr
[Acid Mist (lb) / Vm std (ft^3)] x F-Factor		lb/MMBtu

SULFUR DIOXIDE (SO2)

[7.061E-5 x (Vt - Vtb) x N x Vsol] / Vol(aloq)	4.30E-06	lb SO2
[SO2 (lb) / Vm std (ft^3)] x Qs std (ft^3/min) x 60	0.61	lb/hr
[SO2 (lb) / Vm std (ft^3)] x F		lb/MMBtu
[Mass SO2 (lb) x 385 / 64E+6 (ft^3/lb)] / Vm (std)	0.49	ppm
ppm x 0.0 % Corr. / 17.6 % CO2 in Stack		ppm @ 0% CO2
ppm x (20.9% - 0.0% O2 Corr)/(20.9% - 9.7% O2 Stack)		ppm @ 0% O2
SO2 (lb/hr / Heat Input)		lb/MMBtu

HYDROGEN CHLORIDE DATA SUMMARY

[Mass HCl(mg) x 385 x 1E6] / [453600 x 36.5 x Vm(std		ppm
ppm x 0.0 % Corr. / 17.6 % CO2 in Stack		ppm @ 0% CO2
ppm x (20.9% - 0.0% O2 Corr)/(20.9% - 17.6% O2 Stack		ppm @ 0% O2
[Mass HCl(mg) x 60 x Qs / (Vm(std) x 453,600)]...		lb/hr

EMISSION RATE CALCULATIONS

PLANT :Florida Rock Industries
Cement Kiln

STANDARD TEMP. : 68 F
RUN NO.: 2
DATE : July 21, 2000

Front Half Wash (FHW)	0.00000 grams	Vm(std)	45.788 ft3
Mass Filter (MF)	0.00000 grams	Vw(std)	7.908 ft3
Back Half Wash (BHW)	0.00000 grams	Qs(std)	126,717 dscfm
Vm(std) SO2	45.788 dscf	Bws	0.147
CO2 CORR 0.0 %		CO2	17.10 %
O2 CORR. 0.0 %		O2	11.70 %

F-FACTOR

10E6 x [3.64(%H) + 1.53(%C) + 0.57(%S) + 0.14(%N) - 0.46(%O2)] / (Btu/lb) x [(Tstd + 460)/528] ..... dscf/MMBtu

FUEL USE

Use Rate (gal/ton) * Process Wt. (ton/hr) ..... gal/hr

Heat Input = (Process Weight (ton/hr) x Heating .... MMBtu/hr
Value (Btu/gal) x Fuel Use Rate (gal/ton) / 1E6

TOTAL PARTICULATE

15.432 x (FHW + MF + BHW) / [(Vm(std) + Vw(std)] ...	0.0000	gr/scf
15.432 x (FHW + MF + BHW) / (Vm(std)	0.0000	gr/dscf
gr/dscf x (12 / %CO2)	0.0000	@ 0% CO2
gr/dscf x [(20.9 - Oxygen corr.) / (20.9 - %O2)] ...	0.0000	@ 0% O2
0.00857 x Qs(std) x gr/dscf	0.00	lb/hr
F-Fac x 1.4286E-4 x [20.9 / (20.9-%O2)] x gr/dscf ..		lb/MMBtu
Particulate (lb/hr) / Heat Input (MMBtu/hr)		lb/MMBtu

TOTAL ACID MIST

[1.0811E-4 x (Vt - Vtb) x N x Vsol] / Vol(aloq)	1.32E-07	lb Acid Mist
[Acid Mist (lb) / Vm std (ft^3)] x Qs std x 60 ...	0.02	lb/hr
[Acid Mist (lb) / Vm std (ft^3)] x F-Factor		lb/MMBtu

SULFUR DIOXIDE (SO2)

[7.061E-5 x (Vt - Vtb) x N x Vsol] / Vol(aloq)	.5.16E-06	lb SO2
[SO2 (lb) / Vm std (ft^3)] x Qs std (ft^3/min) x 60	0.86	lb/hr
[SO2 (lb) / Vm std (ft^3)] x F		lb/MMBtu
[Mass SO2 (lb) x 385 / 64E+6 (ft^3/lb)] / Vm (std)	0.68	ppm
ppm x 0.0 % Corr. / 17.6 % CO2 in Stack		ppm @ 0% CO2
ppm x (20.9% - 0.0% O2 Corr)/(20.9% - 17.6% O2 Stack		ppm @ 0% O2
SO2 (lb/hr / Heat Input)		lb/MMBtu

HYDROGEN CHLORIDE DATA SUMMARY

[Mass HCl(mg) x 385 x 1E6] / [453600 x 36.5 x Vm(std	ppm
ppm x 0.0 % Corr. / 17.1 % CO2 in Stack	ppm @ 0% CO2
ppm x (20.9% - 0.0% O2 Corr)/(20.9% - 17.1% O2 Stack	ppm @ 0% O2
[Mass HCl(mg) x 60 x Qs / (Vm(std) x 453,600)]...	lb/hr

EMISSION RATE CALCULATIONS

PLANT :Florida Rock Industries
Cement Kiln

RUN NO.: 3
STANDARD TEMP. : 68 F DATE : July 21, 2000

Front Half Wash (FHW)	0.00000 grams	Vm(std)	47.028 ft3
Mass Filter (MF)	0.00000 grams	Vw(std)	8.096 ft3
Back Half Wash (BHW)	0.00000 grams	Qs(std)	131,511 dscfm
Vm(std) SO2	47.028 dscf	Bws	0.147
CO2 CORR 0.0 %		CO2	16.80 %
O2 CORR. 0.0 %		O2	11.40 %

F-FACTOR

10E6 x [3.64(%H) + 1.53(%C) + 0.57(%S) + 0.14(%N) - 0.46(%O2)] / (Btu/lb) x [(Tstd + 460)/528] ..... dscf/MMBtu

FUEL USE

Use Rate (gal/ton) * Process Wt. (ton/hr) ..... gal/hr

Heat Input = (Process Weight (ton/hr) x Heating .... MMBtu/hr
Value (Btu/gal) x Fuel Use Rate (gal/ton) / 1E6

TOTAL PARTICULATE

15.432 x (FHW + MF + BHW) / [(Vm(std) + Vw(std)] ...	0.0000	gr/scf
15.432 x (FHW + MF + BHW) / (Vm(std)	0.0000	gr/dscf
gr/dscf x (12 / %CO2)	0.0000	@ 0% CO2
gr/dscf x [(20.9 - Oxygen corr.) / (20.9 - %O2)] ...	0.0000	@ 0% O2
0.00857 x Qs(std) x gr/dscf	0.00	lb/hr
F-Fac x 1.4286E-4 x [20.9 / (20.9-%O2)] x gr/dscf ..		lb/MMBtu
Particulate (lb/hr) / Heat Input (MMBtu/hr)		lb/MMBtu

TOTAL ACID MIST

[1.0811E-4 x (Vt - Vtb) x N x Vsol] / Vol(aloq)	0.00E+00	lb Acid Mist
[Acid Mist (lb) / Vm std (ft^3)] x Qs std x 60 ...	0.00	lb/hr
[Acid Mist (lb) / Vm std (ft^3)] x F-Factor		lb/MMBtu

SULFUR DIOXIDE (SO2)

[7.061E-5 x (Vt - Vtb) x N x Vsol] / Vol(aloq)	.5.16E-06	lb SO2
[SO2 (lb) / Vm std (ft^3)] x Qs std (ft^3/min) x 60	0.87	lb/hr
[SO2 (lb) / Vm std (ft^3)] x F		lb/MMBtu
[Mass SO2 (lb) x 385 / 64E+6 (ft^3/lb)] / Vm (std)	0.66	ppm
ppm x 0.0 % Corr. / 17.6 % CO2 in Stack		ppm @ 0% CO2
ppm x (20.9% - 0.0% O2 Corr)/(20.9% - 17.6% O2 Stack		ppm @ 0% O2
SO2 (lb/hr / Heat Input)		lb/MMBtu

HYDROGEN CHLORIDE DATA SUMMARY

[Mass HCl(mg) x 385 x 1E6] / [453600 x 36.5 x Vm(std		ppm
ppm x 0.0 % Corr. / 16.8 % CO2 in Stack		ppm @ 0% CO2
ppm x (20.9% - 0.0% O2 Corr)/(20.9% - 16.8% O2 Stack		ppm @ 0% O2
[Mass HCl(mg) x 60 x Qs / (Vm(std) x 453,600)]...		lb/hr

FIELD DATA SHEETS

Plant: FRI - Newberry Cement Plant
Sample Loc.: Newberry, FL
Control Type: ESP
Sample Type: Method 8
Date: 7/21/00 Run No.: 1
Time Start: 10:56 Time End: 11:58
Sample Time: 5/3/12 min/port 60 total min.
Dry Bulb: °F Wet Bulb: °F VP @ DP:
Bar. Pressure 29.96 Hg Stack Press.: Hg Ps: 0.25 "H2O
Moisture: 17 % FDA: Gas Density Factor:
Temperature: 95 °F Wind Dir.: West Wind Speed: 3-5
Weather: Cloudy Thermocouple Readout: KAK-2
Sample Box #: Mono-1 Meter Box No.: KA-4
Meter Y: 0.997 @ Delta H: 1.376 Pitot Corr.: 0.84
Nozzle Diameter: 0.308 in. Probe Length: 4 6/6 ft
Probe Heater Setting: 240-250°F Nomograph Cf: 1.6
Stack Dimensions: 112" in
Stack Area: ft²
Effective Stack Area: ft²
Stack Height: ≥ 240' ft

First Imp +78m
2,3 Imp +89

Purged for 15 min @ 2.45" H_2O

Stack Dimensions

Umbilical: 200'
Thermocouple
Probe No.: KAK-38
Pitot Tube: KA-5 II

Material Processing Rate:
Final Gas Meter Reading: 350.084 ft³
Initial Gas Meter Reading: 299.600 ft³
Total Metered Gas Volume: 50.484 ft³
Condensate Gain in Impingers: 167 mL
Weight Gain in Silica Gel: 30 g
Total Moisture Gain: 197 mL
Silica Gel Container No.: 4
Filter Number:

Leak Check – Meter Box
Initial: 0.015 cfm @ 15 in. H2O
Final: 0.010 cfm @ 6 in. H2O
Leak Check – Pitot Tubes
Impact 3 "H2O for 15 sec: (Stable), Leak
Static 3 "H2O for 15 sec: (Stable), Leak

KOOGLER & ASSOCIATES

Test Conducted By: G. Haven, S. Ball
Stack Test Observers:
O_2 = 9.7%
CO_2 = 11.6%

Port and Traverse Point No.	Distance from Inside Stack Wall (in.)	Clock Time	Gas Meter Reading (ft³)	Stack Velocity Head ("H2O)	Meter Orifice Pressure Difference ("H2O) Calculated	Meter Orifice Pressure Difference ("H2O) Actual	Stack Gas Temperature (°F)	Sample Box Temperature (°F)	Last Impinger Temperature (°F)	Meter Temperature (°F)	Vacuum on Sample Train ("Hg)	Oxygen Meter Reading (% O2)
Average												
1-1			99.6	0.59	2.71	2.71	215	240	73	98	6	
2			304.5	0.58	2.48	2.48	214	241	60	98	6	
3			9.3	0.49	2.25	2.25	212	242	62	98	6	
2-1			13.8	0.59	2.71	2.71	214	244	65	98	6	
2			16.7	0.57	2.62	2.62	215	244	65	99	6	
3			23.6	0.48	2.21	2.21	213	241	66	100	6	
3-1			28.3	0.58	2.66	2.66	215	234	63	101	6	
2			33.0	0.56	2.58	2.58	219	241				

Port and Traverse Point No.	Distance from Inside Stack Wall (in.)	Clock Time	Gas Meter Reading (ft³)	Stack Velocity Head ("H2O)	Meter Orifice Pressure Difference ("H2O)		Stack Gas Temperature (°F)	Sample Box Temperature (°F)	Last Impinger Temperature (°F)	Meter Temperature (°F)	Vacuum on Sample Train ("Hg)	Oxygen Meter Reading (% O2)
					Calculated	Actual						
3-3			37.9	0.48	1.98	1.98	216	235	63	103	6	
4-1			42.2	0.54	2.48	2.48	237	241	64	104	6	
2			46.9	0.51	2.46	2.46	249	240	60	105	6	
3			51.5	0.49	2.25	2.25	237	243	59	106	6	

Plant: FRI Cement Kiln
Sample Loc.: New Berry, FL
Control Type: ESP
Sample Type: Method 8
Date: 7/21/00 Run No.: 2
Time Start: 12:66 Time End: 19:18
Sample Time: 5/7/12 min/port 60 total min.
Dry Bulb: °F Wet Bulb: °F VP @ DP:
Bar. Pressure 29.90 "Hg Stack Press.: "Hg Ps: 0.25 H20
Moisture: 15 % FDA: Gas Density Factor:
Temperature: 90 °F Wind Dir: West Wind Speed: 3-5
Weather: ~~Clear~~ Overcast Thermocouple Readout: KAK-2
Sample Box #: Mono-1 Meter Box No.: KA-4
Meter Y: 0.997 @ Delta H: 1.376 Pitot Corr.: 0.84
Nozzle Diameter: 0.278 in. Probe Length: 4 glass ft
Probe Heater Setting: 245° Nomograph Cf: 3.14
Stack Dimensions: 112" in
Stack Area: ft²
Effective Stack Area: ft²
Stack Height: ≈ 240' ft

