AP42 Section:	11.20
Reference:	8
Title:	Sulfur Dioxide Emission Measurements, Lightweight Aggregate Kiln No. 5 (Inlet), Carolina Solite Corporation, Aquadale, North Carolina, Sholtes & Koogler Environmental Consultants, Inc., Gainesville, FL, May 1991.

SULFUR DIOXIDE EMISSION MEASUREMENTS

LIGHTWEIGHT AGGREGATE
KILN NO. 5
SCRUBBER INLET

CAROLINA SOLITE
AQUADALE, NORTH CAROLINA

MAY 16, 1991

KOOGLER & ASSOCIATES
ENVIRONMENTAL SERVICES
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KOOGLER & ASSOCIATES

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KOOGLER & ASSOCIATES

To the best of my knowledge and in my professional judgement, all applicable field and analytical procedures comply with modern engineering principles and all test data and plant operating data are true and correct.

John B. Koogler, Ph.D., P.E.

5/31/91
Date

KOOGLER & ASSOCIATES

1.0 INTRODUCTION

Carolina Solite owns and operates a lightweight aggregate production facility near Aquadale, North Carolina. Shale is quarried on the property, hauled to the lightweight aggregate facility, and calcined in rotary kilns to produce a lightweight aggregate used in the construction industry.

On May 16, 1991, Koogler & Associates Environmental Services of Gainesville, Florida, conducted sulfur dioxide measurements at the inlet to the scrubber controlling emissions from Kiln No. 5 in accordance with EPA Method 8 as described in 40CFR60, Appendix A. The purpose of the testing was to determine the sulfur dioxide transport rate to the scrubber (or the uncontrolled sulfur dioxide emission rate from the kiln).

Prior to the test date, the North Carolina Department of Environment, Health and Natural Resources, Division of Environmental Management (NCDEM) was notified of the test schedule and the test method. Mr. Mike Landis of NCDEM was present during the test period to observe plant operations and test procedures.

During the period of testing, the No. 5 lightweight aggregate kiln was operating at a production rate of 8.0 tons of product per hour. The kiln was being fired with coal at a rate of 1.3 tons per hour; or at a heat input of 34.8 million BTU per hour.

The sulfur dioxide transport rate was calculated using two procedures. One procedure involved the use of the "F" factor as described in EPA Method 19, 40CFR60, Appendix A and the second method involved calculating the mass transport rate of sulfur dioxide (pounds per hour) and dividing by the measured heat input to the kiln. The concentration of sulfur dioxide measured in the stack gas and used in both methods of calculating sulfur dioxide transport was 9.29×10^{-5} pounds of sulfur dioxide per dry standard cubic foot of stack gas. The "F" factor for bituminous coal is 9780 dscf per million BTU heat input at zero percent oxygen in the stack gas. The average oxygen concentration measured in the stack gas during the three test runs was 11.3 percent resulting in an oxygen corrected "F" factor of 21,359 dscf per million BTU heat input. The sulfur dioxide emission rate based on the corrected "F" factor was 1.98 pounds per million BTU heat input.

To calculate the sulfur dioxide mass emission rate, a stack gas flow of 9797 dry standard cubic feet per minute was measured. This stack gas flow rate and the measured sulfur dioxide concentration resulted in a mass sulfur dioxide transport rate of 54.63 pounds per hour. Based on measured heat input of 34.8 million BTU per hour, the calculated sulfur dioxide transport rate was 1.57 pounds per million BTU heat input.

The sulfur dioxide transport rates calculated using both methods are less than the sulfur dioxide emission limit for Kiln No. 5 of 2.3 pounds per million BTU heat input.

2.0 PROCESS DESCRIPTION

Shale is quarried on site and hauled to the lightweight aggregate production facility. The shale is crushed to size and fed to rotary kilns where it is calcined to produce lightweight aggregate. As the shale is heated, it expands approximately doubling in volume. The lightweight aggregate is then discharged from the kiln, cooled and sized. The resulting product is a strong lightweight aggregate used in the construction industry.

During the test period of May 16, 1991, Kiln No. 5 was fired with coal at the rate of 1.3 tons per hour. The heating value of the coal averaged 13,397 BTU per pound resulting in a heat input to Kiln No. 5 of 34.8 MMBTU per hour; or 4.35 MMBTU per ton of product (at a lightweight production rate of 8.0 tons per hour). The data sheets used for determining the coal feed rate to the kiln are included in the Appendix of this report.

The gas stream leaving the kiln passes through a scrubber system and is discharged to the atmosphere through a 32-inch diameter stack at a height of approximately 90 feet above grade.

3.0 SAMPLING POINT LOCATION

Two sampling ports are located in a 32-inch diameter stack 25 feet above the duct leading from the scrubber to the stack and 60 feet below the top of the stack. The two sampling ports are located 90 degrees to one another. Using criteria of EPA Method 1, 40CFR60, Appendix A, 12 traverse points were used for measuring the stack gas flow rate.

The sampling for sulfur dioxide was conducted at a single point near the center of the 34-in diameter duct upstream of the scrubber as mutually agreed by Koogler & Associates and the NCDEM representative.

Figure 1 is a schematic diagram of the stack showing the sample ports and traverse point locations for measuring the stack gas flow rate and the location of the sample port upstream of the scrubber.

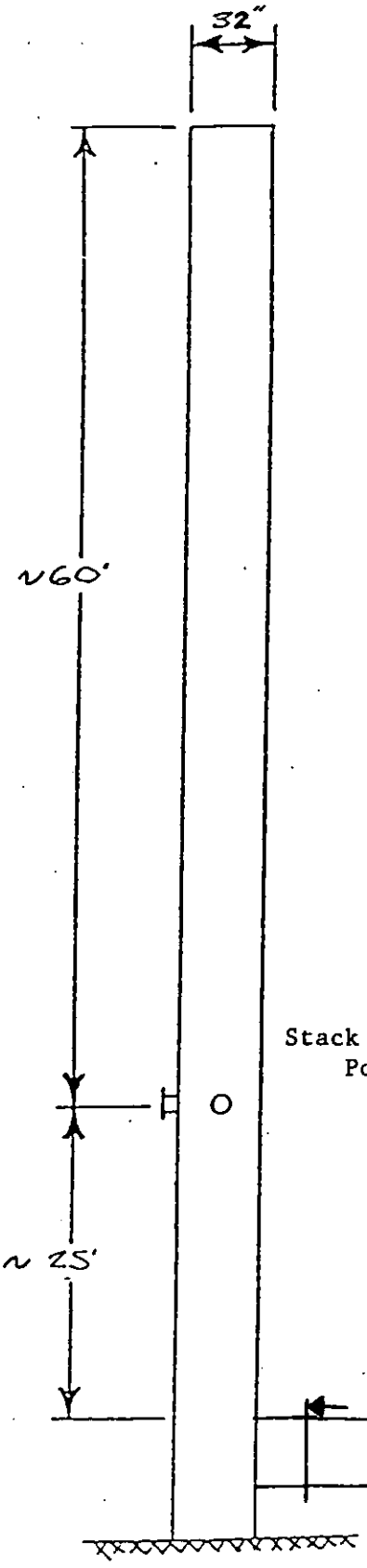

FIGURE 1

SAMPLING POINT LOCATIONS

KILN NO. 5 STACK AND SCRUBBER INLET

CAROLINA SOLITE
AQUADALE, NC

Point No.	Inches Inside Stack Wall
1	1.4
2	4.7
3	9.5
4	22.5
5	27.3
6	30.6

4.0 FIELD AND ANALYTICAL PROCEDURES

The sulfur dioxide sampling was conducted in accordance with EPA Method 8 as described in 40CFR60, Appendix A. This test method with sampling at a single point in the duct upstream of the scrubber was recommended by NCDEM personnel.

The stack gas velocity measurements were made in accordance with EPA Methods 1 and 2 and stack gas moisture measurements were made in accordance with EPA Method 4, both as described in 40CFR60, Appendix A. The condensate volume collected in the stack gas with a Method 8 sampling train was used for the Method 4 moisture determination.

