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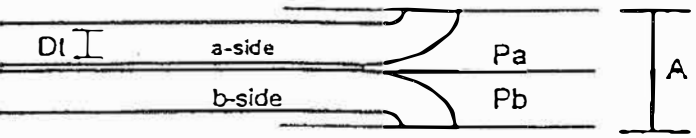
Final Report #2 Kiln
11/24/98

EMT Report Number 98-530
Compliance Lime Kiln Test Program for
ROCKWELL LIME COMPANY
Manitowoc, Wisconsin
Test Date: November 24, 1998
Report Date: December 31, 1998

Environmental Monitoring and Technologies, Inc.
Pitot Tube Inspection Data sheet

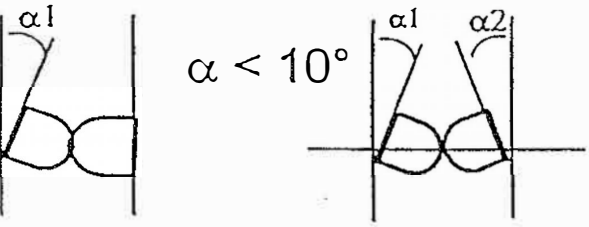
Probe/Pitot Number 96A

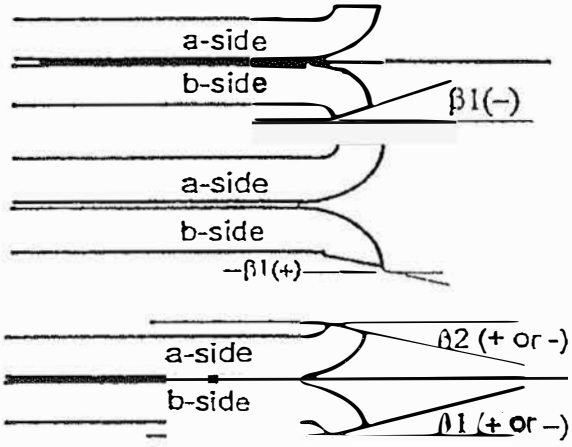
Date 4-22-99



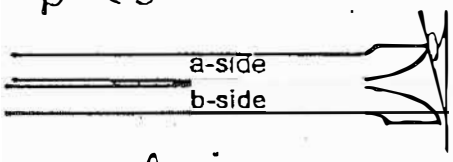
3/16 < Dt < 3/8

1.05 Dt < Pa < 1.50 Dt
1.05 Dt < Pb < 1.50 Dt
Pa = Pb

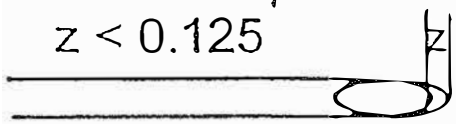




β < 5°



z = A sin γ
z < 0.125



w = A sin θ
w < 0.03125

Level ?	✓
Obstructions ?	N
Damaged ?	N
α_1 (< 10°)	✓
α_2 (< 10°)	✓
β_1 (< 5°)	✓
β_2 (< 5°)	✓
γ	<1°
θ	<1°
A	0.854
Dt	0.375
1.05Dt<Pa<1.50Dt	✓
1.05Dt<Pa<1.50Dt	✓
0.1875"<Dt<0.375"	✓
A sin γ < 0.125 "	✓
A sin θ < 0.03125 "	✓
PASS INSPECTION?	✓
per method 2,Cp = 0.84	✓

ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

8100 North Austin Avenue
Morton Grove, Illinois 60053-3203
847-967-6666
FAX: 847-967-6735

Groundwater Monitoring
Laboratory Services
Mobile Laboratory Services
Source Emissions

Waste Characterization (RCRA)
Wastewater Compliance Monitoring
• Pretreatment
• User Charge

FAX TRANSMISSION NOTICE

Date: 2-22-99

Time: 8:45 am

To: DON BRISCH

Company: ROCKWELL LIME

Fax Number: 920-682-7972

Sender: TEDDIE SCHMIDT

You should receive 5 *pages, including this notice. If you do not receive all pages, please call the sender immediately. This transmission includes:*

Comments: 4 REVISED PAGES WHICH WERE FAXED TO Jim CRAWFORD, FRI p.m. ONLY RUN 1 INVOLVED - CORRECTION TO TEMP. AVERAGE AFFECTED FLOWS, ISOKINETICS, LB/HR + LB/TON STONE FEED. SLIGHT UPWARD CHANGE. DNR SATISFIED WITH FAXED PAGES.