Purged 5 min @ 1.72 "H2O

Stack Dimensions

Umbilical: 200
Thermocouple
Probe No.: KA-38
Pitot Tube: KA-55

Material Processing Rate:
Final Gas Meter Reading: 420.231 ft³
Initial Gas Meter Reading: 371.500 ft³
Total Metered Gas Volume: 48.731 ft³
Condensate Gain in Impingers: 143 mL
Weight Gain in Silica Gel: 25 g
Total Moisture Gain: 168 mL
Silica Gel Container No.: 12
Filter Number:

Leak Check – Meter Box
Initial: 0.012 cfm @ 15 In. H2O
Final: 0.004 cfm @ 5 In. H2O
Leak Check – Pitot Tubes
Impact 3 "H2O for 15 sec: Stable / Leak
Static 3 "H2O for 15 sec: Stable / Leak

KOOGLER & ASSOCIATES

Test Conducted By: G. Haven, S. Bell
Stack Test Observers:
CO_2 = 12%
O_2 = 4.7

Port and Traverse Point No.	Distance from Inside Stack Wall (in.)	Clock Time	Gas Meter Reading (ft³)	Stack Velocity Head ("H2O)	Meter Orifice Pressure Difference ("H2O) Calculated	Meter Orifice Pressure Difference ("H2O) Actual	Stack Gas Temperature (°F)	Sample Box Temperature (°F)	Last Impinger Temperature (°F)	Meter Temperature (°F)	Vacuum on Sample Train ("Hg)	Oxygen Meter Reading (% O2)
Average												
1-1			71.5	0.63	1.97	1.97	215	248	82	103	5	
2			75.8	0.63	1.97	1.97	228	242	56	103	5	
3			80.0	0.50	1.57	1.58	217	241	56	102	5	
2-1			84.1	0.64	2.0	2.0	218	237	57	102	5	
2			88.5	0.60	1.88	1.88	218	244	60	103	5	
3			92.7	0.50	1.57	1.57	214	234	62	104	5	
3-1			96.7	0.63	1.98	1.98	214	232	64	103	5	
2			401.0	0.33	1.04	1.04	212					

Port and Traverse Point No.	Distance from Inside Stack Wall (in.)	Clock Time	Gas Meter Reading (ft³)	Stack Velocity Head ("H2O)	Meter Orifice Pressure Difference ("H2O)		Stack Gas Temperature (°F)	Sample Box Temperature (°F)	Last Impinger Temperature (°F)	Meter Temperature (°F)	Vacuum on Sample Train ("Hg)	Oxygen Meter Reading (% O2)
					Calculated	Actual						
3-3			4.4	0.36	1.13	1.13	212	245	62	104	4	
4-1			407.8	0.62	1.95	1.95	235	237	79	100	5	Plant down
2			12.1	0.61	1.92	1.92	232	249	60	100	5	13:36 ↓
3			16.3	0.53	1.66	1.66	224	241	63	100	5	↑ 19:00

Plant: FRI - Newberry, FL Cement Kiln

Sample Loc.:

Control Type: ESP

Sample Type: Method 8

Date: 7/21/00 Run No.: 3

Time Start: ~~09:50~~ 19:50 Time End: ~~09:59~~ 20:59

Sample Time: ~~5~~ 3/5/12 min/port 60 total min.

Dry Bulb: °F Wet Bulb: °F VP @ DP:

Bar. Pressure 29.90 "Hg Stack Press.: "Hg Ps: 0.25 "H2O

Moisture: 15 % FDA: Gas Density Factor:

Temperature: 89 °F Wind Dir.: VAR Wind Speed: 8-10

Weather: Broken Thermocouple Readout: KAK-2

Sample Box #: Mod 1 Meter Box No.: KA-2

Meter Y: 0.997 @ Delta H: 1.376 Pitot Corr.: 0.84

Nozzle Diameter: 0.276 in. Probe Length: 4 Glass ft

Probe Heater Setting: 245°F Nomograph Cf: 3.17

Stack Dimensions : 112 in

Stack Area: ft²

Effective Stack Area: ft²

Stack Height: ≈ 240' ft

Purged 15 min @ 1.85 "H2O

Stack Dimensions

Umbilical: 200'

Thermocouple Probe No.: KAK-38

Pitot Tube: KA-55 II

Material Processing Rate:

Final Gas Meter Reading: 482.852 ft³

Initial Gas Meter Reading: 432.906 ft³

Total Metered Gas Volume: 49.952 ft³

Condensate Gain in Impingers: 148 mL

Weight Gain in Silica Gel: 24 g

Total Moisture Gain: 172 mL

Silica Gel Container No.: 11

Filter Number:

Leak Check – Meter Box

Initial: 0.011 cfm @ 15 in. H2O

Final: 0.005 cfm @ 6 in. H2O

Leak Check – Pitot Tubes

Impact 3 "H2O for 15 sec: (Stable) Leak

Static 3 "H2O for 15 sec: (Stable) Leak

KOGLER & ASSOCIATES

Test Conducted By:

Stack Test Observers:

O_2 = 11.4

CO_2 = 16.8 %

Port and Traverse Point No.	Distance from Inside Stack Wall (in.)	Clock Time	Gas Meter Reading (ft³)	Stack Velocity Head ("H2O)	Meter Orifice Pressure Difference ("H2O) Calculated	Meter Orifice Pressure Difference ("H2O) Actual	Stack Gas Temperature (°F)	Sample Box Temperature (°F)	Last Impinger Temperature (°F)	Meter Temperature (°F)	Vacuum on Sample Train ("Hg)	Oxygen Meter Reading (% O2)
AVERAGE												
1-1			32.9	0.62	1.96	1.96	220	262	80	98	6	
2			37.4	0.59	1.87	1.87	222	~~255~~ 240	68	99	5	
3			41.5	0.50	1.59	1.59	217	238	60	100	5	
2-1			45.4	0.66	2.1	2.1	214	238	68	101	6	
2			49.7	0.64	2.03	2.03	219	238	62	102	6	
3			54.1	0.52	1.65	1.65	216	232	65	102	5	
3-1			58.1	0.62	1.97	1.97	219	240	68	102	6	
2			62.4	0.63	2.0	2.0	216					

Port and Traverse Point No.	Distance from Inside Stack Wall (in.)	Clock Time	Gas Meter Reading (ft³)	Stack Velocity Head ("H2O)	Meter Orifice Pressure Difference ("H2O)		Stack Gas Temperature (°F)	Sample Box Temperature (°F)	Last Impinger Temperature (°F)	Meter Temperature (°F)	Vacuum on Sample Train ("Hg)	Oxygen Meter Reading (% O2)
					Calculated	Actual						
3-3			66.6	0.48	1.52	1.52	217	235	62	102	5	
4-1			70.4	0.64	2.03	2.03	218	246	62	102	6	
2			74.3	0.61	1.93	1.93	220	242	61	102	5	
3			79.1	0.50	1.59	1.59	219	245	60	102	5	
							~~217~~	~~249~~	~~60~~	~~102~~	~~5~~	

SAMPLING RATE CALCULATIONS

Date 7/21/00

Plant Name FRI

Location Newberry, FL

Source Cement Kiln

ΔH = Orifice Reading (inches H_2O)
Dn = Nozzle Diameter (inches)
ΔHθ = Meter Box Constant
Bw = Moisture Fraction
Tm = Meter Temperature (°F)
Ts = Stack Temperature (°F)
Ms = Wet Molecular Weight of Stack Gas (From Table)
ΔP = Pitot Reading. (inches H_2O)

$$\left[\frac{Tm + 460}{Ms(Ts+460)} (1 - Bw)^2 \; \Delta H\theta \; (Dn)^4 \; 17741\right] \cdot \Delta P = \Delta H$$

Moisture Fraction	Ms
0.0	29.0
0.05	28.5
0.10	27.9
0.15	27.4
0.20	26.8
0.25	26.2
0.30	25.7
0.35	25.2
0.40	24.6

567 / 27.2 (470)

567 / 18224

560 / 27.4 C

568 / 27.4 (215+460)

	Run 1		Run 2		Run 3
$\frac{Tm + 460}{Ms\,(Ts + 460)}$ =	0.0311		0.0367		0.0300
× $(1 - Bw)^2$ =	0.6889		0.7225		0.7225
× ΔHθ =	1.376		1.376		1.376
× $(Dn)^4$ =	0.0027	0.0088	0.0027	0.0058	0.0060
× 17741 =	17741		17741		
× ΔP =					
	1.41	4.6	1.46	3.14	3.17

0.8

× 0.75

0.8 1.376

LABORATORY DATA SHEETS

Acid Mist

~~SO_2~~

LAB DATA

Plant Name Florida Rock Industries Date Analyzed 7/28/00

Analyzed By G. Haven

Stack	Sample No.	V.T.	V.T.B.	N.	V.Soln.	V.A.
cement Kiln	Run 1-1	0.2	0.2	0.00975	500	100
	1-2	0.2	0.2			
	2-1	0.2	0.2			
	2-2	0.25	0.2			
	3-1	0.2	0.2			
	3-2	0.2	0.2			
	IPA Blank 1	0.1				
	IPA Blank 2	0.1				
	H_2O_2 Blank 1	0.1				100
	H_2O_2 Blank 2	0.1				
	〃					100

V.T. = Volume of Barium perchlorate titrant used for sample (ml)
V.T.B. = Volume of Barium perchlorate titrant used for blank (ml)
N. = Normality of Barium perchlorate.
V.Soln. = Total solution volume
V.A. = Volume of sample aliquot titrated (ml)

KOOGLER & ASSOCIATES

SO_2
LAB DATA

Plant Name Florida Rock Ind. Date Analyzed 7/28/00

Analyzed By G. Haven

Stack	Sample No.	V.T.	V.T.B.	N.	V.Soln.	V.A.
Cement Kiln	Run 1-1	0.3	0.2	0.00975	1000	20
	1-2	0.35	0.2			
	Run 2-1	0.35	0.2			20 ~~0.35~~
	Run 2-2	0.35	0.2			20 0.35
	Run 3-1	0.4	0.2			20
	3-2	0.3	0.2			20
Blank	H_2O_2 1	0.1			↓	100
	2	0.1				
Blank	IPA 1	0.1				100
	2	0.1				
				↓		

V.T. = Volume of Barium perchlorate titrant used for sample (ml)
V.T.B. = Volume of Barium perchlorate titrant used for blank (ml)
N. = Normality of Barium perchlorate.
V.Soln. = Total solution volume
V.A. = Volume of sample aliquot titrated (ml)

KOOGLER & ASSOCIATES

CHAIN OF CUSTODY RECORD

Project Number _____

Project Name Florida Rock Industries

Sample Location : Cement Kiln

Newberry, FL

Sample Identification	Remarks
FHR1	Front half train Run #1
FHR2	" " " " #2
FHR3	" " " " #3
BHR1	Back Half train Run #1
BHR2	" " " " #2
BHR3	" " " " #3
SG# 4	Silica Gel # 4
SG# 12	" " # 12
SG# 11	" " # 11

Sampled By: (Signature) John A. Hann Date: 7/21/00 Time: See DATA SHEETS

Relinquished By: (Sign) _____ Date: _____ Time: _____

Received By: (Sign) _____ Date: _____ Time: _____

Relinquished By: (Sign) _____ Date: _____ Time: _____

Received By: (Sign) _____ Date: _____ Time: _____

Relinquished By: (Sign) _____ Date: _____ Time: _____

Received By Lab: (Sign) John A. Hann Date: 7/21/00 Time: 23:00

Sample Shipped VIA: _____ UPS _____ Fed Express _____ Bus

Shipping Bill Number: _____

PLANT OPERATING DATA

INFORMATION REQUIRED IN
GENERAL STACK TEST REPORTS

Permit Number ACO1 - 267311

Source I.D. # —

Permit Expiration Date —

Permit Conditions:

Production Rate 149.9 ~~139.83~~ —

Emission Limits (PM, SO_2, VE, etc.) _____

Fuel Limits (Sulfur, etc.) _____

Test Conducted (P.M., VE, SO_2, NOx, etc.) Acid mist

Actual Production Rate 139.83

Measured Emission Rates 0.78 lb/hr SO_2, 0.007 lb/hr H_2SO_4 mist

List of Measured Parameters as Required by Permit

Scrubber ΔP _____

Scrubber Water Flow _____

Scrubber Water Pressure _____

Baghouse ΔP _____

Baghouse Inlet Temperature _____

*Type of Fuel Coal

Fuel Use Rate _____

*Fuel Analysis _____

Name of DEP Observer L. Lalwani

Date of Last Inspection Performed by Plant Personnel _____

Discussion of any Problems (non-isokinetic, missing runs, plant upset, etc.)

_____

_____

_____

KOOGLER & ASSOCIATES

Florida Rock Industries, Inc.
Cement Group
Thompson S. Baker Cement plant

Process Weight Rate Sheet

Source: Kiln/Raw Mill Stack Test Date: July 21, 2000

Permit No.: AC01-267311 Permitted Rate: 149.9 TPH

Test Parameter(s): Sulfuric Acid Mist (H_2SO_4) & Sulfur Dioxide (SO_2)

	Run Times		Process Input Rate	
Run No. 1	1050 -	1158	135.5	TPH
Run No. 2	1250 -	1918	144	TPH
Run No. 3	1950 -	2059	140	TPH

I here by certify that to the best of my knowledge the above data is true and correct.