5.0 SUMMARY OF RESULTS

During the test period of May 16, 1991, Kiln No. 5 at Carolina Solite was operating under normal conditions at a lightweight aggregate production rate of 8.0 tons per hour. The measured heat input during the time of testing was 34.8 MMBTU per hour based on a coal feed rate of 1.3 tons per hour and a coal heating value of 13,397 BTU per pound.

The stack gas flow rate measured during the test period was 9797 dry standard cubic feet per minute at a temperature of 128°F, a moisture content of 14.4 percent and an oxygen content of 11.3 percent. The measured sulfur dioxide concentration in the gas stream upstream of the scrubber was 9.29×10^{-5} pounds per dry standard cubic foot.

Using the "F" factor method of calculating sulfur dioxide transport as described in EPA Method 19, 40CFR60, Appendix A, the transport rate to the scrubber was 1.98 pounds per million BTU heat input.

Based on the sulfur dioxide concentration in the gas stream, a gas flow of 9797 dry standard cubic feet per minute and a measured heat input of 34.8 million BTU per hour, the calculated sulfur dioxide transport rate was 1.57 pounds per million BTU heat input.

The permitted sulfur dioxide emission rate from Kiln No. 5 is 2.3 pounds per million BTU heat input. Based upon the tests conducted on May 16, 1991, it can be concluded that Kiln No. 5 was operating in compliance with

the permitted sulfur dioxide emission rate.

The field and analytical data sheets, all calculations, documentation of plant operating data, equipment calibration sheets and project participants are included in the Appendix of this report.

TABLE 1
SUMMARY OF STACK GAS FLOW DATA

SOLITE / AQUADALE, N.C.
NO. 5 SCRUBBER STACK
MAY 16, 1991

Run No.	Process Weight Rate (Tons/Hr)	Stack Gas Flow Rate (SCFMD)	Stack Gas Temperature (Deg F)	Stack Gas Moisture (%)	STACK GAS Oxygen (%)	STACK GAS CO2 (%)
1	0.0	10105	127.3	14.0	10.6	8.8
2	0.0	9687	128.0	14.4	11.2	8.1
3	0.0	9598	129.3	14.8	12.2	7.6
Average	0.0	9797	128.2	14.4	11.33	8.17

TABLE 2

SO2 EMISSION CALCULATIONS

PLANT : SOLITE / AQUADALE, N.C.
NO.5 SCRUBBER INLET DATE : NAY 16 1991

Std. Temp. : 68 DEG. F
F-Factor : dscf/MMBtu

Run No.	Vm(std), dscf	lb/dscf	lb/MMBtu	ppm	ppm @3.0 %O2	lb/hr
1A	43.782	9.29E-05		559.60	1119.21	56.32
1B						
Run Average	43.782	9.29E-05		559.60	1119.21	56.32
2A	44.467	9.53E-05		573.94	1022.24	55.38
2B						
Run Average	44.467	9.53E-05		573.94	1022.24	55.38
3A	45.063	9.06E-05		545.96	1116.87	52.19
3B						
Run Average	45.063	9.06E-05		545.96	1116.87	52.19
Test Average	44.437	9.29E-05		559.83	1086.11	54.63

CALCULATIONS :

Vm(std) = [T(std) + 460 / 29.92] x Vm x Y x (Pb + (dH / 13.6)) / (Tm + 460) ..... dscf

CSO2 = 7.061e-5 x [(Vt - Vtb) x N x (Vsoln / Va)] / Vm(std) .....lb/dscf

CSO2 = F-Factor x (lb SO2/dscf) x [20.9 / (20.9 - %O2)] ..... lb/MMBtu

CSO2 = lb/dscf x (6.024e6) ..... ppm

CSO2 = ppm x [(20.9 - Oxygen Corr.) / (20.9 - %O2)] ..... ppm @ 3.0 % O2

ESO2 = lb/dscf x dscfm x (60 min/hr) ..... lb/hr

APPENDIX

1. Calculations
2. Field and Laboratory Data Sheets
3. Plant Information
4. Equipment Calibrations
5. Project Participants

CALCULATIONS

GENERAL DATA

DATA FILE NAME: EPA_58

Company : SOLITE / AQUADALE, N.C.
Source/Unit : NO.5 SCRUBBER OUTLET
Date : MAY 16, 1991
Stack dia. : 32.00 inch OR : Duct Length : 0.00 inch
Oxygen Corr.: 0.0 percent Duct Width : 0.00 inch
Cp : 0.840
Std. Temp. : 68 dF

FUEL ANALYSIS DATA,
(for calculating F-Factor)

		Process Wt.	
Hydrogen,wt% :	0.00	Run 1 :	0.0 tons/hr
Carbon, wt% :	0.00	Run 2 :	0.0
Sulfur, wt% :	0.00	Run 3 :	0.0
Nitrogen,wt% :	0.00		
Oxygen, wt% :	0.00		
Btu/lb :	0		

F-Factor : dscf/MMBtu; enter this value or (F9) for result.

FIELD DATA	RUN 1	RUN 2	RUN 3
Meter Temp., Tm (dF)	97.30	94.00	90.90
Stack Temp., Ts (dF)	127.30	128.00	129.30
Sq.Rt. dP	0.65	0.63	0.62
dH (in. H2O)	1.83	1.83	1.83
Meter Vol.,Vm (ft3)	45.33	45.27	45.64
Meter Y	1.00	1.001	1.001
Bar. Press.,Pb (in.Hg.)	29.87	29.87	29.87
Vol. H2O, Vlc (ml)	246.00	1398.0	1577.0
Static Press.,Ps (in.H2O)	-0.22	-0.22	-0.22
Test Time (min.)	60.00	60.0	60.0
Nozzle Dia.,Dn (in.)	0.25	0.250	0.250
Oxygen, O2 (%)	11.95	10.85	12.15
Carbon Dioxide, CO2 (%)	8.85	8.05	7.55
Carbon Monoxide, CO (%)	0.00	0.00	0.00

Is this Method 5 or Method 5/8 ? (5 or 58) : 58

LABORATORY RESULTS	RUN 1	RUN 2	RUN 3	
GRAVIMETRIC ANALYSIS :				
Front Half Wash (FHW)	0.00000	0.00000	0.00000	grams
Filterable Particulate (MF)	0.00000	0.00000	0.00000	
Condensible Particulate (BHW)	0.00000	0.00000	0.00000	
SO2 ANALYSIS :				
SO2 Analysis (H2O2 impingers)	0.00	0.00	0.00	mg H2SO4
Sample Volume, ml	1000	2000	2000	
Sample Aliquot, ml	2	2	2	
Volume of Titer, ml	10.00	5.85	5.40	
Volume of Titer Blank, ml	0.20	0.20	0.20	

Normality of BaCl 0.0000000

SOURCE TEST CALCULATIONS

PLANT : SOLITE / AQUADALE, N.C.
NO.5 SCRUBBER OUTLET

RUN NO.: 1
DATE : MAY 16, 1991

STD.TEMP, Tstd	= 68 DEG. F	STATIC PRESS., Ps	= -0.22 in. H20
METER TEMP, Tm	= 97.3 DEG. F	PITOT COFF., Cp	= 0.840
STACK TEMP, Ts	= 127.3 DEG. F	STACK I.D.	= 32.00 inch
AVG.VEL.HEAD, dP	= 0.43 in. H20	DUCT LENGTH	= inch
METER ORIFICE, dH	= 1.83 in. H20	DUCT WIDTH	= inch
METER VOL., Vm	=45.334 Cu.Ft.	STACK AREA, As	= 5.585 Sq.Ft.
METER COFF., Y	= 1.001	TEST TIME	= 60.00 min.
BAR. PRESS., Pb	= 29.87 in.Hg	NOZZLE DIA.	= 0.250 inch
COND.(Vlc)	= 246.0 ml	NOZZLE DIA., An	= 3.4E-04 Sq.Ft.