Our FAX Number is: (847) 967-6735

THIS MESSAGE IS INTENDED ONLY FOR THE USE OF THE INDIVIDUAL OR ENTITY TO WHICH IT IS ADDRESSED AND MAY CONTAIN INFORMATION THAT IS PRIVILEGED, CONFIDENTIAL AND EXEMPT FROM DISCLOSURE UNDER APPLICABLE LAW. IF THE READER OF THIS MESSAGE IS NOT THE INTENDED RECIPIENT, YOU ARE HEREBY NOTIFIED THAT ANY DISSEMINATION, DISTRIBUTION OR COPYING OF THIS COMMUNICATION IS STRICTLY PROHIBITED. IF YOU HAVE RECEIVED THIS COMMUNICATION IN ERROR, PLEASE NOTIFY US IMMEDIATELY, BY TELEPHONE, AND RETURN THE ORIGINAL MESSAGE TO US AT THE ABOVE ADDRESS VIA THE U.S. POSTAL SERVICE. THANK YOU.

SUMMARY TABLE #1 - LIME KILN EXHAUST RESULTS - REVISED

COMPANY: Rockwell Lime Company
LOCATION: Manitowoc, WI (Rockwood)
SOURCE: Lime Kiln Exhaust
TEST DATE: 11-24-98

TEST RUN	1	2	3	AVERAGE
GAS PARAMETERS				
Velocity (ft/sec)	37.2	38.5	39.5	38.4
Volume flow (acfm)	61286.4	63570.6	65084.7	63313.9
Volume flow (scfh, wb)	2469353.3	2402567.1	2468783.9	2446901.4
Volume flow (dscfh)	2331469.4	2278168.0	2332093.0	2313910.1
Temperature (deg. F)	322.7	374.4	371.4	356.2
Oxygen (%)	15.0	13.8	14.0	14.3
Carbon Dioxide (%)	13.5	13.0	13.0	13.2
Moisture (% by volume)	5.6	5.2	5.5	5.4
PARTICULATE SAMPLE				
Sample Volume (dscf)	32.647	47.430	48.203	
Isokinetic	90.1	99.4	98.7	
Mass Collected (mg)	113.3	58.5	52.0	
Concentration (gr/dscf)	0.05355	0.01903	0.01665	0.02974
Emission rate (lb/hr)	17.84	6.20	5.55	9.86
Emission Rate, lb/Ton Stone Feed	0.75	0.25	0.23	0.41
SO2 RESULTS				
SO2 conc (ppm)	379.7	369.7	394.5	381.3
Emission rate (lb/hr)	145.06	140.04	152.98	146.03
Emission rate (lb/MMBTU)	1.779	1.660	1.875	1.77
PROCESS DATA				
Heat Input (MMBtu/hr)	81.53	84.36	81.60	82.50
Stone Feed (Tons/hr)	23.73	24.6	24.47	24.27

OPACITY RESULTS

The Opacity CEM read "0" throughout the entire test period.
Strip chart attached to this report by Rockwell Lime Company, prior to submittal to WDNR.

Environmental Monitoring & Technologies, Inc.

SUMMARY TABLE #2 - PROCESS DATA / SUPPLEMENTARY RESULTS - REVISED

Company: Rockwell Lime Company
Location: Manitowoc, WI
Source: Lime Kiln Exhaust
Run #: 1-3
Date: 11-24-98

Manufacturing Data Compiled During EMT's Stack Test on #2 Kiln

Test Run	Time	Natural Gas (CF)	Coal/Coke Blend (Lbs)	Stone Feed (Tons)	Baghouse Pressure Differential Readings Across Each Compartment #1	#2	#3	#4	#5	#6	#7	#8
#1	1009 - 1109	19,900	4,949	23.73	2.6	2.4	2.4	2.4	2.5	2.3	2.5	2.5
#2	1203 - 1303	20,400	5,137	24.60	2.7	2.5	2.4	2.4	2.1	2.1	2.2	2.6
#3	1344 - 1444	20,400	4,914	24.47	2.1	2.2	2.2	2.2	2.0	2.1	2.2	2.2

Fuel Data	Natural Gas	Coal/Coke Blend
Btu Value / CF or Lb	1,012	12,404
% Sulfur / CF or LB	2.90E-05	1.99

Total Heat Input MMBTU/hr = ((Nat. Gas CF x BTU Value) + (Coal/Coke Blend Lbs x BTU Value)) ÷1e06