George Townsend
Name (Print)

George Townsend
Signature

July 31, 2000
Date

Environmental & Safety Manager
Title

File: Process Rate.pub

EQUIPMENT CALIBRATIONS

NOZZLE CALIBRATION

DATE 7/21/00

PLANT NAME FRI

LOCATION Newberry, FL

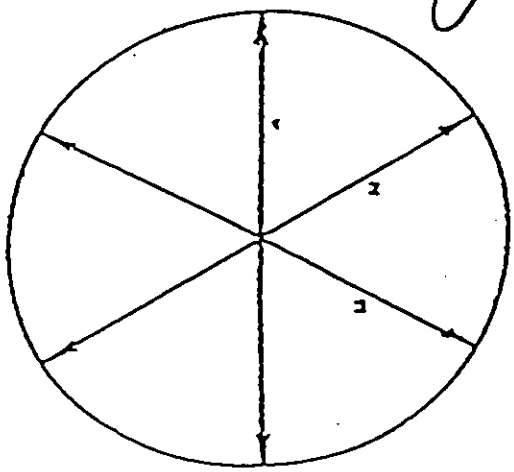
SOURCE Cement Kiln

Measurement No.	Inside Diameter (inches)
1	0.308 ~~0.227~~
2	0.308 ~~0.227~~
3	0.308 ~~0.227~~

Average 0.308 ~~0.227~~

Area of Nozzle _____ ft^2

Calibrated by: Glen A. Haen



Nozzle X-Section

KOOGLER & ASSOCIATES

NOZZLE CALIBRATION

DATE 7/21/00

PLANT NAME FRI

LOCATION Newberry FL

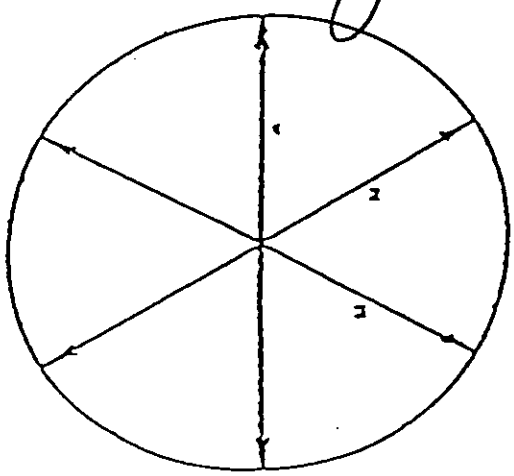
SOURCE Cement Kiln

Measurement No.	Inside Diameter (inches)
1	0.277
2	0.278
3	0.279

Average 0.278

Area of Nozzle _____ ft^2

Calibrated by: [signature]



Nozzle X-Section

KOGLER & ASSOCIATES

PITOT TUBE CALIBRATION MEASUREMENTS

PITOT TUBE IDENTIFICATION NO. KA-SS II

DATE CALIBRATED 7-5-00

PITOT TUBE ASSEMBLY LEVEL ? ✓ YES _____ NO

PITOT TUBE OPENINGS DAMAGED ? ____ YES (EXPLAIN BELOW) ✓ NO

α_1= 1.5 ° (<10°) α_2= 1.5 ° (<10°)

β_1= 2.5 ° (<5°) β_2= 2.0 ° (<5°)

Y= 1.5 °, θ= 2.0 °, A= 0.948 IN. = (PA+PB)

Z = A SIN Y = 0.0248 IN. (<0.125 IN.)

W = A SIN θ = 0.0331 IN. (<0.031 IN.)

P_A 0.464 IN. P_b 0.466 IN.

D_t 0.377 IN. (≥ 0.1875 IN. ≤ 0.3750 IN.)

COMMENTS: Pitot tube looked ok. day of test.

CALIBRATION REQUIRED? _____ YES ✓ NO

CALIBRATED BY: R Paul

PTCMFORM 1/8/87

KOOGLER Ka ASSOCIATES

POST TEST THERMOCOUPLE
CALIBRATION

DATE ~~8/2~~ 7/21/00

PLANT NAME Florida Rock Industries

LOCATION Newberry, FL

SOURCE Cement Kiln

Thermocouple Readout # KAK-2

Umbilical Cord # 200'

Switch Box # KAK-2

Thermocouple # KAK-38

Average Stack Temperature °F 220°

*Observed Mercury in Glass (ASTM) °F 215

Observed Thermocouple Reading °F 217

Percent Difference $\frac{(675) - (677)}{(460)} \times 100 = -0.296\%$

Tolerance ≤ 1.5%

* Observed Temperature must be within ten percent of the average stack temperature.

Signature

ROBERTSON & ASSOCIATES

KOOGLER & ASSOCIATES, ENVIRONMENTAL SERVICES
ANNUAL THERMOCOUPLE CALIBRATION 12/27/99

KA70 RO/UMB		ICE (F)	ASTM (F)	AMB. (F)	ASTM (F)	212 (F)	ASTM (F)	400 (F)	ASTM (F)	KA70 RO/UMB	
KA1/100'	STACK	32	33	73	72	208	209	405	406	KA1/100'	STACK
	BOX	33	32	72	72	210	210	404	406		BOX
	IMP	32	32	73	73	211	212	400	401		IMP
KA2/200'	STACK	33	33	73	72	209	210	415	416	KA2/200'	STACK
	BOX	32	32	72	73	211	210	418	418		BOX
	IMP	32	33	71	72	212	212	409	410		IMP
KA3/25'	STACK	32	33	73	73	211	210	409	410	KA3/25'	STACK
SWBXKA3	BOX	33	32	72	73	215	215	415	416		BOX
	IMP	33	32	72	73	212	212	408	407		IMP
KA4/25'	STACK	32	32	73	74	205	205	420	420	KA4/25'	STACK
SWBXKA3	BOX	32	33	74	74	207	208	422	421		BOX
	IMP	32	33	72	73	211	212	425	425		IMP
KAK/200K	STACK	31	32	74	74	213	213	419	420	KAK/200K	STACK
KAK-38	BOX	32	32	72	73	215	216	422	422	KAK-38	BOX
SWBXKAK1	IMP	32	33	74	73	219	220	400	401		IMP
KA1/200'	STACK	33	33	73	73	211	210	422	422	KA1/200'	STACK
	BOX	33	33	73	72	214	214	419	418		BOX
	IMP	33	32	73	72	209	209	425	425		IMP
KA2/100'	STACK	33	33	73	72	209	210	422	423	KA2/100'	STACK
	BOX	33	32	73	74	212	211	425	425		BOX
	IMP	32	33	72	73	212	211	426	425		IMP

Signature [signature]

Date 12/27/99

KOOGLER & ASSOCIATES, ENVIRONMENTAL SERVICES
ANNUAL THERMOCOUPLE CALIBRATION 12/27/99

THERMOCOUPLE #	ICE (F)	ASTM (F)	AMB. (F)	ASTM (F)	212 (F)	ASTM (F)	400 (F)	ASTM (F)	THERMOCOUPLE #
KA-06	33	33	73	74	212	212	420	419	KA-06
KA-07	33	32	74	75	209	210	421	422	KA-07
KA-08	34	33	74	74	211	211	415	416	KA-08
KA-09	33	33	74	74	215	216	416	417	KA-09
KA-10	34	33	72	72	214	215	408	407	KA-10
KA-11	33	33	72	72	212	212	415	414	KA-11
KA-12	33	33	73	72	219	220	408	407	KA-12
KA-38	34	33	73	74	211	211	412	411	KA-38
KA-39	34	33	73	73	212	211	416	415	KA-39
KA-50	33	34	74	73	215	214	415	416	KA-50
KA-64	33	33	74	74	211	211	410	411	KA-64
KA-70	33	33	73	74	212	213	405	406	KA-70
KA-71	34	34	73	73	211	210	407	408	KA-71
KA-72	34	33	72	72	216	215	410	410	KA-72
KA-105	34	33	73	73	217	218	404	405	KA-105
KA-108	34	34	72	73	214	215	412	411	KA-108
KA-115	34	33	72	72	213	214	409	410	KA-115
KA-126	34	33	72	72	216	216	410	409	KA-126

THERMOCOUPLE #	ICE (F)	ASTM (F)	AMB. (F)	ASTM (F)	212 (F)	ASTM (F)	400 (F)	ASTM (F)	THERMOCOUPLE #
KAK-08	32	32	73	74	218	217	407	406	KAK-08
KAK-09	31	31	73	73	211	212	405	406	KAK-09
KAK-10	32	32	74	74	209	210	377	376	KAK-10
KAK-11	31	31	75	75	206	206	399	398	KAK-11
KAK-12	32	31	74	74	218	217	407	406	KAK-12
KAK-38	31	31	74	74	210	211	410	410	KAK-38
KAK-65	32	32	74	74	205	205	377	377	KAK-65
KAK-72	31	31	74	75	208	208	400	401	KAK-72
KAK-110	31	32	75	74	209	210	399	400	KAK-110
KAK-07	32	31	75	74	209	210	389	390	KAK-07

VOST SWITCH BOX	T.COUPLE				
CH#1	C-1	32	33	74	75
CH#2	C-1	33	32	74	74
CH#3	C-1	33	33	75	74

VOST SWITCH BOX					
CH#1	C-2	32	33	73	74
CH#2	C-2	33	33	74	75
CH#3	C-2	32	33	75	75

Signature Steph D-Bee

Date 12/27/99

KOOGLER & ASSOCIATES, ENVIRONMENTAL SERVICES
ANNUAL THERMOCOUPLE CALIBRATION 12/27/99

Range (ºC)	Measured Voltage (mV)	Measured Voltage (V)	Calc. Temp. (ºC)	Readout Temp. (ºC)	Percent Difference (%)
KAK-12	28.7	0.029	690	693	-0.45023
	37.4	0.037	902	900	0.217654
KAK-38	28.9	0.029	694	698	-0.51192
	37.2	0.037	897	900	-0.33898
KAK-72	28.5	0.029	685	687	-0.30387
	37.5	0.038	904	908	-0.39058
KAK-65	28.2	0.028	678	680	-0.32666
	37.8	0.038	912	910	0.218082
KA-110	29	0.029	694	699	-0.65592
	37	0.037	894	899	-0.50758

EQUATIONS :

T (calc.)=(0.226584602+(24152.109*V)+(67233.4248*V^2)+(2210340.682*V^3)
-(860963914.9*V^4)+(48350600000*V^5)-(1184520000000*V^6)
+(13869000000000*V^7)-(63370800000000*V^8))

Where :

V = Measured Voltage (Volts)
T(calc.) = Temperature calculated based on voltage

Signature 

Date 12/27/99

BERYLLIUM TESTS

POST-TEST DRY GAS METER CALIBRATION FORM

COMPANY:	Florida Rock Industries
SOURCE:	Cement Kiln
DATE:	August 9, 2000
PRETEST Y:	0.997
TEST METER NUMBER:	KA-1
METER BOX NUMBER:	KA-4
BAROMETRIC PRESSURE (Pb):	30.01
DELTA H (dH):	2

	TEST METER READING (ft^3)	DRY GAS READING (ft^3)	TIME (min) µ	VACUUM SETTING (in. Hg)
INITIAL	304.563	321.225		
FIRST	310.023	326.635	6.1	6
SECOND	319.263	335.835	10.3	6
THIRD	328.421	345.017	10.2	6

DELTA H	TEST METER Vt (ft^3)	DRY GAS Vd (ft^3)	TEST METER TEMP. Tt (|F)	DRY GAS TEMP. Td (|F)
2	5.460	5.410	77.5	81.5
PB	9.240	9.200	77.5	84.5
30.01	9.158	9.182	77	87

$$Yi = \frac{Vt*Pb*(Td+460)}{Vd*(Pb+dH/13.6)*(Tt+460)}$$

	Yi	
RUN 1 (Yi)=	1.011794	88727.26 / 87692.95
RUN 2 (Yi)=	1.012466	150985.7 / 149126.6
RUN 3 (Yi)=	1.011005	150332.8 / 148696.4
AVG. Y =	1.011755	

PRETEST Y =	0.997
AVG. DETA Y =	0.014755
DELTA Y LIMIT =	· 0.05
IS TEST WITHIN 5%?	YES

Vt = Gas volume passing through the test meter, ft^3
Vd = Gas volume passing through the dry gas meter, ft^3
Tt = Temperature of the gas in the test meter, |F
Tdi = Temperature of the inlet gas of the dry gas meter, |F
Tdo = Temperature of the outlet gas of the dry gas meter, |F
Td = Average temperature of the gas in the dry gas meter, the average of Tdi and Tdo, |F
dH = Pressure difference accross the orifice, in, H2O
Yi = Ratio of test meter to dry gas meter for each run
Y = Average ratio of accuracy of test meter to dry gas meter for all three runs, tolerance = pretest · 0.05*Y
µ = Time of calibration run, min
Pb = Barometric pressure, in Hg.

DRY GAS METER AND ORIFICE CALIBRATION

CONTROL BOX NO. KA-4 BAROMETRIC PRESS. 30.39 IN. HG.