GAS ANALYSIS = 11.95 % O2 0.00 % CO
8.85 % CO2 79.20 % N2

****

Vm(std) = [T(std) + 460 / 29.92] x Vm x Y x (Pb + (dH / 13.6)) / (Tm + 460)..... = 43.115 dscf

Vw(std) =(8.9148 x 10e-5) x (Tstd + 460) x Vlc = 11.579 scf

Bws = Vw(std) / (Vm(std) + Vw(std))..... = 0.212 ; Lower Bws value used.

Bws @ Saturated Conditions = Vapor Press. of H2O @ Dew Point Temp. / (Ps, in.Hg.) ..... = 0.140

%EA =(%O2 - 0.5%CO)/(0.264%N2 - (%O2-0.5%CO)) x 100 = 133.39

Md =(.44 x %CO2)+(.32 x %O2)+[.28 x (%N2 + %CO)] = 29.89

Ms = (Md x (1-Bws)) + (18.0 x Bws)..... = 28.23

P(stack) = Pbar + (Ps / 13.6) ..... = 29.85 in. Hg

vs = 85.49 x CP x (Sq.Rt.dP) x [Sq.Rt.(Ts + 460) / (Ms x P(stack))] ..... = 39.09 ft/sec

Qs = vs x As x 60 ..... = 13,098 acf/min

Qs(std) = Qs x (1-Bws)x((Tstd + 460)/(Ts + 460)) x (P(stack)/29.92) ..... = 10,105 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] ..... =

SOURCE TEST CALCULATIONS

PLANT : SOLITE / AQUADALE, N.C.
NO.5 SCRUBBER OUTLET

RUN NO.: 2
DATE : MAY 16, 1991

STD.TEMP, Tstd	= 68 DEG. F	STATIC PRESS.,Ps	= -0.22 in. H20
METER TEMP, Tm	= 94.00 DEG. F	PITOT COFF., Cp	= 0.840
STACK TEMP, Ts	= 128.0 DEG. F	STACK I.D.	= 32.00 inch
AVG.VEL.HEAD,dP	= 0.39 in. H20	DUCT LENGTH	= inch
METER ORIFICE,dH	= 1.83 in. H20	DUCT WIDTH	= inch
METER VOL., Vm	=45.265 Cu.Ft.	STACK AREA, As	= 5.585 Sq.Ft.
METER COFF., Y	= 1.001	TEST TIME	= 60.00 min.
BAR. PRESS., Pb	= 29.87 in.Hg	NOZZLE DIA.	= 0.250 inch
COND.(Vlc)	=1398.0 ml	NOZZLE DIA., An	= 3.4E-04 Sq.Ft.

GAS ANALYSIS = 10.85 % O2 0.00 % CO
8.05 % CO2 81.10 % N2

****

Vm(std) = [T(std) + 460 / 29.92] x Vm x Y x (Pb + (dH / 13.6)) / (Tm + 460)..... = 43.306 dscf

Vw(std) =(8.9148 x 10e-5) x (Tstd + 460) x Vlc = 65.804 scf

Bws = Vw(std) / (Vm(std) + Vw(std))..... = 0.603 | Lower Bws value used.

Bws @ Saturated Conditions = Vapor Press. of H20 @ Dew Point Temp. / (Ps, in.Hg.) ..... = 0.144

%EA =(%O2 - 0.5%CO)/(0.264%N2 - (%O2-0.5%CO)) x 100 = 102.74

Md =(.44 x %CO2)+(.32 x %O2)+[.28 x (%N2 + %CO)] = 29.72

Ms = (Md x (1-Bws)) + (18.0 x Bws)..... = 28.04

P(stack) = Pbar + (Ps / 13.6) ..... = 29.85 in. Hg

vs = 85.49 x CP x (Sq.Rt.dP) x [Sq.Rt.(Ts + 460) / (Ms x P(stack))] ..... = 37.68 ft/sec

Qs = vs x As x 60 ..... = 12,626 acf/min

Qs(std) = Qs x (1-Bws)x((Tstd + 460)/(Ts + 460)) x (P(stack)/29.92) ..... = 9,687 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] ..... =

SOURCE TEST CALCULATIONS

PLANT : SOLITE / AQUADALE, N.C.
NO.5 SCRUBBER OUTLET

RUN NO.: 3
DATE : MAY 16, 1991

STD.TEMP, Tstd	= 68 DEG. F	STATIC PRESS.,Ps	=	-0.22	in. H20
METER TEMP, Tm	= 90.90 DEG. F	PITOT COFF., Cp	=	0.840	
STACK TEMP, Ts	= 129.3 DEG. F	STACK I.D.	=	32.00	inch
AVG.VEL.HEAD,dP	= 0.39 in. H20	DUCT LENGTH	=		inch
METER ORIFICE,dH	= 1.83 in. H20	DUCT WIDTH	=		inch
METER VOL., Vm	=45.644 Cu.Ft.	STACK AREA, As	=	5.585	Sq.Ft.
METER COFF., Y	= 1.001	TEST TIME	=	60.00	min.
BAR. PRESS., Pb	= 29.87 in.Hg	NOZZLE DIA.	=	0.250	inch
COND.(Vlc)	=1577.0 ml	NOZZLE DIA., An	=	3.4E-04	Sq.Ft.

GAS ANALYSIS = 12.15 % O2 0.00 % CO
7.55 % CO2 80.30 % N2

****

$Vm(std) = [T(std) + 460 / 29.92] \times Vm \times Y \times (Pb + (dH / 13.6)) / (Tm + 460)$ ..... = 43.914 dscf

$Vw(std) = (8.9148 \times 10e\text{-}5) \times (Tstd + 460) \times Vlc$ = 74.230 scf

$Bws = Vw(std) / (Vm(std) + Vw(std))$ ..... = 0.628 ¦ Lower Bws value used.

Bws @ Saturated Conditions = Vapor Press. of H20 @ Dew Point Temp. / (Ps, in.Hg.) ..... = 0.148

$\%EA = (\%O2 - 0.5\%CO) / (0.264\%N2 - (\%O2 - 0.5\%CO)) \times 100$ = 134.27

$Md = (.44 \times \%CO2) + (.32 \times \%O2) + [.28 \times (\%N2 + \%CO)]$ = 29.69

$Ms = (Md \times (1-Bws)) + (18.0 \times Bws)$ ..... = 27.97

$P(stack) = Pbar + (Ps / 13.6)$ ..... = 29.85 in. Hg

$vs = 85.49 \times CP \times (Sq.Rt.dP) \times [Sq.Rt.(Ts + 460) / (Ms \times P(stack))]$ ..... = 37.59 ft/sec

$Qs = vs \times As \times 60$ ..... = 12,595 acf/min

$Qs(std) = Qs \times (1-Bws) \times ((Tstd + 460)/(Ts + 460)) \times (P(stack)/29.92)$ ..... = 9,598 dscf/min

$I = (Ts+460) \times [(0.002669 \times Vlc) + (Vm(std) / (T(std) + 460) / 29.92] \times 100 / [Time \times P(stack) \times An \times vs \times 60]$ ..... =

GENERAL DATA

DATA FILE NAME: SOLNC5S0

Company : SOLITE / AQUADALE, N.C.
Source/Unit : NO.5 SCRUBBER INLET
Date : NAY 16 1991
Oxygen Corr.: 3.0 percent
F-Factor : dscf/MMBtu
Std. Temp. : 68 dF

PRINT_MENU — Place a 1 next to the pages to be printed, then select PRINT from program menu.

INPUT	1	Data Input.
SUMMARY	1	SO2 Calculations & Summary Page.