SO2 lb/MMBTU = SO2 lb/hr ÷ MMBTU/hr

Particulate lb/Ton Stone Feed = Particulate lb/hr ÷ Ton Stone Feed/hr

Test Run	Heat Input (MMBTU/hr)	SO2 (lb/hr)	**SO2 (lb/MMBTU)**	Stone Feed (Tons/hr)	Particulates (lb/hr)	**Particulates (lb/Ton Stone Feed)**
#1	81.53	145.06	**1.779**	23.73	17.84	**0.75**
#2	84.36	140.04	**1.660**	24.60	6.20	**0.25**
#3	81.60	152.98	**1.875**	24.47	5.55	**0.23**

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Environmental Monitoring & Technologies, Inc.

EPA Methods 2-5 Moisture, Flow & Particulate Calculation Summary

Company Rockwell Lime
Location Manitowoc, WI
Source Lime Kiln Baghouse Outlet
Run # 1
Date 11-24-98

Barometric (Pbar)	29.80	in.Hg	Static Pressure (Pg)	-0.21	in.H2O
Meter Y Factor (Y)	0.9969		Volume Measured (Vm)	33.750	cubic ft.
Stack Area (As)	27.494	sq. ft.	Square Root delta P	0.5532	in.H2O
Oxygen	15.0	%	Δ H	1.28	in.H2O
Carbon Dioxide	13.5	%	Gas Temperature (Ts)	322.7	°F
Impinger Condensate (Wi)	30	mL	Meter Temp. (Tm)	83.5	°F
Silica Gel Gain (Ws)	11	g	CPM Inorganic Mass (Mi)	52.7	mg
Front ½ Particulate (Mf)	49.6	mg	CPM Organic Mass (Mo)	11.0	mg
Run Time	60	minutes	Nozzle Diameter (Dn)	0.280	inches

GAS SAMPLE VOLUME, DRY STANDARD CONDITIONS (Vmstd)
17.64 x Vm x Y x (Pbar + ^H/13.6) x 1/Tm°R = 32.647 dscf

VOLUME OF WATER IN GAS SAMPLE, STANDARD CONDITIONS (Vwstd)
(Wi x 0.04707) + (Ws x 0.04715) = 1.931 scf

PROPORTIONAL MOISTURE CONTENT OF GAS BY VOLUME (Bws)
Vwstd / (Vmstd + Vwstd) = 0.056
= 5.6 % by volume

GAS MOLECULAR WEIGHT, DRY BASIS (Md)
(0.44 x CO2%)+(0.32 x O2%)+(0.28 x (100 - O2% - CO2%)) = 30.76 lb/lb-mole

GAS MOLECULAR WEIGHT, WET BASIS (Ms)
(Md x (1-Bws))+ (18 x Bws) = 30.05 lb/lb-mole

PITOT TUBE COEFFICIENT (Cp) = 0.84

ABSOLUTE GAS PRESSURE (Ps) Pbar + (Static Pressure/13.6) = 29.78 in. Hg

GAS VELOCITY (Vs)
85.49 x Cp x Square Root delta P x ((Ts°R/(Ps x Ms))^½) = 37.2 ft/sec.

GAS VOLUME FLOW RATE (acfm) Stack Area x Vs x 60 = 61286.4 acfm

GAS VOLUME FLOW RATE (scfm)
acfm x Tstd x Ps / (Ts°R x Pstd) = 41155.9 scfm

GAS VOLUME FLOW RATE (scfh) scfm x 60 = 2469353.3 scfh

GAS VOLUME FLOW RATE (dscfm)
(1-Bws) x acfm x Tstd x Ps / (Ts°R x Pstd) = 38857.8 dscfm

GAS VOLUME FLOW RATE (dscfh) dscfm x 60 = 2331469.4 dscfh

Environmental Monitoring & Technologies, Inc.