DATE FEB. 22, 2000 PERFORMED BY ROC

	RUN 1	RUN 2	RUN 3	RUN 4	RUN 5
VACUUM ("Hg)	0.0	0.0	0.0	0.0	0.0
dHw ("H2O)	-0.28	-0.30	-0.33	-0.37	-0.43
dHd ("H2O)	0.50	1.00	1.50	2.50	3.50
INITIAL WTM	3.036	28.727	994.704	20.046	9.754
FINAL WTM	9.754	34.540	1003.036	28.727	20.046
INITIAL DGM	103.007	129.171	94.618	120.249	109.760
FINAL DGM	109.760	135.141	103.007	129.171	120.249
TEMP. WTM (F)	68.00	69.00	68.00	69.00	68.00
TEMP. DGM (F)	76.00	80.00	75.00	80.00	78.00
TEST TIME (MIN.)	14.50	9.00	11.00	9.00	9.00
**********	**********	**********	**********	**********	**********
NET VOLUME WTM	6.718	5.813	8.332	8.681	10.292
NET VOLUME DGM	6.753	5.970	8.389	8.922	10.489
Y	1.009	0.992	1.004	0.988	0.992
dH@	1.264	1.296	1.421	1.453	1.447
**********	**********	**********	**********	**********	**********

AVERAGE Y = 0.997

ACCEPTABLE Y RANGE = 0.980 TO 1.020 OK

AVERAGE dH@ = 1.376

$$Y = (Vw\ (Pb - (dHw / 13.6)) \times (Td + 460)) / (Vd\ (Pb + (dHd / 13.6)) \times (Tw + 460)$$

$$dH@ = 0.0317 \times dHd / (Pb\ (Td + 460)) \times ((Tw + 460) \times time) / Vw)^2$$

CALCULATIONS

SUMMARY OF SOURCE EMISSION TEST DATA

Florida Rock Industries
Cement Kiln
July 24, 2000

Run No.	Process Weight Rate (Tons/hr)	Stack Gas Flow Rate (SCFMD)	Stack Gas Temperature (F)	Stack Gas Moisture (%)	Total Beryllium Conc. (gr/dscf)	Total Beryllium Emission Rate (Lbs/Hr)
1	135.0	93,275	246	17.0	0.0001	0.06
2	140.0	98,112	248	16.0	0.0001	0.12
3	140.0	129,320	200	16.0	0.0000	0.01
Average	138.3	106,903	231	16.3	0.0001	0.06

GENERAL DATA

DATA FILE NAME: BERYLM

Company : Florida Rock Industries **********
Source/Unit : Cement Kiln 11:10 AM
Date : July 24, 2000 Cp : 0.840
Stack dia. : 112.00 inch OR : Duct Length : 0.00 inch
Oxygen Corr.: 0.0 percent Duct Width : 0.00 inch
CO2 Corr. : 0.0 percent Std. Temp. : 68 F

FUEL ANALYSIS DATA, (By F Factor or Fuel Use)
F Factor = F, Fuel Use = U F Process Wt.

Hydrogen,wt% : 0.00 Run 1 : 135 Tons/hr
Carbon, wt% : 0.00 Run 2 : 140
Sulfur, wt% : 0.00 Run 3 : 140
Nitrogen,wt% : 0.00
Oxygen, wt% : 0.00
Btu/lb : 0

Type of Flow Meter : (1=Meter Box 2=Mass Flow Meter) 1
F-Factor : dscf/MMBtu;

FIELD DATA ------- METHOD 5	RUN 1	RUN 2	RUN 3
Meter Temp., Tm (F)	94	98	98
Stack Temp., Ts (F)	246	248	200
Sq.Rt. dP	0.57	0.60	0.74
dH (in. H2O)	1.04	1.13	1.73
Meter Vol.,Vm (ft3)	75.612	77.352	96.896
Meter Y	0.997	0.997	0.997
Bar. Press.,Pb (in.Hg.)	30.13	30.13	30.13
Vol. H2O, Vlc (ml)	315	299	374
Static Press.,Ps (in.H2O)	-0.24	-0.24	-0.24
Test Time (min.)	120.0	120.0	120.0
Nozzle Dia.,Dn (in.)	0.280	0.280	0.280
Oxygen, O2 (%)	8.5	7.8	9.8
Carbon Dioxide, CO2 (%)	22.4	24.1	15.0
Carbon Monoxide, CO (%)	0.0	0.0	0.0

Report Emission Criteria in ? 1 = lb/hr g = gr/dscf : L
Process Rate Units ? T = Ton/hr, L = Lbs/hr, C = Cans/min: T
Allowable Particulate Matter Emission Rate .....:

LABORATORY RESULTS	RUN 1	RUN 2	RUN 3	
GRAVIMETRIC ANALYSIS METHOD 5 :				
Front Half Wash (FHW)	0.00036	0.00066	0.00005	grams
Filterable Sample (MF)	0.00000	0.00000	0.00000	
Condensible Sample (BHW)	0.00000	0.00000	0.00000	

SOURCE TEST CALCULATIONS

PLANT : Florida Rock Industries
Cement Kiln

RUN NO.: 1
DATE : July 24, 2000

STD.TEMP, Tstd	=	68 F	STATIC PRESS.,Ps	=	-0.24 in. H2O
METER TEMP, Tm	=	93.5 F	PITOT COFF., Cp	=	0.840
STACK TEMP, Ts	=	246.3 F	STACK I.D.	=	112.00 inch
AVG.VEL.HEAD,dP	=	0.323 in. H2O	DUCT LENGTH	=	inch
METER ORIFICE,dH	=	1.04 in. H2O	DUCT WIDTH	=	inch
METER VOL., Vm	=	75.612 Cu.Ft.	STACK AREA, As	=	68.417 Sq.Ft.
METER COFF., Y	=	0.997	TEST TIME	=	120.00 min.
BAR. PRESS., Pb	=	30.13 in.Hg	NOZZLE DIA.	=	0.280 inch
COND.(Vlc)	=	315.0 ml	NOZZLE DIA., An	=	4.3E-04 Sq.Ft.

GAS ANALYSIS = 8.50 % O2 0.00 % CO
22.40 % CO2 69.10 % N2

****

Vm(std) = [(T(std) + 460) / 29.92] x Vm x Y x (Pb + (dH / 13.6)) / (Tm + 460).....	=	72.600	dscf
Vw(std) =(8.9148 x 10e-5) x (Tstd + 460) x Vlc	=	14.827	scf
Bws = Vw(std) / (Vm(std) + Vw(std)).....	=	0.170	Lower Bws value used.
Bws @ Saturated Conditions = Vapor Press. of H2O @ Dew Point Temp. / (Ps, in.Hg.)	=	1.000	
%EA =(%O2 - 0.5%CO)/(0.264%N2 - (%O2-0.5%CO)) x 100	=	87.25	
Md =(.44 x %CO2)+(.32 x %O2)+[.28 x (%N2 + %CO)]	=	31.92	
Ms = (Md x (1-Bws)) + (18.0 x Bws).....	=	29.56	
P(stack) = Pbar + (Ps / 13.6)	=	30.11	in. Hg
vs = 85.49 x CP x (Sq.Rt.dP) x [Sq.Rt.(Ts + 460) / (Ms x P(stack))]	=	36.37	ft/sec
Qs = vs x As x 60	=	149,303	acf/min
Qs(std) = Qs x (1-Bws)x((Tstd + 460)/(Ts + 460)) x (P(stack)/29.92)	=	93,275	dscf/min
I = (Ts+460) x [(0.002669 x Vlc) + (Vm(std) / (T(std) + 460) / 29.92] x 100 / [Time x P(stack) x An x vs x 60]	=	103.79	%

SOURCE TEST CALCULATIONS

PLANT : Florida Rock Industries
Cement Kiln

RUN NO.: 2
DATE : July 24, 2000

STD.TEMP, Tstd	=	68 F	STATIC PRESS.,Ps	=	-0.24 in. H2O
METER TEMP, Tm	=	98.33 F	PITOT COFF., Cp	=	0.840
STACK TEMP, Ts	=	247.8 F	STACK I.D.	=	112.00 inch
AVG.VEL.HEAD,dP	=	0.355 in. H2O	DUCT LENGTH	=	inch
METER ORIFICE,dH	=	1.13 in. H2O	DUCT WIDTH	=	inch
METER VOL., Vm	=	77.352 Cu.Ft.	STACK AREA, As	=	68.417 Sq.Ft.
METER COFF., Y	=	0.997	TEST TIME	=	120.00 min.
BAR. PRESS., Pb	=	30.13 in.Hg	NOZZLE DIA.	=	0.280 inch
COND.(Vlc)	=	299.0 ml	NOZZLE DIA., An	=	4.3E-04 Sq.Ft.

GAS ANALYSIS	=	7.80	% O2	0.00	% CO
		24.10	% CO2	68.10	% N2

****

Vm(std) = [T(std) + 460 / 29.92] x Vm x Y x (Pb + (dH / 13.6)) / (Tm + 460).....	=	73.644	dscf
Vw(std) =(8.9148 x 10e-5) x (Tstd + 460) x Vlc	=	14.074	scf
Bws = Vw(std) / (Vm(std) + Vw(std)).....	=	0.160	Lower Bws value used.
Bws @ Saturated Conditions = Vapor Press. of H2O @ Dew Point Temp. / (Ps, in.Hg.)	=	1.000	
%EA =(%O2 - 0.5%CO)/(0.264%N2 - (%O2-0.5%CO)) x 100	=	76.63	
Md =(.44 x %CO2)+(.32 x %O2)+[.28 x (%N2 + %CO)]	=	32.17	
Ms = (Md x (1-Bws)) + (18.0 x Bws).....	=	29.89	
P(stack) = Pbar + (Ps / 13.6)	=	30.11	in. Hg
vs = 85.49 x CP x (Sq.Rt.dP) x [Sq.Rt.(Ts + 460) / (Ms x P(stack))]	=	37.92	ft/sec
Qs = vs x As x 60	=	155,646	acf/min
Qs(std) = Qs x (1-Bws)x((Tstd + 460)/(Ts + 460)) x (P(stack)/29.92)	=	98,112	dscf/min
I = (Ts+460) x [(0.002669 x Vlc) + (Vm(std) / (T(std) + 460) / 29.92] x 100 / [Time x P(stack) x An x vs x 60]	=	100.09	%

SOURCE TEST CALCULATIONS

PLANT : Florida Rock Industries
Cement Kiln

RUN NO.: 3
DATE : July 24, 2000

STD.TEMP, Tstd	=	68 F	STATIC PRESS.,Ps	=	-0.24 in. H2O
METER TEMP, Tm	=	98.17 F	PITOT COFF., Cp	=	0.840
STACK TEMP, Ts	=	200.3 F	STACK I.D.	=	112.00 inch
AVG.VEL.HEAD,dP	=	0.552 in. H2O	DUCT LENGTH	=	inch
METER ORIFICE,dH	=	1.73 in. H2O	DUCT WIDTH	=	inch
METER VOL., Vm	=	96.896 Cu.Ft.	STACK AREA, As	=	68.417 Sq.Ft.
METER COFF., Y	=	0.997	TEST TIME	=	120.00 min.
BAR. PRESS., Pb	=	30.13 in.Hg	NOZZLE DIA.	=	0.280 inch
COND.(Vlc)	=	374.0 ml	NOZZLE DIA., An	=	4.3E-04 Sq.Ft.

GAS ANALYSIS = 9.80 % O2 0.00 % CO
15.00 % CO2 75.20 % N2

****

Vm(std) = [T(std) + 460 / 29.92] x Vm x Y x (Pb + (dH / 13.6)) / (Tm + 460).....	=	92.414	dscf
Vw(std) =(8.9148 x 10e-5) x (Tstd + 460) x Vlc	=	17.604	scf
Bws = Vw(std) / (Vm(std) + Vw(std)).....	=	0.160	Lower Bws value used.
Bws @ Saturated Conditions = Vapor Press. of H2O @ Dew Point Temp. / (Ps, in.Hg.)	=	0.779	
%EA =(%O2 - 0.5%CO)/(0.264%N2 - (%O2-0.5%CO)) x 100	=	97.49	
Md =(.44 x %CO2)+(.32 x %O2)+[.28 x (%N2 + %CO)]	=	30.79	
Ms = (Md x (1-Bws)) + (18.0 x Bws).....	=	28.75	
P(stack) = Pbar + (Ps / 13.6)	=	30.11	in. Hg
vs = 85.49 x CP x (Sq.Rt.dP) x [Sq.Rt.(Ts + 460) / (Ms x P(stack))]	=	46.60	ft/sec
Qs = vs x As x 60	=	191,311	acf/min
Qs(std) = Qs x (1-Bws)x((Tstd + 460)/(Ts + 460)) x (P(stack)/29.92)	=	129,320	dscf/min
I = (Ts+460) x [(0.002669 x Vlc) + (Vm(std) / (T(std) + 460) / 29.92] x 100 / [Time x P(stack) x An x vs x 60]	=	95.29	%