FIELD DATA	RUN 1A	RUN 1B	RUN 2A	RUN 2B	RUN 3A	RUN 3B
Meter Temp., Tm (dF)	91.70	0.00	100.40	0.00	95.00	0.00
Stack Temp., Ts (dF)	531.0	0.0	569.0	0.0	528.0	0.0
dH (in. H20)	1.54	1.54	1.83	1.83	1.83	1.83
Meter Vol.,Vm (ft3) 46.065		0.000	47.490	0.000	47.663	0.000
Meter Y	0.991	0.991	0.991	0.991	0.991	0.991
Bar. Press.,Pb (in.Hg.)	29.87	29.87	29.87	29.87	29.87	29.87
Static Press.,Ps (in.H20) ..	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22
Test Time (min.)	60.0	60.0	60.0	60.0	60.0	60.0
Oxygen, 02 (%)	11.95	11.95	10.85	10.85	12.15	12.15
Carbon Dioxide, C02 (%)	8.85	8.85	8.05	8.05	7.55	7.55
Carbon Monoxide, CO (%)	0.00	0.00	0.00	0.00	0.00	0.00
Gas Flow Rate, dscfm	10105	0	9687	0	9598	0

LABORATORY RESULTS	RUN 1A	RUN 1B	RUN 2A	RUN 2B	RUN 3A	RUN 3B
Sample Volume, ml	1000	0	1000	0	1000	0
Sample Aliquot, ml	2	0	2	0	2	0
Volume of Titer, ml	12.20	0.00	12.70	0.00	12.25	0.00
Volume of Titer Blank, ml ..	0.20	0.00	0.20	0.00	0.20	0.00

Barium Perchlorate
Normality :

0.00960

SO_2 Emission Calculations

Method 19, 40 CFR 60, Appendix A

"F" Factor

$C_{SO_2} = 9.29 \times 10^{-5}$ lb/dscf (Table 2)

"F" = 9780 dscf/MMBTU

$O_2 = 11.33\%$ (Table 1)

$$E_{SO_2} = \left(9780 \frac{ft^3}{MMBTU}\right)\left(9.29 \times 10^{-5} \frac{lb}{ft^3}\right)\left(\frac{20.9}{20.9 - 11.33}\right)$$

$$= 1.98 \text{ lb } SO_2/MMBTU$$

SO_2 Mass Emission Rate and Measured Heat Input

$C_{SO_2} = 9.29 \times 10^{-5}$ lb/dscf (Table 2)

$Q = 9797$ dscfm (Table 1)

Heat Input = 34.8 MMBTU/hr (Appendix)

$$E_{SO_2} = \left(9797 \frac{ft^3}{min}\right)\left(60 \frac{min}{hr}\right)\left(9.29 \times 10^{-5} \frac{lb}{ft^3}\right)\left(1/34.8 \text{ MMBTU/hr}\right)$$

$$= 1.57 \text{ lb } SO_2/MMBTU$$

FIELD AND LABORATORY DATA SHEETS

KOOGLER & ASSOCIATES

KOOGLER & ASSOCIATES, *Environmental Services*

4014 N.W. 13th Street • Gainesville, Florida 32609 • 904/377-5822

SOURCE SAMPLING FIELD DATA SHEET

Plant Solite N.C. / Carolina Sour
Sampling Location #5 Kiln Inlet
Type of Control Scrubber
Type of Samples SO_2
Date 5-16-91 Run No. 1
Time Start 1141 Time End 1241
Sample Time 5 min/pt 60 Total min
DB ___ °F, WB ___ °F, VP @ DP ___ "Hg
Bar. Press. 29.77 "Hg, Stack Press. ___ "Hg
Moisture ___ %, FDA ___, Gas Density Factor ___
Temp. 79 °F, W/D S, W/S 1-5
Weather Clear Thermocouple Readout KA-3
Sample Box No. KA-2 Meter Box No. KA-2
Meter ΔH@ 1.546 Pitot Corr. Factor /
Nozzle Dia. / in., Probe Length 4 ft
Probe Heater Setting 40 Nomograph C_f AH
Stack Dimensions 34 in
Stack Area 6.31 ft^2
Effective Stack Area 6.31 ft^2
Stack Height 6.31 ft

Y = .991
ΔH = 1.548

Stack Dimensions

Umbilical Cord /
Thermocouple Probe No. KA-12
Pitot Tube No. /

Mat'l Processing Rate ___
Final Gas Meter Reading 490.126 ft^3 (46.065)
Initial Gas Meter Reading 444.061 ft^3
Condensate Increase in Impingers 52 ml (78)
Moisture in Silica Gel 26 gm
Silica Gel Container No. 5 Filter No. ___

46065 purge 5 min 15 min ΔH max

Orsat: %CO_2 ___ %O_2 ___ %CO ___ %N_2 ___

Test Conducted By: Steve Ball

Stack Test Observers: Michael Landis

Leak Check Meter Box
Initial 0.005 cfm @ 14 In H_2
Final 0.002 cfm @ 4 In Hg

Pitot Tubes
Impact 3 In H_2O for 15 sec. Stable, Leak
Static 3 In H_2O for 15 sec. Stable, Leak

Port and Traverse Point No.	Distance From Inside Stack Wall (in.)	Clock Time	Gas Meter Reading (ft^3)	Stack Velocity Head ("H_2O)	Meter Orifice Press. Diff. ("H_2O) Calc.	Meter Orifice Press. Diff. ("H_2O) Actual	Stack Gas Temp. (°F) 533 531	Sample Box Temp. (°F)	Last Imp. Temp. (°F)	Meter Temp. (°F) 967	Vacuum on Sample Train ("Hg)
1			444.0		1.54	1.54	533		69	87	2
2			47.7				521		55	87	2
3			51.4				529		56	89	2
4			55.2				528		57	90	3
5			59.1				529		60	91	3
6			62.9				531		60	92	3
7			66.7				531		62	93	3
8			70.5				535		63	93	4

KOOGLER & ASSOCIATES

Port and Traverse Point No.	Distance From Inside Stack Wall (in.)	Clock Time	Gas Meter Reading (ft^3)	Stack Velocity Head ($"H_2O$)	Meter Orifice Press. Diff. ($"H_2O$)		Stack Gas Temp. (°F)	Sample Box Temp (°F)	Last Imp. Temp. (°F)	Meter Temp. (°F)	Vacuum on Sample Train ("Hg)
					Calc.	Actual					
9			74.2		1.54	1.54	533		64	94	4
10			78.3				537		65	94	4
11			82.3				540		65	95	4
12			86.2				549		66	95	4

46.065

533

KOOGLER & ASSOCIATES

KOOGLER & ASSOCIATES, *Environmental Services*
4014 N.W. 13th Street • Gainesville, Florida 32609 • 904/377-5822

SOURCE SAMPLING FIELD DATA SHEET

Plant: Solite N.C. / Chandler Source
Sampling Location: #5 Kiln inlet
Type of Control: Scrubber
Type of Samples: SO_2
Date: 5-16 Run No.: 2
Time Start: ~~2091~~ 1409 Time End: 15:29
Sample Time: 5 min/pt 60 Total min
DB ___ °F, WB ___ °F, VP @ DP ___ "Hg
Bar. Press. 29.86 "Hg, Stack Press. ___ "Hg
Moisture ___ %, FDA ___, Gas Density Factor ___
Temp. 80 °F, W/D SE, W/S 1-5
Weather: Partly Cloudy Thermocouple Readout: KA-3
Sample Box No.: ___ Meter Box No.: KA-2
Meter ΔH@: 1.548 Pitot Corr. Factor: ___
Nozzle Dia.: / in., Probe Length: 4 glass ft
Probe Heater Setting: 29 Nomograph C_f: NA
Stack Dimensions: 34 in
Stack Area: 6.31 ft^2
Effective Stack Area: 6.31 ft^2
Stack Height: 6.31 ft

DH = 1.548
Y = .991

Stack Dimensions

Umbilical Cord: /
Thermocouple Probe No.: KA-12
Pitot Tube No.: ___

Mat'l Processing Rate: ___ 47.49
Final Gas Meter Reading: 550.092 ft^3
Initial Gas Meter Reading: 502.602 ft^3
Condensate Increase in Impingers: 44 ml (65)
Moisture in Silica Gel: 21 gm
Silica Gel Container No.: 30 Filter No.: ___

purge sample 15 min no meter off

Orsat:				
$\%CO_2$				
$\%O_2$				
$\%CO$				
$\%N_2$				

Test Conducted By: Steve Bell
Stack Test Observers: ___

Leak Check Meter Box: Initial 0.009 cfm @ 15 In H_2 / Final 0.002 cfm @ ~~8~~ 3 In Hg
Pitot Tubes: Impact 3 In H_2O for 15 sec. Stable, Leak / Static 3 In H_2O for 15 sec. Stable, Leak