EPA Methods 2-5 Moisture, Flow & Particulate Calculation Summary

Company Rockwell Lime
Location Manitowoc, WI
Source Lime Kiln Baghouse Outlet
Run # 1
Date 11-24-98

GAS SAMPLE VOLUME, DRY STANDARD CONDITIONS (Vmstd)	=	32.647	dscf
PROPORTIONAL MOISTURE CONTENT OF GAS BY VOLUME (Bws)	=	0.056	
GAS VOLUME FLOW RATE, (dscfh)	=	2331469.4	dscfh
FRONT ½ PARTICULATE MASS, FILTER AND PROBE WASH (Mf)	=	49.6	mg
CONDENSIBLE PARTICULATE MATTER (CPM), INORGANIC MASS (Mi)	=	52.7	mg
CONDENSIBLE PARTICULATE MATTER (CPM), ORGANIC MASS (Mo)	=	11.0	mg
FRONT ½ PARTICULATE CONCENTRATION, (gr/dscf) Mf x 0.001g/mg x 1/Vmstd x 15.43 gr/g	=	0.0234	gr/dscf
INORGANIC CPM CONCENTRATION, (gr/dscf) Mi x 0.001g/mg x 1/Vmstd x 15.43 gr/g	=	0.0249	gr/dscf
ORGANIC CPM CONCENTRATION, (gr/dscf) Mo x 0.001g/mg x 1/Vmstd x 15.43 gr/g	=	0.0052	gr/dscf
TOTAL MEASURED PARTICULATE MATTER CONCENTRATION, (gr/dscf)	=	0.0535	gr/dscf
FRONT ½ PARTICULATE EMISSION RATE, (lb/hr) 2.205E-06 lb/mg x Mf x dscfh x 1/Vmstd	=	7.8105	lb/hr
INORGANIC CPM EMISSION RATE, (lb/hr) .205E-06 lb/mg x Mi x dscfh x 1/Vmstd	=	8.2986	lb/hr
ORGANIC CPM EMISSION RATE, (lb/hr) 2.205E-06 lb/mg x Mo x dscfh x 1/Vmstd	=	1.7322	lb/hr
TOTAL MEASURED PARTICULATE EMISSION RATE, (lb/hr)	=	17.8413	lb/hr
CALCULATION OF PERCENT ISOKINETIC VARIATION 100 % x (0.09450 x Ts°R x Vmstd) / (Ps x Vs x An x minutes x (1-Bws))	=	90.1	%

Gas Temperature, Ts°R =	782.7	Gas Velocity, Vs =	37.2
Absolute Gas Pressure, Ps =	29.78	1 - Bws =	0.944
Area of Nozzle (sq.ft.), An =	0.0004276	minutes =	60

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Groundwater Monitoring
Laboratory Services
Mobile Laboratory Services
Source Emissions

Waste Characterization (RCRA)
Wastewater Compliance Monitoring
• Pretreatment
• User Charge

December 31, 1998

Mr. Don Brisch
Rockwell Lime Company
4110 Rockwood Road
Manitowoc, WI 54220

Re: EMT Report Number 98-530
Compliance Emissions Test Program
Lime Kiln Exhaust

Dear Mr. Brisch:

Enclosed please find three copies of Environmental Monitoring and Technologies' Report No. 98-530, detailing the procedures followed and results obtained, from the emissions compliance test program performed at the Rockwell Lime facility in Manitowoc, Wisconsin.

All procedures followed, data obtained, and resulting calculations from the study are contained herein. The accuracy of this data has been verified and is complete, to the best of my knowledge.

If you have questions, or require additional information regarding this report, feel free to call me at 847/967-6666.

Sincerely,

Jay Whitaker
Director, Source Emissions Department

JW/tms

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OBJECTIVE

Rockwell Lime Company, of Manitowoc, Wisconsin, retained Environmental Monitoring and Technologies, Inc., to conduct a compliance test program upon one Lime Kiln Exhaust, at the Rockwell facility in Manitowoc, Wisconsin.

The intent of this test program was to demonstrate compliance with Wisconsin DNR Permit No. 93-RV-108, dated February 7, 1995.

Testing was performed as per the guidelines of the Wisconsin Department of Natural Resources (WDNR) and the United States Environmental Protection Agency (USEPA).

Parameters determined were:

* Stack gas velocity - ft. Per second
* Volumetric flow rate - acfm, scfh, dscfh
* Oxygen and carbon dioxide content of stack gas - %
* Gas moisture content - % by volume
* Gas temperature - °F
* Particulate matter - gr/dscf, lb/hr
* Condensible particulate (back-half) - gr/dscf, lb/hr
* Opacity - by CEM

Coordinating the sampling program were:

Don Brisch.....Rockwell Lime Company
Jay Whitaker.....EMT Source Emissions Director
Mike Betka.....EMT Project Manager

Mr. James Crawford, and Ms. Jeannine Campion of the Wisconsin Department of Natural Resources, Green Bay Area Office, were also present to observe the testing.