A. FIELD DATA SUMMARY

PLANT : Florida Rock Industries
Cement Kiln
DATE : July 24, 2000

	RUN 1	RUN 2	RUN 3
Vlc = Vol water collected in train, ml	315.0	299.0	374.0
Vm = Sample gas vol, meter cond., acf	75.612	77.352	96.896
Y = Meter calibration factor	0.9970	0.9970	0.9970
Pbar = Barometric pressure, in. Hg	30.13	30.13	30.13
Pstatic = Stack static pressure, in. H2O	-0.24	-0.24	-0.24
dH = Avg meter pressure diff, in. H2O	1.04	1.13	1.73
Tm = Absolute meter temp., degrees R	553.5	558.3	558.2
Vm(std) = Sample gas vol, Std. cond., dscf	72.600	73.644	92.414
Bws = Water vapor in gas stream, fraction	0.170	0.160	0.160
MF = Moisture factor (1 - Bws)	0.830	0.840	0.840
CO2 = Carbon Dioxide, dry, volume %	22.40	24.10	15.00
O2 = Oxygen, dry, volume %	8.50	7.80	9.80
N2 = Nitrogen, dry volume %	69.10	68.10	75.20
Md = Molecular weight of stack gas, dry	31.92	32.17	30.79
Ms = Molecular weight of stack gas, wet	29.56	29.89	28.75
Cp = Pitot tube coefficient	0.84	0.84	0.84
Sq.Rt. dP = Avg. square root of each dP	0.5686	0.5955	0.7430
Ts = Absolute stack temp., degrees R	706.3	707.8	660.3
A = Area of stack, ft2	68.42	68.42	68.42
Qstd = Volumetric flowrate, dscfm	93,275	98,112	129,320
An = Nozzle area, ft2	4.28E-04	4.28E-04	4.28E-04
0 = Sample time, minutes	120.00	120.00	120.00
%I = Isokinetic variation, percent	103.79	100.09	95.29

B. PARTICULATE DATA SUMMARY

PLANT : Florida Rock Industries
Cement Kiln
DATE : July 24, 2000

	RUN 1	RUN 2	RUN 3
Sample Weight (FHW + MF + BHW), mg	0.36	0.66	0.05
Meter Volume, standard cond., Vm(std)	72.600	73.644	92.414
Carbon Dioxide, percent	22.40	24.10	15.00
Oxygen, percent	8.50	7.80	9.80
Sample Concentration :			
gr/scf	0.0001	0.0001	0.0000
gr/dscf	0.0001	0.0001	0.0000
gr/dscf @ 0 % CO2	0.0000	0.0001	0.0000
gr/dscf @ 0 % O2	0.0001	0.0002	0.0000
ppm * MW (dry gas).....	4.2	7.6	0.4
ppm * MW @ 0% CO2	0.0	0.0	0.0
ppm * MW @ 0% O2	7.1	12.1	0.8

EMISSION RATE CALCULATIONS

PLANT :Florida Rock Industries
Cement Kiln

STANDARD TEMP. : 68 F
RUN NO.: 1
DATE : July 24, 2000

Front Half Wash (FHW)	0.00036 grams	Vm(std)	72.600 ft3
Mass Filter (MF)	0.00000 grams	Vw(std)	14.827 ft3
Back Half Wash (BHW)	0.00000 grams	Qs(std)	93,275 dscfm
Vm(std) SO2	dscf	Bws	0.170
CO2 CORR 0.0 %		CO2	22.40 %
O2 CORR. 0.0 %		O2	8.50 %

F-FACTOR

10E6 x [3.64(%H) + 1.53(%C) + 0.57(%S) + 0.14(%N) - 0.46(%O2)] / (Btu/lb) x [(Tstd + 460)/528] ..... dscf/MMBtu

FUEL USE

Use Rate (gal/ton) * Process Wt. (ton/hr) ..... gal/hr

Heat Input = (Process Weight (ton/hr) x Heating .... MMBtu/hr
Value (Btu/gal) x Fuel Use Rate (gal/ton) / 1E6

TOTAL PARTICULATE

15.432 x (FHW + MF + BHW) / [(Vm(std) + Vw(std)] ...	0.0001	gr/scf
15.432 x (FHW + MF + BHW) / (Vm(std)	0.0001	gr/dscf
gr/dscf x (12 / %CO2)	0.0000	@ 0% CO2
gr/dscf x [(20.9 - Oxygen corr.) / (20.9 - %O2)] ...	0.0001	@ 0% O2
0.00857 x Qs(std) x gr/dscf	0.06	lb/hr
F-Fac x 1.4286E-4 x [20.9 / (20.9-%O2)] x gr/dscf ..		lb/MMBtu
Particulate (lb/hr) / Heat Input (MMBtu/hr)		lb/MMBtu

TOTAL ACID MIST

[1.0811E-4 x (Vt - Vtb) x N x Vsol] / Vol(aloq)	lb Acid Mist
[Acid Mist (lb) / Vm std (ft^3)] x Qs std x 60 ...	lb/hr
[Acid Mist (lb) / Vm std (ft^3)] x F-Factor	lb/MMBtu

SULFUR DIOXIDE (SO2)

[7.061E-5 x (Vt - Vtb) x N x Vsol] / Vol(aloq)	lb SO2
[SO2 (lb) / Vm std (ft^3)] x Qs std (ft^3/min) x 60	lb/hr
[SO2 (lb) / Vm std (ft^3)] x F	lb/MMBtu
[Mass SO2 (lb) x 385 / 64E+6 (ft^3/lb)] / Vm (std)	ppm
ppm x 0.0 % Corr. / 22.4 % CO2 in Stack	ppm @ 0% CO2
ppm x (20.9% - 0.0% O2 Corr)/(20.9% - 8.5% O2 Stack)	ppm @ 0% O2
SO2 (lb/hr / Heat Input)	lb/MMBtu

HYDROGEN CHLORIDE DATA SUMMARY

[Mass HCl(mg) x 385 x 1E6] / [453600 x 36.5 x Vm(std	ppm
ppm x 0.0 % Corr. / 22.4 % CO2 in Stack	ppm @ 0% CO2
ppm x (20.9% - 0.0% O2 Corr)/(20.9% - 22.4% O2 Stack	ppm @ 0% O2
[Mass HCl(mg) x 60 x Qs / (Vm(std) x 453,600)]...	lb/hr

EMISSION RATE CALCULATIONS

PLANT :Florida Rock Industries
Cement Kiln

RUN NO.: 2
STANDARD TEMP. : 68 F DATE : July 24, 2000

Front Half Wash (FHW)	0.00066 grams	Vm(std)	73.644 ft3
Mass Filter (MF)	0.00000 grams	Vw(std)	14.074 ft3
Back Half Wash (BHW)	0.00000 grams	Qs(std)	98,112 dscfm
Vm(std) SO2	dscf	Bws	0.160
CO2 CORR 0.0 %		CO2	24.10 %
O2 CORR. 0.0 %		O2	7.80 %

F-FACTOR

10E6 x [3.64(%H) + 1.53(%C) + 0.57(%S) + 0.14(%N) - 0.46(%O2)] / (Btu/lb) x [(Tstd + 460)/528] ..... dscf/MMBtu

FUEL USE

Use Rate (gal/ton) * Process Wt. (ton/hr) ..... gal/hr
Heat Input = (Process Weight (ton/hr) x Heating .... MMBtu/hr
Value (Btu/gal) x Fuel Use Rate (gal/ton) / 1E6

TOTAL PARTICULATE

15.432 x (FHW + MF + BHW) / [(Vm(std) + Vw(std)] ...	0.0001	gr/scf
15.432 x (FHW + MF + BHW) / (Vm(std)	0.0001	gr/dscf
gr/dscf x (12 / %CO2)	0.0001	@ 0% CO2
gr/dscf x [(20.9 - Oxygen corr.) / (20.9 - %O2)] ...	0.0002	@ 0% O2
0.00857 x Qs(std) x gr/dscf	0.12	lb/hr
F-Fac x 1.4286E-4 x [20.9 / (20.9-%O2)] x gr/dscf ..		lb/MMBtu
Particulate (lb/hr) / Heat Input (MMBtu/hr)		lb/MMBtu

TOTAL ACID MIST

[1.0811E-4 x (Vt - Vtb) x N x Vsol] / Vol(aloq)	lb Acid Mist
[Acid Mist (lb) / Vm std (ft^3)] x Qs std x 60 ...	lb/hr
[Acid Mist (lb) / Vm std (ft^3)] x F-Factor	lb/MMBtu

SULFUR DIOXIDE (SO2)

[7.061E-5 x (Vt - Vtb) x N x Vsol] / Vol(aloq) .	lb SO2
[SO2 (lb) / Vm std (ft^3)] x Qs std (ft^3/min) x 60	lb/hr
[SO2 (lb) / Vm std (ft^3)] x F	lb/MMBtu
[Mass SO2 (lb) x 385 / 64E+6 (ft^3/lb)] / Vm (std)	ppm
ppm x 0.0 % Corr. / 22.4 % CO2 in Stack	ppm @ 0% CO2
ppm x (20.9% - 0.0% O2 Corr)/(20.9% - 22.4% O2 Stack	ppm @ 0% O2
SO2 (lb/hr / Heat Input)	lb/MMBtu

HYDROGEN CHLORIDE DATA SUMMARY

[Mass HCl(mg) x 385 x 1E6] / [453600 x 36.5 x Vm(std	ppm
ppm x 0.0 % Corr. / 24.1 % CO2 in Stack	ppm @ 0% CO2
ppm x (20.9% - 0.0% O2 Corr)/(20.9% - 24.1% O2 Stack	ppm @ 0% O2
[Mass HCl(mg) x 60 x Qs / (Vm(std) x 453,600)]...	lb/hr

EMISSION RATE CALCULATIONS

PLANT :Florida Rock Industries
Cement Kiln

RUN NO.: 3
STANDARD TEMP. : 68 F DATE : July 24, 2000

Front Half Wash (FHW)	0.00005 grams	Vm(std)	92.414 ft3
Mass Filter (MF)	0.00000 grams	Vw(std)	17.604 ft3
Back Half Wash (BHW)	0.00000 grams	Qs(std)	129,320 dscfm
Vm(std) SO2	dscf	Bws	0.160
CO2 CORR 0.0 %		CO2	15.00 %
O2 CORR. 0.0 %		O2	9.80 %

F-FACTOR

10E6 x [3.64(%H) + 1.53(%C) + 0.57(%S) + 0.14(%N) - 0.46(%O2)] / (Btu/lb) x [(Tstd + 460)/528] ..... dscf/MMBtu

FUEL USE

Use Rate (gal/ton) * Process Wt. (ton/hr) ..... gal/hr
Heat Input = (Process Weight (ton/hr) x Heating .... MMBtu/hr
Value (Btu/gal) x Fuel Use Rate (gal/ton) / 1E6

TOTAL PARTICULATE

15.432 x (FHW + MF + BHW) / [(Vm(std) + Vw(std)] ...	0.0000	gr/scf
15.432 x (FHW + MF + BHW) / (Vm(std)	0.0000	gr/dscf
gr/dscf x (12 / %CO2)	0.0000	@ 0% CO2
gr/dscf x [(20.9 - Oxygen corr.) / (20.9 - %O2)] ...	0.0000	@ 0% O2
0.00857 x Qs(std) x gr/dscf	0.01	lb/hr
F-Fac x 1.4286E-4 x [20.9 / (20.9-%O2)] x gr/dscf ..		lb/MMBtu
Particulate (lb/hr) / Heat Input (MMBtu/hr)		lb/MMBtu

TOTAL ACID MIST

[1.0811E-4 x (Vt - Vtb) x N x Vsol] / Vol(aloq)	lb Acid Mist
[Acid Mist (lb) / Vm std (ft^3)] x Qs std x 60 ...	lb/hr
[Acid Mist (lb) / Vm std (ft^3)] x F-Factor	lb/MMBtu

SULFUR DIOXIDE (SO2)

[7.061E-5 x (Vt - Vtb) x N x Vsol] / Vol(aloq) .	lb SO2
[SO2 (lb) / Vm std (ft^3)] x Qs std (ft^3/min) x 60	lb/hr
[SO2 (lb) / Vm std (ft^3)] x F	lb/MMBtu
[Mass SO2 (lb) x 385 / 64E+6 (ft^3/lb)] / Vm (std)	ppm
ppm x 0.0 % Corr. / 22.4 % CO2 in Stack	ppm @ 0% CO2
ppm x (20.9% - 0.0% O2 Corr)/(20.9% - 22.4% O2 Stack	ppm @ 0% O2
SO2 (lb/hr / Heat Input)	lb/MMBtu

HYDROGEN CHLORIDE DATA SUMMARY

[Mass HCl(mg) x 385 x 1E6] / [453600 x 36.5 x Vm(std	ppm
ppm x 0.0 % Corr. / 15.0 % CO2 in Stack	ppm @ 0% CO2
ppm x (20.9% - 0.0% O2 Corr)/(20.9% - 15.0% O2 Stack	ppm @ 0% O2
[Mass HCl(mg) x 60 x Qs / (Vm(std) x 453,600)]...	lb/hr

FIELD DATA SHEETS

Plant: ERI Cement Kiln
Sample Loc.: Newberry, FL
Control Type: ESP
Sample Type: Method 104
Date: 7/24/00 Run No.: 1
Time Start: 08:50 Time End: 11:02
Sample Time: 10/3/12 min/port 120 total min.
Dry Bulb: °F Wet Bulb: °F VP @ DP:
Bar. Pressure 30.13 "Hg Stack Press.: "Hg -0.24 Ps: ~~6.83~~ "H2O
Moisture: 15 % FDA: Gas Density Factor:
Temperature: 83 °F Wind Dir.: South Wind Speed: 5-7
Weather: Cloudy Thermocouple Readout: KAK-2
Sample Box #: Mono-1 Meter Box No.: KA-4
Meter Y: 0.997 @ Delta H: 1.376 Pitot Corr.: 0.84
Nozzle Diameter: 0.280 in. Probe Length: 4 9/16 55 ft
Probe Heater Setting: 245°F Nomograph Cf: 3.19
Stack Dimensions: 112" in
Stack Area: ft²
Effective Stack Area: ft²
Stack Height: 3246' ft