Port and Traverse Point No.	Distance From Inside Stack Wall (in.)	Clock Time	Gas Meter Reading (ft^3)	Stack Velocity Head ("H_2O)	Meter Orifice Press. Diff. ("H_2O) Calc.	Meter Orifice Press. Diff. ("H_2O) Actual	Stack Gas Temp. (°F)	Sample Box Temp. (°F)	Last Imp. Temp. (°F)	Meter Temp. (°F)	Vacuum on Sample Train ("Hg)
							568			100.4	
1			2.6		1.54	1.54	563		64	98	2
2			6.5		1.54	1.54	562		50	98	2
3			10.5				566		51	99	2
4			14.4				563		50	100	2
5			16.3				567		57	100	2
6			22.2				571		53	110	2
7			26.2				573		53	101	2
8			30.2				572		54	101	2

1421 stopped 1221 started 14:40

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Port and Traverse Point No.	Distance From Inside Stack Wall (in.)	Clock Time	Gas Meter Reading (ft^3)	Stack Velocity Head ("H_2O)	Meter Orifice Press. Diff. ("H_2O)		Stack Gas Temp. (°F)	Sample Box Temp (°F)	Last Imp. Temp. (°F)	Meter Temp. (°F)	Vacuum on Sample Train ("Hg)
					Calc.	Actual					
9			34.2		1.54	1.54	572		53	101	3
10			38.3		"	"	574		52	102	3
11			42.2		"	"	573		54	102	3
12			46.2		"	"	573		55	103	3

KOOGLER & ASSOCIATES

KOOGLER & ASSOCIATES, Environmental Services
4014 N.W. 13th Street • Gainesville, Florida 32609 • 904/377-5822

SOURCE SAMPLING FIELD DATA SHEET

Plant Solite NC / Chromium Solite
Sampling Location #5 Kiln Inlet
Type of Control Scrubber
Type of Samples SO_2
Date 5-16-91 Run No. 3
Time Start 16:51 Time End 17:51
Sample Time 5 min/pt 60 Total min
DB ___ °F, WB ___ °F, VP @ DP ___ "Hg
Bar. Press. ~~29.80~~ 29.57 "Hg, Stack Press. ___ "Hg
Moisture ___ %, FDA ___, Gas Density Factor ___
Temp. 85 °F, W/D SE, W/S 1-5
Weather Rain / Cool Thermocouple Readout KA-3
Sample Box No: KA-2 Meter Box No. KA-2
Meter ΔH@ 1.548 Pitot Corr. Factor /
Nozzle Dia. / in., Probe Length 4 ~~ft~~
Probe Heater Setting Lo Nomograph C_p ΔH 1.548
Stack Dimensions 34 in
Stack Area 6.31 ft^2
Effective Stack Area 6.31 ft^2
Stack Height 6.31 ft

Y = .991
ΔH = 1.548

Stack Dimensions

Umbilical Cord /
Thermocouple Probe No. KA-12
Pitot Tube No. /

Mat'l Processing Rate ___
Final Gas Meter Reading 610.215 ft^3
Initial Gas Meter Reading 562.552 ft^3
Condensate Increase in Impingers 33 ml
Moisture in Silica Gel 24 gm
Silica Gel Container No. 34 Filter No. ___

47,663
15 min purge AT ΔH

Orsat: %CO_2 ___
%O_2 ___
%CO ___
%N_2 ___

Test Conducted By: Steve Bell

Stack Test Observers: ___

Leak Check Meter Box
Initial 0.009 cfm @ 14 In H_2
Final 0.001 cfm @ 3 In Hg

Pitot Tubes –
Impact 3 In H_2O for 15 sec. Stable, Leak
Static 3 In H_2O for 15 sec. Stable, Leak

Port and Traverse Point No.	Distance From Inside Stack Wall (in.)	Clock Time	Gas Meter Reading (ft^3)	Stack Velocity Head ("H_2O)	Meter Orifice Press. Diff. ("H_2O) Calc.	Meter Orifice Press. Diff. ("H_2O) Actual	Stack Gas Temp. (°F)	Sample Box Temp. (°F)	Last Imp. Temp. (°F)	Meter Temp. (°F)	Vacuum on Sample Train ("Hg)
							562			95	
1			~~620~~		1.54	1.54	~~528~~ 556		64	97	2
2			~~66.3~~				557		61	97	2
3			70.4				560		63	96	2
4			74.3				561		64	96	2
5			~~78.5~~				562		67	95	2
6			82.3				560		67	95	2
7			86.3				564		66	94	2
8			90.3				~~565~~		67	94	2

KOOGLER & ASSOCIATES

Port and Traverse Point No.	Distance From Inside Stack Wall (in.)	Clock Time	Gas Meter Reading (ft^3)	Stack Velocity Head ("H_2O)	Meter Orifice Press. Diff. ("H_2O)		Stack Gas Temp. (°F)	Sample Box Temp (°F)	Last Imp. Temp. (°F)	Meter Temp. (°F)	Vacuum on Sample Train ("Hg)
					Calc.	Actual					
9			94.3		1.54	1.54	564		66	94	3
10			96.3				563		65	94	3
11			602.3				563		66	94	3
12			606.3				560		65	94	3

KOOGLER & ASSOCIATES

CHAIN OF CUSTODY RECORD

Project Number: 150-91-01

Project Name: Carolina Solite

Sample Location: #5 Kiln Inlet

Sample Identification	Remarks
Silica Gell #5	Run #1
" " #30	Run #2
" " #34	Run #3
Run 1 - 2,3 Imp. Catch	+ Wash
Run 2 - 2,3 Imp. Catch	"
Run 3 - 2,3 Imp. Catch	"

Sampled By: (Signature) Steph Bell Date: 5-17-91 Time: 1100

Relinquished By: (Sign) Steph Bell Date: 5-17-91 Time: 1200

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

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

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

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

Received By Lab: (Sign) RC Paul Date: 5-17-91 Time: 1700

Sample Shipped VIA: ______ UPS ______ Fed Express ______ Bus

Shipping Bill Number: ______

KOOGLER & ASSOCIATES

SO_2
LAB DATA

Plant Name Solite Aquadale Date Analyzed 5-20-91

Analyzed By RC Paul

Stack	Sample No.	V.T.	V.T.B.	N.	V.Soln.	V.A.
#5 bith	1-1	12.2	0.2	0.0096	1000	2
scrubber	2	12.2				5
outlet						
	2-1	12.6				2
	2	12.8				5
	3-1	12.2				2
	2	12.3				5

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)

PLANT INFORMATION

KOOGLER & ASSOCIATES

Post-it™ brand fax transmittal memo 7671 | # of pages ▸ 1

To RODNEY PAUL	From STEVE HOLT
Co. KOOGLER & A.	Co. CSC
Dept.	Phone #
Fax #	Fax #

#5 KILN COMP. TEST

COAL USAGE

966 LOADER EMPTY WGHT = 37920 LB

966 LOADER LOADED WGHT = 43,120 LB
" " " " = 43,300 LB
" " " " = 42,940 LB

TOTAL GROSS WGHT = 129,360 LB

TOTAL EMPTY WGHT = 113,760 LB

TOTAL NET WGHT = 15,600 LB

COAL BIN FULL - 11:15AM

COAL BIN REFILLED 5:15 PM

TOTAL RUN TIME = 6:00 HR

$$\frac{15,600\ LB}{6.00\ hr} \times \frac{1\ Ton}{2000\ LB} = 1.3\ Tons/hr$$

1.3 Tons/hr × 26,794,000 BTU/TON = 34,832,200 BTU

EQUIPMENT CALIBRATIONS

PITOT TUBE CALIBRATION MEASUREMENTS

PITOT TUBE IDENTIFICATION NO. KA-SI

DATE CALIBRATED 8-9-90

PITOT TUBE ASSEMBLY LEVEL ? ✓ YES _____ NO

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

α_1= 2.0 ° (<10°) α_2= 1.5 ° (<10°)

β_1= 2.5 ° (<5°) β_2= 2.0 ° (<5°)

Y= 2.5 °, θ= 1.0 °, A= 0.928 IN. = (PA+PB)

Z = A SIN Y = 0.0405 IN. (<0.125 IN.)