Stack Dimensions

Umbilical: 200'
Thermocouple
Probe No.: KAK-38
Pitot Tube: KA-55II

Material Processing Rate:
Final Gas Meter Reading: 571.512 ft³
Initial Gas Meter Reading: 495.900 ft³
Total Metered Gas Volume: 75.612 ft³
Condensate Gain in Impingers: 299 mL
Weight Gain in Silica Gel: 66 g
Total Moisture Gain: 365 mL
Silica Gel Container No.:
Filter Number: B

Leak Check – Meter Box
Initial: 0.011 cfm @ 15 in. H2O
Final: 0.008 cfm @ 6 in. H2O
Leak Check – Pitot Tubes
Impact 3 "H2O for 15 sec: (Stable,) Leak
Static 3 "H2O for 15 sec: (Stable,) Leak

KOOGLER & ASSOCIATES

Test Conducted By: G. Haven, S. Bell
Stack Test Observers:
CO_2 = 22.4 %
O_2 = 8.5 %

Port and Traverse Point No.	Distance from Inside Stack Wall (in.)	Clock Time	Gas Meter Reading (ft³)	Stack Velocity Head ("H2O)	Meter Orifice Pressure Difference ("H2O) Calculated	Meter Orifice Pressure Difference ("H2O) Actual	Stack Gas Temperature (°F)	Sample Box Temperature (°F)	Last Impinger Temperature (°F)	Meter Temperature (°F)	Vacuum on Sample Train ("Hg)	Oxygen Meter Reading (% O2)
Average												
1-1			95.9	0.34	1.08	1.08	247	239	79	88	5	
2			2.4	0.30	0.950	0.96	247	233	58	91	5	
3			8.5	0.24	0.83	0.83	246	245	62	93	4	
2-1			14.2	0.36	1.15	1.15	248	241	67	96	5	
2			20.7	0.32	1.02	1.02	249	240	57	97	5	
3			27.0	0.25	0.80	0.80	244	235	59	97	5	
3-1			32.6	0.35	1.12	1.12	242	248	61	96	5	
2			39.1	0.36	1.21	1.21	248	247				

Port and Traverse Point No.	Distance from Inside Stack Wall (in.)	Clock Time	Gas Meter Reading (ft^3)	Stack Velocity Head ("H2O)	Meter Orifice Pressure Difference ("H2O)		Stack Gas Temperature (°F)	Sample Box Temperature (°F)	Last Impinger Temperature (°F)	Meter Temperature (°F)	Vacuum on Sample Train ("Hg)	Oxygen Meter Reading (% O2)
					Calculated	Actual						
3-3			45.8	0.29	0.93	0.93	245	254	63	95	5	
4-1			51.9	0.39	1.24	1.24	247	241	60	92	6	
2			58.7	0.38	1.21	1.21	250	245	60	91	6	
3			65.5	0.28	0.89	0.89	243	242	62	91	6	

6+CB+9842

Plant: FRI Cement Kiln
Sample Loc.: Newberry, FL
Control Type: ESP
Sample Type: Method 104
Date: 7/24/00 Run No.: 2
Time Start: 11:27 Time End: 13:31
Sample Time: 10/3/12 min/port 60 total min.
Dry Bulb: °F Wet Bulb: °F VP @ DP:
Bar. Pressure 30.13 "Hg Stack Press.: "Hg -0.24 ΔPs: 0.85 "H2O
Moisture: 15 % FDA: Gas Density Factor:
Temperature: 87 °F Wind Dir.: West Wind Speed: 3-5
Weather: Broken Thermocouple Readout: KAK-2
Sample Box #: Mono-1 Meter Box No.: Kt-4
Meter Y: 0.997 @ Delta H: 1.376 Pitot Corr.: 0.84
Nozzle Diameter: 0.280 in. Probe Length: 4 6655 ft
Probe Heater Setting: 245 °F Nomograph Cf: 3.12
Stack Dimensions: 112 "
Stack Area: in
Effective Stack Area: ft²
Stack Height: 3240 ft

Stack Dimensions

Umbilical: 200
Thermocouple Probe No.: KAK-38
Pitot Tube: KA-88II

Material Processing Rate:
Final Gas Meter Reading: 649.152 ft³
Initial Gas Meter Reading: 571.800 ft³
Total Metered Gas Volume: 77.352 ft³
Condensate Gain in Impingers: 276 mL
Weight Gain in Silica Gel: 23 g
Total Moisture Gain: 299 mL
Silica Gel Container No.: 32
Filter Number:

Leak Check – Meter Box
Initial: 0.0012 cfm @ 15 In. H2O
Final: 0.011 cfm @ 8 In. H2O
Leak Check – Pitot Tubes
Impact 3 "H2O for 15 sec: (Stable) Leak
Static 3 "H2O for 15 sec: (Stable) Leak

KOOGLER & ASSOCIATES

Test Conducted By: G. Haven, S. Bell
Stack Test Observers: CO2 = 24.1 %, O2 = 7.8%

Port and Traverse Point No.	Distance from Inside Stack Wall (in.)	Clock Time	Gas Meter Reading (ft³)	Stack Velocity Head ("H2O)	Meter Orifice Pressure Difference ("H2O) Calculated	Meter Orifice Pressure Difference ("H2O) Actual	Stack Gas Temperature (°F)	Sample Box Temperature (°F)	Last Impinger Temperature (°F)	Meter Temperature (°F)	Vacuum on Sample Train ("Hg)	Oxygen Meter Reading (% O2)
Average:												
1-1			71.8	0.49	1.53	1.53	229	242	80	90	8	
2			79.4	0.46	1.44	1.44	243	251	66	92	7	
3			86.6	0.27	0.84	0.84	249	245	66	94	6	
2-1			92.4	0.32	1.0	1.0	247	246	70	96	6	
2			98.5	0.31	0.97	0.97	259	249	65	97	6	
3			604.5	0.23	0.72	0.72	253	243	64	98	6	
3-1			9.7	0.32	1.0	1.0	249	245	64	99	6	
2			15.8	0.33	1.03	1.03						

Port and Traverse Point No.	Distance from Inside Stack Wall (in.)	Clock Time	Gas Meter Reading (ft³)	Stack Velocity Head (" H2O)	Meter Orifice Pressure Difference (" H2O)		Stack Gas Temperature (°F)	Sample Box Temperature (°F)	Last Impinger Temperature (°F)	Meter Temperature (°F)	Vacuum on Sample Train (" Hg)	Oxygen Meter Reading (% O2)
					Calculated	Actual						
3-3			22.0	0.23	0.72	0.72	251	224	63	102	6	
4-1			27.3	0.45	1.40	1.40	251	232	66	103	8	
2			34.6	0.50	1.56	1.56	247	244	62	104	8	
3			42.0	0.42	1.31	1.31	238	240	64	105	8	

Plant: ERI - Cement Kiln
Sample Loc.: Newberry, FL
Control Type: ESP
Sample Type: Method 104
Date: 7/24/00 Run No.: 3
Time Start: 14:12 Time End: 16:18
Sample Time: 10/3/2 min/port 120 total min.
Dry Bulb: °F Wet Bulb: °F VP @ DP:
Bar. Pressure 30.13 "Hg Stack Press.: 30.11 "Hg -0.24 -0.83 "H20
Moisture: 15 % FDA: Gas Density Factor:
Temperature: 87 °F Wind Dir.: South Wind Speed: 7-10
Weather: Broken Thermocouple Readout: KAK-2
Sample Box #: Mona 1 Meter Box No.: KAK-2
Meter Y: 0.997 644 @ Delta H: 1.376 Pitot Corr.: 0.84
Nozzle Diameter: 0.280 in. Probe Length: 4 6 6 ft
Probe Heater Setting: 245°F Nomograph Cf: 0.312
Stack Dimensions: 112 in
Stack Area: 68.4 ft²
Effective Stack Area: 66.4 ft²
Stack Height: ≥ 240' ft

Stack Dimensions

Umbilical: 200'
Thermocouple
Probe No.: KAK-38
Pitot Tube: KA-5516

Material Processing Rate:
Final Gas Meter Reading: 746.396 ft³
Initial Gas Meter Reading: 649.500 ft³
Total Metered Gas Volume: 96.896 ft³
Condensate Gain in Impingers: 355 mL
Weight Gain in Silica Gel: 19 g
Total Moisture Gain: 374 mL
Silica Gel Container No.: 33
Filter Number: C

Leak Check – Meter Box
Initial: 0.018 cfm @ 15 In. H20
Final: 0.002 cfm @ 9 In. H20
Leak Check – Pitot Tubes
Impact 3 "H20 for 15 sec: (Stable) Leak
Static 3 "H20 for 15 sec: (Stable) Leak

KOOGLER & ASSOCIATES

Test Conducted By: G. Haven, S. Bell
CO2 = 15%
O2 = 9.8%
Stack Test Observers:

Port and Traverse Point No.	Distance from Inside Stack Wall (in.)	Clock Time	Gas Meter Reading (ft³)	Stack Velocity Head ("H20)	Meter Orifice Pressure Difference ("H20) Calculated	Meter Orifice Pressure Difference ("H20) Actual	Stack Gas Temperature (°F)	Sample Box Temperature (°F)	Last Impinger Temperature (°F)	Meter Temperature (°F)	Vacuum on Sample Train ("Hg)	Oxygen Meter Reading (% O2)
Average												
1-1			49.5	0.65	2.02	2.02	201	248	74	100	8	
2			58.5	0.60	1.92	1.92	200	239	61	100	8	
3			66.8	0.44	1.37	1.37	199	244	64	100	6	
2-1			74.1	0.62	1.93	1.93	200	235	68	98	7	
2			82.5	0.60	1.92	1.91	200	241	63	97	8	
3			90.16	0.43	1.34	1.34	199	243	63	98	6	
3-1			98.3	0.63	1.96	1.96	201	245	67	98	8	
2			106.4	0.56	1.81	1.81	202	247	67	98	8	

FRI Run 3
2/24/06

Port and Traverse Point No.	Distance from Inside Stack Wall (in.)	Clock Time	Gas Meter Reading (ft³)	Stack Velocity Head ("H2O)	Meter Orifice Pressure Difference ("H2O)		Stack Gas Temperature (°F)	Sample Box Temperature (°F)	Last Impinger Temperature (°F)	Meter Temperature (°F)	Vacuum on Sample Train ("Hg)	Oxygen Meter Reading (% O2)
					Calculated	Actual						
3-3	4.	1459	14.8	0.45	1.40	1.40	199	260	61	98	7	
4-1			22.6	0.60	1.87	1.87	202	255	64	97	8	
2			30.5	0.59	1.84	1.84	201	259	63	97	8	
3			38.8	0.47	1.46	1.46	199	258	64	97	7	

SAMPLING RATE CALCULATIONS

Date 7/24/00

Plant Name FRI

Location Newberry, FL

Source Cement Kiln

ΔH = Orifice Reading (Inches H_2O)
Dn = Nozzle Diameter (Inches)
ΔHθ = Meter Box Constant
Bw = Moisture Fraction
Tm = Meter Temperature (°F)
Ts = Stack Temperature (°F)
Ms = Wet Molecular Weight of Stack Gas (From Table)
ΔP = Pitot Reading (Inches H_2O)

$$\left[\frac{Tm + 460}{Ms(Ts+460)}\,(1 - Bw)^2\,\Delta H\theta\,(Dn)^4\,17741\right]\cdot \Delta P = \Delta H$$

Moisture Fraction	Ms
0.0	29.0
0.05	28.5
0.10	27.9
0.15	27.4
0.20	26.8
0.25	26.2
0.30	25.7
0.35	25.2
0.40	24.6

550 / 27.4(215+460) 18495

555

	Run 1	Run 2	Run 3
$\frac{Tm + 460}{Ms\,(Ts + 460)}$ =	0.0297	0.625	
× $(1 - Bw)^2$ =	0.7225	0.7225	
× ΔHθ =	1.376	1.376	
× $(Dn)^4$ =	0.00641	0.00641	
× 17741 =	17741	17741	
× ΔP =			
	3.19	3.12	

LABORATORY DATA SHEETS

FLOWERS

CHEMICAL LABORATORIES INCORPORATED

Received From:
Koogler Assoc.
4014 NW 13th St.
Gainsvile,FL 32609

Date Reported : Aug29 2000
Project Number : FL Rock Ind.
PO Number : 187-00-09
FLDOH Number : E83018
NYSDOH Number : 11595
CTDPH Number : 0173
NCDEHNR Number : 296
SCDHEC Number : 96019

For: Be
Date Sampled:Jul25 2000 Date Received:Aug 9 2000 Lab Numbers: 31688-31697

REPORT OF ANALYSIS

	Beryllium mg
Accuracy:	91.8
Precision:	.620
Det.Limit:	.00010
Client ID	
Lab Number	
CONT1R1	
31688	0.359
CONT2R1	
31689	<0.00010
CONT3R1	
31690	<0.00010
CONT1R2	
31691	0.212
CONT2R2	
31692	<0.00010
CONT3R2	
31693	0.444
CONT1R3	
31694	0.0472
CONT2R3	
31695	<0.00010

Certificate of Results
Sample integrity certified prior to analysis. Test results meet all requirments of the NELAC Standards, except as noted in the QA Report Section 4. This Report may not be reproduced in part, results relate only to items tested.

Jefferson S. Flowers, Ph.D.
President/Technical Director

Jefferson L. Flowers, Ph.D
Jefferson S. Flowers, Ph.D
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FLORIDA 32715 - 0597
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FAX: (407) 260-6110

FLOWERS

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CTDPH Number : 0173
NCDEHNR Number : 296
SCDHEC Number : 96019

For: Be
Date Sampled:Jul25 2000 Date Received:Aug 9 2000 Lab Numbers: 31688-31697

REPORT OF ANALYSIS

	Beryllium mg
Accuracy:	91.8
Precision:	.620
Det.Limit:	.00010
Client ID	
Lab Number	
CONT3R3	
31696	<0.00010
FILTDIBLANKS	
31697	<0.00010

Certificate of Results
Sample integrity certified prior to analysis. Test results meet all requirments of the NELAC Standards, except as noted in the QA Report Section 4. This Report may not be reproduced in part, results relate only to items tested.

Jefferson S. Flowers, Ph.D.
President/Technical Director

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CTDPH Number : 0173
NCDEHNR Number : 296
SCDHEC Number : 96019

For: Be
Date Sampled:Jul25 2000 Date Received:Aug 9 2000 Lab Numbers: 31688-31697

REPORT OF INFORMATION

Parameter	Unit	Limit		Expected Value	Range	Correlation
				31688		
Beryllium	mg	-	-	0.359		
				31689		
Beryllium	mg	-	-	.00020		
				31690		
Beryllium	mg	-	-	.00020		
				31691		
Beryllium	mg	-	-	0.212		
				31692		
Beryllium	mg	-	-	.00020		
				31693		
Beryllium	mg	-	-	0.444		

The above information is intended to highlight exceptional data as compared to the upper control limits (Limit) established for each of the parameters. Range exceedances are flagged by integer values in the Range column. The Expected values are derived from historical data. Expected is computed as either the mean or computed directly from another parameter using linear regression. All known correlation rule exceedances are listed as enumerated rule numbers in the Correlation column. Correlation pair rules are defined on the last page.

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Gainsvile,FL 32609

Date Reported : Aug29 2000
Project Number : FL Rock Ind.
PO Number : 187-00-09
FLDOH Number : E83018
NYSDOH Number : 11595
CTDPH Number : 0173
NCDEHNR Number : 296
SCDHEC Number : 96019

For: Be
Date Sampled:Jul25 2000 Date Received:Aug 9 2000 Lab Numbers: 31688-31697

REPORT OF INFORMATION

Parameter	Unit	Limit	Expected Value	Range	Correlation
			31694		
Beryllium	mg	-	- 0.0472		
			31695		
Beryllium	mg	-	- .00020		
			31696		
Beryllium	mg	-	- .00020		
			31697		
Beryllium	mg	-	- .00020		

The above information is intended to highlight exceptional data as compared to the upper control limits (Limit) established for each of the parameters. Range exceedances are flagged by integer values in the Range column. The Expected values are derived from historical data. Expected is computed as either the mean or computed directly from another parameter using linear regression. All known correlation rule exceedances are listed as enumerated rule numbers in the Correlation column. Correlation pair rules are defined on the last page.

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FLOWERS CHEMICAL LABORATORIES

ANALYTICAL RESULTS FORM FLDOH Number E83018

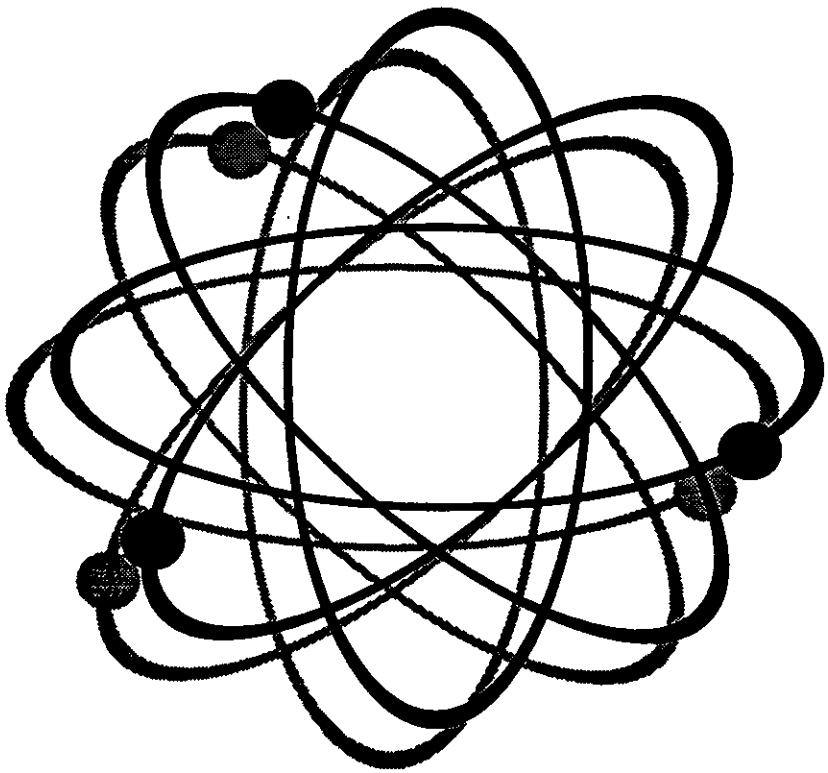
Parameter	Symbol	Unit	Cont1 R1	Cont2 R1	Cont3 R1	Cont1 R2	Cont2 R2	Cont3 R2	Cont1 R3	Cont2 R3	Cont3 R3	Filt/DI Blanks	QA Section					
			31688	31689	31690	31691	31692	31693	31694	31695	31696	31697	Method	MDL	%RSD	%Rec	Analys	Date
Beryllium	*	mg	0.359	<0.0001U	<0.0001U	0.212	<0.0001U	0.444	0.0472	<0.0001U	<0.0001U	<0.0001U	EPA200.8	0.0001	0.629	91.8	MAN	08-18-2000 10:50
			Date Received:		08-09-00		Typed:		08-29-00	Sent:		08-29-00						

Project Number	FL Rock Ind.	Qualifier Key	
PO Number	187-00-09	J	Surrogate recovery limits have been exceeded;
Date Sampled	1 07-25-00 *		No known quality control criteria exists for the component;
Date Analyzed	0		The sample matrix interfered with the ability to make any accurate determination.
Compacted		Q	Sample held beyond the accepted holding time.
Format	NormL	U	Indicates that the compound was analyzed for but not detected.
Unit Cost	Exted	V	Indicates that the analyte was detected in both the sample and the associated method blank.
Be	1200 10 *		

Quality Assurance Report

Prepared for: Koogler Assoc.
Project Number: FL Rock Ind.
Lab Numbers: 31688 - 31697

Report date: 29-Aug-00



FLOWERS CHEMICAL LABORATORIES

FLOWERS CHEMICAL LABORATORIES, INC.

QA SDG Narrative Summary

Client:	Koogler Assoc.
Project Number:	FL Rock Ind.
P.O. Number:	187-00-09
Date Sampled:	25-Jul-00
Lab Numbers:	31688 - 31697

Sample Handling

Sample handling and holding time criteria were met for all samples.

Samples Collected by Submitter. No unusual events occured during analysis.

The requested analytes did not require surrogates.

Accuracy / Precision:

QCCS Check Sample:

Standards Traceability:

The t-test limits were met for all calibration standards as shown in section 5.
The t-test limits were met for all QCCS standards as shown in section 5.
The t-test limits were met for all matrix spike standards as shown in section 5.
There was 1 standard blank.
The t-test limits were met for all surrogate spike standards as shown in section 5.

FLOWERS CHEMICAL LABORATORIES, INC.

QA Section 5

Standards Traceability

Client: Koogler Assoc.
Project Number: FL Rock Ind.
P.O. Number: 187-00-09
Date Sampled: 25-Jul-00
Lab Numbers: 31688 - 31697

Compound Name	Manfacturer Name	Manfacturer Lot #	Rec Lot #	Rec By	Date Recieved	Valid Until	Prep Lot #	Prep By	Date Prepared	Valid Until	t-test	t-test range	Contro Mean	Contro Std	Lot Mean	Lot Std
			Standard				Lot									
Beryllium	Fisher	9NFS30Z471	1095	EVB	01-10-00	12-30-00	1446	EVB	01-19-00	12-30-00	3.02	>1.68	1.10		0.962	0.068
QCCS	Fisher	9NFS30Z471	1095	MAN	01-10-00	12-30-00	1734	MAN	07-05-00	11-30-00			1.03	0.092	1.10	
Matrix Spike	Fisher	9NFS30Z471	1095	MAN	01-10-00	12-30-00	1570	EVB	03-07-00	09-07-00	2.77	>1.68	1.10		1.11	0.054
EPA200.8 Blank	Flowers Chemical Laboratorie	Valid	34	JSF	01-01-95	12-31-01	14	JSF	01-01-95	01-01-01						

Koogler

CHAIN OF CUSTODY RECORD

Project Number: 187-00-09

Project Name: Florida Rock Industries

Sample Location: Cement Kiln
Newberry, FL

Please analyze for Beryllium

Sample Identification	Remarks	
Cont. 1 R1 FRL	Filter · Run #1 · Florida Rock Ind.	31688
Cont. 2 R1 ②	Impinger Catch Run #1	31689
Cont. 3 R1	Probe Rinse Run #1	31690
Cont. 1 R2	Filter Run #2	31691
Cont. 2 R2	Impinger Catch Run #2	31692
Cont. 3 R2	Probe Rinse Run #2	31693
Cont. 1 R3	Filter Run # 3	31694
Cont. 2 R3	Impinger Catch Run #3	31695
Cont. 3 R3	Probe Rinse Run #3	31696
Filter + DiH2O/Acetone ~~Blanks~~	Reagent Blanks	31697

Please combine

Please combine

Please combine

Please combine Blanks

Sampled By: (Signature) Glen A. Hoen Date: 7/25/00 Time: SEE DATA SHEETS

Relinquished By: (Sign) Glen A. Hoen Date: 8/1/00 Time: 16:00

Received By: (Sign) _____ Date: _____ Time: _____

Relinquished By: (Sign) _____ Date: _____ Time: _____

Received By: (Sign) _____ Date: _____ Time: _____

Relinquished By: (Sign) _____ Date: _____ Time: _____

Received By Lab: (Sign) R. Nowy Date: 8900 Time: 2:00PM

Sample Shipped VIA: _____ UPS _____ Fed Express _____ Bus

Shipping Bill Number: _____

PM: Kathy Dorris

Flowers Chemical Laboratories, Inc.

Cooler Receipt, Custody Record Verification, Preservation Form

Client: **Koogler Assoc.** FCL Lab #: **31688 - 31697**

Project: **FL Rock Ind.**

Cooler Rec'd on **08/09/00 16:0** Cooler opened on: **08-09-00**

Rec'd b **SJW** Log-in date: **08-09-00**

		Yes	No	NA
a.	Airbills or airbill stickers		X	
b.	Traffic reports or packing lists		X	
c.	Custody seals on shipping containers		X	
d.	Custody seals intact?			X
e.	Custody seal numbers			X
	if yes,			
f.	Airbill or airbill sticker		X	
	Shipped via: Airbill #:			
g.	Cooler Temperature upon receipt Room Degrees C			
h.	If sample vials received, were bubbles observed?		X	
i.	Client/FCL chain-of-custody forms present	X		
j.	Was condition of shipping containers OK	X		
k.	Sample tags present	X		
l.	Were sample containers in good condition	X		
m.	Were all containers labeled correctly	X		
n.	Did all labels agree with Chain of Custody record	X		
o.	Were correct containers sent for requested analysis	X		
p.	Were samples properly preserved (see below)	X		
q.	Project Manager notified as to discrepancies			X

Explanation of Discrepancies/Remarks:

Preservation Check

pH	Reagent	Yes	No
>12	NaOH		X
<2	HNO3		X
<2	H2SO4		X
<2	HCL		X
	Na2S2O3		X

Returned Containers

P.250mL	1
P.500mL	
P.1L	
P.2L	
Wir-Pac	
40mlVil	
G.250mL	
G.500mL	
G.1L	
G.4L	

PLANT OPERATING DATA

Florida Rock Industries, Inc.
Cement Group
Thompson S. Baker Cement plant

Process Weight Rate Sheet

Source: Kiln/Raw Mill Stack Test Date: July 24, 2000

Permit No.: AC01-267311 Permitted Rate: 149.9 TPH

Test Parameter(s): Beryllium (Be)

	Run Times		Process Input Rate	
Run No. 1	850 -	1102	135	TPH
Run No. 2	1127 -	1331	140	TPH
Run No. 3	1412 -	1618	140	TPH

I here by certify that to the best of my knowledge the above data is true and correct.