W = A SIN θ = 0.0162 IN. (<0.031 IN.)

P_A 0.465 IN. P_b 0.463 IN.

D_t 0.374 IN. (≥ 0.1875 IN. ≤ 0.3750 IN.)

COMMENTS: _____

CALIBRATION REQUIRED? _____ YES ✓ NO

CALIBRATED BY: RC Paul

PTCMFORM 1/8/87

KOOGLER & ASSOCIATES

POST TEST THERMOCOUPLE
CALIBRATION

DATE 5-17-91

PLANT NAME Coming Source

LOCATION "

SOURCE #5 Kiln Inlet

Thermocouple Readout # KA-3

Umbilical Cord # N/A not used

Switch Box # N/A not used

Thermocouple # KA-12

Average Stack Temperature °F 542.6

*Observed Mercury in Glass (ASTM) °F 545

Observed Thermocouple Reading °F 546

Percent Difference $\frac{(ASTM + 460) - (Thermo + 460)}{(ASTM + 460)} \times 100 =$ .099

Tolerance ≤ 1.5%

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

Stephen Bell
Signature

KOOGLER & ASSOCIATES

KOOGLER & ASSOCIATES, ENVIRONMENTAL SERVICES
ANNUAL THERMOCOUPLE CALIBRATIONS

Umbilical Cord No. 100 FT TC No. 63	BOX 1						BOX 2					
	STACK		BOX		IMP		STACK		BOX		IMP	
	TC[1]	ASTM[1]	TC	ASTM	TC	ASTM	TC	ASTM	TC	ASTM	TC	ASTM
Ice Bath	32	32	32	32	33	32	32	32	33	32	33	32
Ambient	83	84	82	84	83	84	81	84	81	84	82	84
212°	211	212	210	212	211	212	211	212	210	212	211	212
400°	412	414	413	414	413	413	413	414	414	414	413	414

Thermocouple Readout No. KA-1	UMBILICAL CORD NO. 100 FT						UMBILICAL CORD NO. 200 FT					
	STACK		BOX		IMP		STACK		BOX		IMP	
	TC	ASTM	TC	ASTM	TC	ASTM	TC	ASTM	TC	ASTM	TC	ASTM
Ice Bath	32	32	33	32	32	32	32	32	33	32	32	32
Ambient	83	84	82	84	83	84	84	84	83	84	83	84
212°	211	212	212	212	211	212	211	212	211	212	210	212
400°	413	414	414	414	414	414	412	413	413	414	414	414

Thermocouple Probe No.	TEMPERATURE							
	ICE BATH		AMBIENT		212°		400°	
	TC	ASTM	TC	ASTM	TC	ASTM	TC	ASTM
61	32	32	84	84	211	212	409	409
62	32	32	84	84	211	212	410	412
63	32	32	84	84	211	212	412	414
64	33	32	82	84	210	212	413	414
126	32	32	83	84	212	212	404	407
50	33	32	82	84	211	212	404	406
90	33	32	82	84	211	212	401	402
70	32	32	81	84	210	212	404	406
108	33	32	83	84	210	212	400	401

[1] Thermocouple reading (°F)
[2] American Society of Testing Materials Mercury in glass thermometer (°F)

Signature Stephen Bell
Date 9-28-90

POST-TEST DRY GAS METER CALIBRATION FORM

Date: May 20-91 Meter Box No.: KA-2 Plant: Carolina Solite

Barometric Pressure, P_b = 30.04 In Hg Test Meter No.: KA-1 Pretest Y: 0.991

Orifice Manometer Setting, (ΔH) In. H_2O	Gas Volume		Dry Gas Meter Temperature				Time (θ), Min.	Vacuum Setting In. Hg.	Y_i	$\frac{Y_T P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6})(t_T + 460)}$
	Test Meter (V_{T_3}), Ft.	Dry Gas Meter (V_{d_3}), Ft.	Test Meter (t_T), °F	Inlet (t_{d_i}), °F	Outlet (t_{d_o}), °F	Average (t_d), a °F				
1.55	7.633	7887	82			82	10	4	0.964	
1.55	7.641	7896	82			83	10	4	0.966	
1.55	7.638	7888	82			83	10	4	0.967	
									0.9667	

[a] If there is only one thermometer on the day gas meter, record the temperature under t_d

where:

Y_T = Gas volume passing through the test meter, ft^3.

V_d = Gas volume passing through the dry gas meter, ft^3.

t_T = Temperature of the gas in the test meter, °F.

t_{d_i} = Temperature of the inlet gas of the dry gas meter, °F.

t_{d_o} = Temperature of the outlet gas of the dry gas meter, °F.

t_d = Average temperature of the gas in the dry gas meter, obtained by the average of t_{d_i} and t_{d_o}, °F.

ΔH = Pressure differential across orifice, In. H_2O

Y_i = Ratio of accuracy 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 Y $\pm$0.05Y.

P_b = Barometric pressure, In. Hg.

θ = Time of calibration run, min.

KODGLER & ASSOCIATES

METER CALIBRATION FORM

GAS METER METHOD

DATE: 5-14-91

METER BOX NO: KA-2

BAROMETRIC PRESSURE: 30.04

TEST Δ HD	ORIFICE Δ HD	TEST GAS METER VOLUME			DRY GAS METER VOLUME			TEMP OF TEST METER °F	TEMP OF DRY METER °F	RUN TIME MINUTES
		FINAL	INITIAL	ACTUAL FT^3	FINAL	INITIAL	ACTUAL FT^3			
-0.24	0.5	97,225	91,236	5.989	28,346	22,351	5,995	80	80	14.0
-0.24	1.0	603,335	597,225	6.110	34,492	28,346	6146	81	80	10.0
-0.25	1.6	83,370	73,328	10,043	14,448	4,407	10,041	79	78	13.0
-0.28	2.5	12,006	3,335	~~8,671~~ ~~43,241~~	~~43,241~~ ~~34,492~~	34,492 &	8,749	81	80	9.0
-0.32	3.5	91,236	83,370	7866	22,351	14,448	7,903	80	79	7.0

GAS METER THERMOMETER CALIBRATION

N.B.S. MERCURY °F	METER BOX °F
32	32
48	50
75	74
85	86
105	106

SIGNATURE: Rodney C Paul

DRY GAS METER AND ORIFICE CALIBRATION

CONTROL BOX NO. KA-2 BAROMETRIC PRESS. 30.04 IN. HG.

DATE 05/14/91 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)	-0.24	-0.24	-0.25	-0.28	-0.32
dHd ("H2O)	0.50	1.00	1.60	2.50	3.50
INITIAL WTM	591.236	597.225	573.328	603.335	583.370
FINAL WTM	597.225	603.335	583.370	612.006	591.236
INITIAL DGM	422.35	428.35	404.41	434.49	414.45
FINAL DGM	428.35	434.49	414.45	443.24	422.35
TEMP. WTM (F)	80.00	81.00	79.00	81.00	80.00
TEMP. DGM (F)	80.00	80.00	78.00	80.00	79.00
TEST TIME (MIN.)	14.00	10.00	13.00	9.00	7.00
**********	**********	**********	**********	**********	**********
NET VOLUME WTM	5.989	6.110	10.042	8.671	7.866
NET VOLUME DGM	5.995	6.146	10.041	8.749	7.903
Y	0.998	0.990	0.995	0.984	0.986
dH@	1.557	1.532	1.528	1.540	1.582
**********	**********	**********	**********	**********	**********