George Townsend
Name (Print)

George Townsend
Signature

July 31, 2000
Date

Environmental & Safety Manager
Title

File: Process Rate.pub

EQUIPMENT CALIBRATIONS

NOZZLE CALIBRATION

DATE 7/24/00

PLANT NAME FRI

LOCATION Newberry, FL

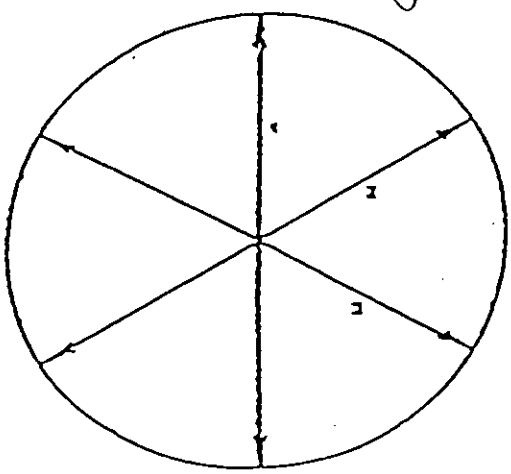
SOURCE Cement Kiln

Measurement No.	Inside Diameter (inches)
1	0.280
2	0.280
3	0.280

Average 0.280

Area of Nozzle _____ ft^2

Calibrated by: Glen A. Haven



Nozzle X-Section

KOGLER & ASSOCIATES

PITOT TUBE CALIBRATION MEASUREMENTS

PITOT TUBE IDENTIFICATION NO. KA-SS II

DATE CALIBRATED 7-5-00

PITOT TUBE ASSEMBLY LEVEL ? ✓ YES _____ NO

PITOT TUBE OPENINGS DAMAGED ? ____ YES (EXPLAIN BELOW) ✓ NO

α_1= 1.5 ° (<10°) α_2= 1.5 ° (<10°)

β_1= 2.5 ° (<5°) β_2= 2.0 ° (<5°)

Y= 1.5 °, θ= 2.0 °, A= 0.948 IN. = (PA+PB)

Z = A SIN Y = 0.0248 IN. (<0.125 IN.)

W = A SIN θ = 0.0331 IN. (<0.031 IN.)

P_A 0.464 IN. P_b 0.466 IN.

D_t 0.377 IN. (≥ 0.1875 IN. ≤ 0.3750 IN.)

COMMENTS: Pitot tube looked ok. day of test.

CALIBRATION REQUIRED? _____ YES ✓ NO

CALIBRATED BY: R Paul

PTCMFORM 1/8/87

KOOGLER Ka ASSOCIATES

POST TEST THERMOCOUPLE
CALIBRATION

DATE 7/24/00

PLANT NAME FRI

LOCATION Newberry, FL

SOURCE Cement Kiln

Thermocouple Readout # KAK-2

Umbilical Cord # 200'

Switch Box # KAK-2

Thermocouple # KAK-36

Average Stack Temperature °F _____

*Observed Mercury in Glass (ASTM) °F _____

Observed Thermocouple Reading °F _____

Percent Difference $\frac{(\text{ASTM} + 460) - (\text{Thermo} + 460)}{(\text{ASTM} - 460)} \times 100 =$ _____

Tolerance ≤ 1.5%

* Observed Temperature must be within ten percent of the average stack temperature.

Glen A. Howe
Signature

KOGLER & ASSOCIATES

KOOGLER & ASSOCIATES, ENVIRONMENTAL SERVICES
ANNUAL THERMOCOUPLE CALIBRATION 12/27/99

KA70 RO/UMB		ICE (F)	ASTM (F)	AMB. (F)	ASTM (F)	212 (F)	ASTM (F)	400 (F)	ASTM (F)	KA70 RO/UMB	
KA1/100'	STACK	32	33	73	72	208	209	405	406	KA1/100'	STACK
	BOX	33	32	72	72	210	210	404	406		BOX
	IMP	32	32	73	73	211	212	400	401		IMP
KA2/200'	STACK	33	33	73	72	209	210	415	416	KA2/200'	STACK
	BOX	32	32	72	73	211	210	418	418		BOX
	IMP	32	33	71	72	212	212	409	410		IMP
KA3/25'	STACK	32	33	73	73	211	210	409	410	KA3/25'	STACK
SWBXKA3	BOX	33	32	72	73	215	215	415	416		BOX
	IMP	33	32	72	73	212	212	408	407		IMP
KA4/25'	STACK	32	32	73	74	205	205	420	420	KA4/25'	STACK
SWBXKA3	BOX	32	33	74	74	207	208	422	421		BOX
	IMP	32	33	72	73	211	212	425	425		IMP
KAK/200K	STACK	31	32	74	74	213	213	419	420	KAK/200K	STACK
KAK-38	BOX	32	32	72	73	215	216	422	422	KAK-38	BOX
SWBXKAK1	IMP	32	33	74	73	219	220	400	401		IMP
KA1/200'	STACK	33	33	73	73	211	210	422	422	KA1/200'	STACK
	BOX	33	33	73	72	214	214	419	418		BOX
	IMP	33	32	73	72	209	209	425	425		IMP
KA2/100'	STACK	33	33	73	72	209	210	422	423	KA2/100'	STACK
	BOX	33	32	73	74	212	211	425	425		BOX
	IMP	32	33	72	73	212	211	426	425		IMP

Signature [signature]

Date 12/27/99

KOOGLER & ASSOCIATES, ENVIRONMENTAL SERVICES
ANNUAL THERMOCOUPLE CALIBRATION 12/27/99

THERMOCOUPLE #	ICE (F)	ASTM (F)	AMB. (F)	ASTM (F)	212 (F)	ASTM (F)	400 (F)	ASTM (F)	THERMOCOUPLE #
KA-06	33	33	73	74	212	212	420	419	KA-06
KA-07	33	32	74	75	209	210	421	422	KA-07
KA-08	34	33	74	74	211	211	415	416	KA-08
KA-09	33	33	74	74	215	216	416	417	KA-09
KA-10	34	33	72	72	214	215	408	407	KA-10
KA-11	33	33	72	72	212	212	415	414	KA-11
KA-12	33	33	73	72	219	220	408	407	KA-12
KA-38	34	33	73	74	211	211	412	411	KA-38
KA-39	34	33	73	73	212	211	416	415	KA-39
KA-50	33	34	74	73	215	214	415	416	KA-50
KA-64	33	33	74	74	211	211	410	411	KA-64
KA-70	33	33	73	74	212	213	405	406	KA-70
KA-71	34	34	73	73	211	210	407	408	KA-71
KA-72	34	33	72	72	216	215	410	410	KA-72
KA-105	34	33	73	73	217	218	404	405	KA-105
KA-108	34	34	72	73	214	215	412	411	KA-108
KA-115	34	33	72	72	213	214	409	410	KA-115
KA-126	34	33	72	72	216	216	410	409	KA-126

THERMOCOUPLE #	ICE (F)	ASTM (F)	AMB. (F)	ASTM (F)	212 (F)	ASTM (F)	400 (F)	ASTM (F)	THERMOCOUPLE #
KAK-08	32	32	73	74	218	217	407	406	KAK-08
KAK-09	31	31	73	73	211	212	405	406	KAK-09
KAK-10	32	32	74	74	209	210	377	376	KAK-10
KAK-11	31	31	75	75	206	206	399	398	KAK-11
KAK-12	32	31	74	74	218	217	407	406	KAK-12
KAK-38	31	31	74	74	210	211	410	410	KAK-38
KAK-65	32	32	74	74	205	205	377	377	KAK-65
KAK-72	31	31	74	75	208	208	400	401	KAK-72
KAK-110	31	32	75	74	209	210	399	400	KAK-110
KAK-07	32	31	75	74	209	210	389	390	KAK-07

VOST SWITCH BOX	T.COUPLE				
CH#1	C-1	32	33	74	75
CH#2	C-1	33	32	74	74
CH#3	C-1	33	33	75	74

VOST SWITCH BOX					
CH#1	C-2	32	33	73	74
CH#2	C-2	33	33	74	75
CH#3	C-2	32	33	75	75

Signature Steph S-Bee

Date 12/27/99

KOOGLER & ASSOCIATES, ENVIRONMENTAL SERVICES
ANNUAL THERMOCOUPLE CALIBRATION 12/27/99

Range (ºC)	Measured Voltage (mV)	Measured Voltage (V)	Calc. Temp. (ºC)	Readout Temp. (ºC)	Percent Difference (%)
KAK-12	28.7	0.029	690	693	-0.45023
	37.4	0.037	902	900	0.217654
KAK-38	28.9	0.029	694	698	-0.51192
	37.2	0.037	897	900	-0.33898
KAK-72	28.5	0.029	685	687	-0.30387
	37.5	0.038	904	908	-0.39058
KAK-65	28.2	0.028	678	680	-0.32666
	37.8	0.038	912	910	0.218082
KA-110	29	0.029	694	699	-0.65592
	37	0.037	894	899	-0.50758

EQUATIONS :

T (calc.)=(0.226584602+(24152.109*V)+(67233.4248*V^2)+(2210340.682*V^3)
-(860963914.9*V^4)+(48350600000*V^5)-(1184520000000*V^6)
+(13869000000000*V^7)-(63370800000000*V^8))

Where :

V = Measured Voltage (Volts)
T(calc.) = Temperature calculated based on voltage

Signature Stephen S Bell

Date 12/27/99

POST-TEST DRY GAS METER CALIBRATION FORM

COMPANY:	Florida Rock Industries
SOURCE:	Cement Kiln
DATE:	August 9, 2000
PRETEST Y:	0.997
TEST METER NUMBER:	KA-1
METER BOX NUMBER:	KA-4
BAROMETRIC PRESSURE (Pb):	30.01
DELTA H (dH):	2

	TEST METER READING (ft^3)	DRY GAS READING (ft^3)	TIME (min) ⏥	VACUUM SETTING (in. Hg)
INITIAL	304.563	321.225		
FIRST	310.023	326.635	6.1	6
SECOND	319.263	335.835	10.3	6
THIRD	328.421	345.017	10.2	6

DELTA H	TEST METER Vt (ft^3)	DRY GAS Vd (ft^3)	TEST METER TEMP. Tt (°F)	DRY GAS TEMP. Td (°F)
2	5.460	5.410	77.5	81.5
PB	9.240	9.200	77.5	84.5
30.01	9.158	9.182	77	87

$$Yi = \frac{Vt * Pb * (Td + 460)}{Vd * (Pb + dH/13.6) * (Tt + 460)}$$

	Yi	
RUN 1 (Yi)=	1.011794	88727.26 / 87692.95
RUN 2 (Yi)=	1.012466	150985.7 / 149126.6
RUN 3 (Yi)=	1.011005	150332.8 / 148696.4
AVG. Y =	1.011755	

PRETEST Y =	0.997
AVG. DETA Y =	0.014755
DELTA Y LIMIT =	± 0.05
IS TEST WITHIN 5%?	YES

Vt = Gas volume passing through the test meter, ft^3
Vd = Gas volume passing through the dry gas meter, ft^3
Tt = Temperature of the gas in the test meter, °F
Tdi = Temperature of the inlet gas of the dry gas meter, °F
Tdo = Temperature of the outlet gas of the dry gas meter, °F
Td = Average temperature of the gas in the dry gas meter, the average of Tdi and Tdo, °F
dH = Pressure difference accross the orifice, in, H2O
Yi = Ratio of test meter to dry gas meter for each run
Y = Average ratio of accuracy of test meter to dry gas meter for all three runs, tolerance = pretest ± 0.05*Y
⏥ = Time of calibration run, min
Pb = Barometric pressure, in Hg.

DRY GAS METER AND ORIFICE CALIBRATION

CONTROL BOX NO. KA-4 BAROMETRIC PRESS. 30.39 IN. HG.

DATE FEB. 22, 2000 PERFORMED BY ROC

	RUN 1	RUN 2	RUN 3	RUN 4	RUN 5
VACUUM ("Hg)	0.0	0.0	0.0	0.0	0.0
dHw ("H2O)	-0.28	-0.30	-0.33	-0.37	-0.43
dHd ("H2O)	0.50	1.00	1.50	2.50	3.50
INITIAL WTM	3.036	28.727	994.704	20.046	9.754
FINAL WTM	9.754	34.540	1003.036	28.727	20.046
INITIAL DGM	103.007	129.171	94.618	120.249	109.760
FINAL DGM	109.760	135.141	103.007	129.171	120.249
TEMP. WTM (F)	68.00	69.00	68.00	69.00	68.00
TEMP. DGM (F)	76.00	80.00	75.00	80.00	78.00
TEST TIME (MIN.)	14.50	9.00	11.00	9.00	9.00
NET VOLUME WTM	6.718	5.813	8.332	8.681	10.292
NET VOLUME DGM	6.753	5.970	8.389	8.922	10.489
Y	1.009	0.992	1.004	0.988	0.992
dH@	1.264	1.296	1.421	1.453	1.447

AVERAGE Y = 0.997

ACCEPTABLE Y RANGE = 0.980 TO 1.020 OK

AVERAGE dH@ = 1.376

$$Y = (Vw\ (Pb - (dHw / 13.6)) \times (Td + 460)) / (Vd\ (Pb + (dHd / 13.6)) \times (Tw + 460)$$

$$dH@ = 0.0317 \times dHd / (Pb\ (Td + 460)) \times ((Tw + 460) \times time) / Vw)^2$$

PROJECT PARTICIPANTS

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KOOGLER & ASSOCIATES

John B. Koogler, Ph.D., P.E.	Project Advisor
Stephen S. Bell	Field Test Crew
Glen A. Haven	Field Test Crew

FLORIDA ROCK INDUSTRIES, INC.

George Townsend	Environmental & Safety Manager

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