AVERAGE Y = 0.991

ACCEPTABLE Y RANGE = 0.971 TO 1.011

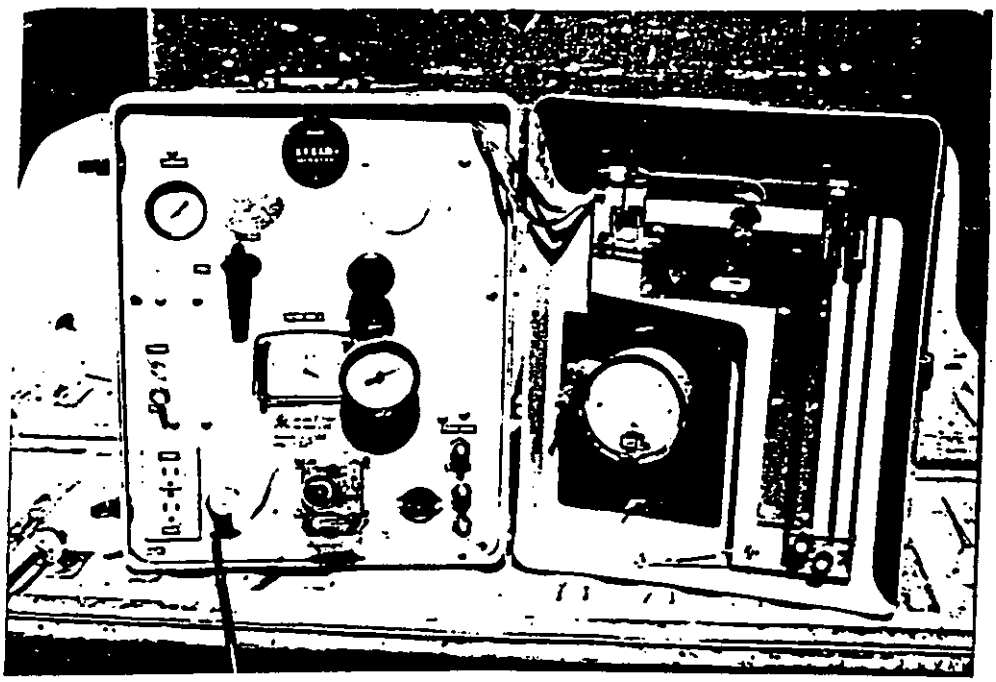
AVERAGE dH@ = 1.548

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

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

KOOGLER & ASSOCIATES
ENVIRONMENTAL SERVICES

SOURCE SAMPLING EQUIPMENT



METER BOX

Equipment used in Source Sampling is either manufactured by or assembled by Koogler & Associates. The guidelines followed are A.P.T.D. 0581, Details of Isokinetic Source Sampling Equipment, and A.P.T.D. 0576, Maintenance, Calibration and Operation of Isokinetic Source Sampling Equipment.

KOOGLER & ASSOCIATES

PROJECT PARTICIPANTS

KOOGLER & ASSOCIATES

PROJECT PARTICIPANTS

Koogler & Associates

John B. Koogler, Ph.D., P.E.	Project Advisor
Rodney C. Paul	Project Supervisor
Stephen Bell	Field Test Crew

Carolina Solite

Steven Holt

North Carolina Department of Environmental Management

Mike Landis

KOOGLER & ASSOCIATES

Branch Code 30

Lab. No. 251432

Date Rec'd 5/14/91

Date Sampled 5/14/91

Sampled By SL PERSONNEL

STANDARD LABORATORIES, INC.

JUN 4 1991

AIR QUALITY PERMITS

SAMPLE ID: AREA 1 STOCKPILE COAL

CAROLINA SOLITE
P.O. BOX 987
ALBEMARLE, NC 28002
ATTN: STEVE HOLT

pile

ULTIMATE ANALYSIS OF COAL	% DRY BASIS
ASH	6.20
HYDROGEN	4.86
CARBON	77.14
NITROGEN	1.62
SULFUR	0.87
OXYGEN	9.31

Respectfully Submitted, Susan Barkley

Branch Code 30

Lab. No. 252192-195

Date Rec'd 5/23/91

Date Sampled 5/23/91

Sampled By SL PERSONNEL

STANDARD LABORATORIES, INC.

SAMPLE ID: STOP BELT SAMPLE
5/21-22/91
SEE BELOW

CAROLINA SOLITE
P.O. BOX 987
ALBEMARLE, NC 28002
ATTN: STEVE HOLT

LAB NO.	SAMPLE ID:	SULFUR, % DRY BASIS
252192	KILN #5	0.24
252193	KILN #6	0.29
252194	KILN #7	0.32
252195	KILN #8	0.29

Respectfully Submitted,

P.O. BOX 987 • ALBEMARLE, NORTH CAROLINA 28002 • PHONE (704) 474-4165

FEDERAL EXPRESS
OBTAIN DELIVERY SIGNATURE

June 3, 1991

George T. Everett, Ph.D.
Director
State of North Carolina
Department of Environment, Health,
and Natural Resources
Division of Environmental Management
512 North Salisbury Street
Raleigh, North Carolina 27604

Subject: Renewal of Air Permit No. 3225R5
Carolina Solite Corporation
Norwood, North Carolina
Stanly County

Dear Dr. Everett:

On May 2, 1991 Carolina Solite Corporation (CSC) agreed to implement the operating conditions as specified in your April 22, 1991, Notice of Intent to Deny Renewal of Air Permit No. 3225R5.

In response to condition b CSC retested Kilns numbered 7, 5, and 8 to assure compliance with 15A NCAC 2D .0516 on May 13, 16, and 20th, 1991, respectively. Five copies of the results of the emissions tests conducted on the subject Kilns are enclosed.

Representative samples of the coal used during all the tests were collected and analyzed by Standard Laboratories, Inc. Five copies of the analysis are enclosed. The coal sampling was conducted as specified in 15A NCAC .0500. In addition to sulfur, a complete ultimate analysis was performed.

Representative samples of the raw materials from each of the three silos feeding the four kilns were retrieved again on May 23, 1991 using the "Stopped Belt Method". This sampling was performed in order to comply with condition b of the operating conditions. The results of the raw material sampling document that the coal and raw materials contained no more than 1.45% sulfur combined by weight during the tests.

The enclosed tests for Kilns numbered 7, 5, and 8 clearly indicate that compliance was demonstrated under 15A NCAC 2D .0516. Additionally, the scrubber sulfur dioxide removal efficiencies can be determined since all scrubber inlets were tested.

This letter and the enclosures complete Carolina Solites' acceptance, implementation, and compliance demonstrations as required by the DEM operating conditions specified in the letter dated April 22, 1991 from Dr. George Everett addressed to Mr. Steve Holt of this office.

Additionally, this letter and the enclosures complete all requested additional information for both the renewal and requested modifications to Air Quality permit no. 3225R5. Accordingly, we request that you please notify Carolina Solite of a projected date for the potential issuance of said permit and modifications.

Sincerely,

James F. Colburn

James F. Colburn
Plant Manager

Enclosure

cc: W/O Enclosure:
Jerry Clayton
Lee Daniel
Laura Butler
Earl McCune
Brenda Smith (MRO)

REF. 8 (AD-42)
REF. 4-6

Emission Test Report
Review Checklist

Reviewer: Brian Shrager
Review Date: 4/3/92

A. Background Information

1. Facility name: Carolina Solite Corporation (2 reports)
   Location: Aquadale, North Carolina
2. Source category: Lightweight aggregate production
3. Test date: May 16, 1991
4. Test sponsor: Carolina Solite Corporation
5. Testing contractor: Koogler & Associates Environmental Services
6. Purpose of test: To determine the uncontrolled SO_2 emission rate from the kiln, and to demonstrate compliance with the SO_2 emission limiting standard of the air permit for the kiln.
7. Pollutants measured

   PM PM-10 CO (SO2) NO_x VOC Pb CO_2

   Others (list): _____

8. Process overview: On an attached page provide a block diagram of the unit operations and associated air pollution control systems at the facility. Identify process tested with letters from the beginning of the alphabet (A, B, C, etc.) and APC systems with letters from end of alphabet (V, W, X, etc.). Also identify test locations with Arabic numerals (1,2,3, ...). Using the ID symbols from that sketch complete the table below that identifies processes or unit operations tested.

Test ID	Process	Process ID	Emissions tested		APCD (controlled emissions only)
			Uncontrolled	Controlled	
1	Kiln (Scrubber Inlet)	A	✓		
2	Kiln (Scrubber Outlet)	B		✓	Scrubber
	(Kiln fired w/ coal)				

B. Process Information

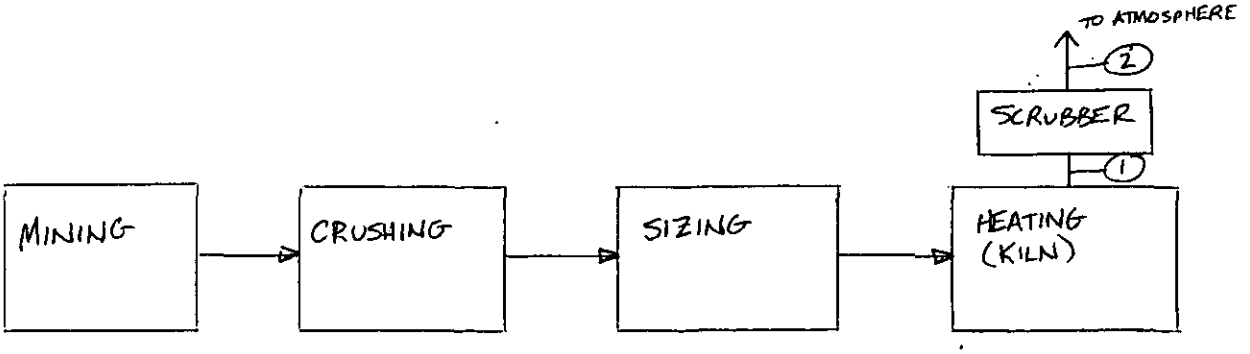
1. Provide a brief narrative description of the process. With as much detail as possible, (e.g., if a furnace or conveyor system is used, identify the type of unit) describe the equipment used for those operations tested. (Note: If process description provided in test report is adequate, attach copy or reproduce here.)

2.0 PROCESS DESCRIPTION

Shale is quarried on site and hauled to the lightweight aggregate production facility. The shale is crushed to size and fed to rotary kilns where it is calcined to produce lightweight aggregate. As the shale is heated, it expands approximately doubling in volume. The lightweight aggregate is then discharged from the kiln, cooled and sized. The resulting product is a strong lightweight aggregate used in the construction industry.

During the test period of May 16, 1991, Kiln No. 5 was fired with coal at the rate of 1.3 tons per hour. The heating value of the coal averaged 13,397 BTU per pound resulting in a heat input to Kiln No. 5 of 34.8 MMBTU per hour; or 4.35 MMBTU per ton of product (at a lightweight production rate of 8.0 tons per hour). The data sheets used for determining the coal feed rate to the kiln are included in the Appendix of this report.

The gas stream leaving the kiln passes through a scrubber system and is discharged to the atmosphere through a 32-inch diameter stack at a height of approximately 90 feet above grade.



2. For each process tested list feedstock materials and products. Indicate if activity factors are for feed (F) rate or product (P) rate.

Process ID	Feedstock materials	Products	Basis for activity factor	F/P
A	SHALE	Lightweight Agg.	Lightweight Agg	P
B	SHALE	Lightweight Agg.	Lightweight Agg	P

Basis for data: _____
(Indicate page/table Nos. in test report)

3. For each process or operation tested and each test run note process capacity and operating rate during test.

Process ID	Capacity	Units	Test run	Process rate	Units
A			1	8.0	TONS/HR
			2	1.3	TONS/HR (COAL) FEED
			3		
			4		
B			1	8.0	TONS/HR
			2		
			3		
			4		
			1		
			2		
			3		
			4		
			1		
			2		
			3		
			4		

Basis for data: Pg 1 - Paragraph 4

C. Air Pollution Control Systems Tested

1. For each air pollution control system pollution control system identified in A.8, note the following

ID	Type of APCD	Manufacturer	Model No.
2	Scrubber		

Note: Be as specific as possible in identifying APCD. For example, indicate "pulse jet fabric filter" rather than simply "fabric filter."

2. For each system identified above, provide a narrative description. For fugitive systems describe capture techniques as well as the removal techniques (use a separate page if necessary)

3. Using the attached parameter list for guidance complete the table below. (Use additional pages as needed.)

APCD ID	Parameter	Units	Readings			
			Run 1	Run 2	Run 3	Run 4
Z						
Type of APCD: SCRUBBER						
Type of APCD:						
Type of APCD:						

D. Sampling and Analysis Methods

1. Complete the following table

Test location	Pollutant	S & A method	Reference/ conditional method	Deviations noted
ALL	SO_2	Method 8	(Y)/N	Y/(N)
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N
			Y/N	Y/N

2. If a method used was not a reference or conditional method, provide a narrative discussion including any data manipulation needed to make results correspond to reference or conditional method results.

3. Describe any deviations identified above.

E. Emission Data Documentation

1. Tabulate the following stack gas data from the test report. (Use additional pages as needed.)

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg. F	127.3	128.0	129.3	
	Moisture	%	14.0	14.4	14.8	
	Oxygen	%	10.6	11.2	12.2	
	Volumetric flow, actual	ACFM	13,098	12,626	12,595	
	Volumetric flow, standard	SCFMD	10,105	9,687	9,598	
	Percent isokinetic					
	Pollutant concentration:					
	SO_2	LB/DSCF	9.29E-05	9.53E-05	9.06E-05	
2	Stack temperature	Deg. F	127.3	128.0	129.3	
	Moisture	%	14.0	14.4	14.8	
	Oxygen	%	10.6	11.2	12.2	
	Volumetric flow, actual	ACFM	13,098	12,626	12,595	
	Volumetric flow, standard	SCFMD	10,105	9687	9598	
	Percent isokinetic					
	Pollutant concentration:					
	SO_2	LB/DSCF	7.70E-05	8.84E-05	8.03E-05	
	Stack temperature					
	Moisture					
	Oxygen					
	Volumetric flow, actual					
	Volumetric flow, standard					
	Percent isokinetic					
	Pollutant concentration:					

2. Tabulate pollutant mass flux rates

Test ID	Pollutant	Units	Mass flux rates			
			Run 1	Run 2	Run 3	Run 4
1	SO_2	lb/hr	56.32	55.38	52.19	
2	SO_2	lb/hr	46.71	51.40	46.23	

3. Present example emission factor calculations below.

TEST 1

SO_2 $\frac{(56.32+55.38+52.19)}{3}$ lb/hr ÷ 8 tons/hr = 6.83 lb/ton

SO_2 EF's lb/ton produced

	RUN 1	RUN 2	RUN 3
Scrubber inlet			
SO_2	$\frac{56.32}{8} = 7.04$	$\frac{55.38}{8} = 6.92$	$\frac{52.19}{8} = 6.52$
scrubber outlet			
SO_2	$\frac{46.71}{8} = 5.84$	$\frac{51.40}{8} = 6.43$	$\frac{46.23}{8} = 5.78$

4. Tabulate emission factors

Process	Pollutant	Units	Average emission factor	
			Uncontrolled	Controlled
A	SO_2	lb/ton produced	6.83	
Kiln (scrubber inlet)				
B	SO_2	lb/ton produced		6.01
Kiln (scrubber outlet)				

ATTACHMENT A
APCD PARAMETERS

Type of APCD	Parameters
Fabric filter	Cleaning mechanism Bag type Cleaning frequency Air to cloth ratio (A/C) Pressure drop Inlet temperature
ESP	Type (wet or dry) Number of fields Rapping cycle (if dry) Specific Collection Area (SCA) Particulate resistivity (if known) Spark rate Current and power levels
Venturi (or other high energy) scrubber	Pressure drop Liquid/gas (L/G) ratio Mist eliminator type
Packed-bed scrubber	Packing depth L/G ratio Caustic use (Y/N) pH Mist eliminator type
Carbon absorber	Bed depth Superficial gas velocity Bed temperature Desorption mechanism (media) Flue-gas moisture Cycle length Time-on-line after breakthrough